



## Rapid assessment of sweetpotato seed and root production and markets in Kamuli and Iganga districts, near Eastern Uganda

SEP  
2021

Prepared for:

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Submitted by:



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**September 2021**

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Rapid assessment for SweetGAINS project under Root Crops program, National Crops Resources Research Institute (NaCRRI)

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**ISBN:** 978-92-9060-611-6

**DOI:** 10.4160/9789290606116

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**Correct citation:**

Angudubo, S., Srinivasulu, R., Namanda, S., Oloka, B., Alajo, A., Musana, P., Waswa, G., Sunday, L., and McEwan, M. (2021). Rapid assessment of sweetpotato seed and root production and markets in Kamuli and Iganga districts near Eastern Uganda. International Potato Center: Lima, Peru. 87 pp.

**Design and Layout**

Communications Department

September 2021

CIP also thanks all donors and organizations which globally support its work through their contributions to the CGIAR Trust Fund. <https://www.cgiar.org/funders/>



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## Acronyms

<b>ACDP</b>	Agriculture Cluster Development Project
<b>AO</b>	Agricultural Officers
<b>ASSP</b>	Agricultural Sector Strategic Plan
<b>BMGF</b>	Bill and Melinda Gates Foundation (BMGF)
<b>CHAIN</b>	Coalition for Health Agriculture and Income Network
<b>CIP</b>	International Potato Center
<b>COVID-19</b>	Coronavirus Disease 2019
<b>DAO</b>	District Agricultural Officer
<b>DCO</b>	District Commercial Officer
<b>DMC</b>	Dry Matter Content
<b>DPO</b>	District Production Officer
<b>DVM</b>	Decentralized Vine Multipliers
<b>EADEN</b>	Eastern Archdiocesan Development Network
<b>EGS</b>	Early Generation Seed
<b>FAAB</b>	Farming as Business
<b>FGD</b>	Focus Group Discussion
<b>GALS</b>	Gender Actual Learning System
<b>GAP</b>	Good Agricultural Practice
<b>IEC</b>	Information, Education and Communication
<b>ISSD</b>	Integrated Seed Sector Development
<b>KII</b>	Key informant interview
<b>LSB</b>	Local Seed Business
<b>MAAIF</b>	Minister of Agriculture, Animal Industry and Fisheries
<b>MDA</b>	Mass Drug Administration programme
<b>MSNP</b>	Multi-Sectoral Nutrition Project
<b>NAADS</b>	National Agricultural Advisory Services
<b>NaCRRRI</b>	National Crops Resources Research Institute
<b>NARI</b>	National Agricultural Research Institute
<b>NARO</b>	National Agricultural Research Organization
<b>NGO</b>	Non-Governmental Organization

<b>NSCS</b>	National Seed Certification Services
<b>OFSP</b>	Orange-Fleshed Sweetpotato
<b>OWC</b>	Operation Wealth Creation
<b>PPP</b>	Public Private Partnership
<b>QDPM</b>	Quality Declared Planting Material
<b>QDS</b>	Quality Declared Seed
<b>SACU</b>	Send A Cow Uganda
<b>SENAI</b>	Seed and Novel Agricultural Innovation
<b>SPVD</b>	Sweetpotato Virus Disease
<b>SPW</b>	Sweetpotato Weevil
<b>SSA</b>	Sub-Saharan Africa
<b>SweetGAINS</b>	Sweetpotato Genetic Advances and Innovative Seed Systems
<b>TC</b>	Tissue Culture
<b>UGX</b>	Uganda Shillings
<b>VEDCO</b>	Volunteer Efforts for Development Concern



## Executive summary

The International Potato Center (CIP) and National Crops Resources Research Institute (NaCRRI) under the supervision of National Agricultural Research Organization are implementing a three-year project entitled, '*Sweetpotato Genetic Advances and Innovative Seed Systems (SweetGAINS)*' funded by Bill and Melinda Gates Foundation (BMGF). The project aims to modernize the current Sweetpotato breeding systems and early generation seed production. SweetGAINS project is structured into work packages (WP1 - WP4) for effective and efficient implementation. As part of work package 4, a detailed rapid assessment of the sweetpotato seed system was conducted. The main objective of the study was to generate bench information to support the implementation of the sweetpotato system.

### Main results

The sweetpotato seed system in Uganda is largely informal and farmers serve dual roles of seed and root production. Under this system, seed quality is poor due to limited quality assurance and variety mixing. The trained seed multipliers focus on the production of certified 1 or 2 with support of NGOs such as HarvestPlus, CIP, VEDCO, ISSD and CARITAS, private laboratory (SENAI), district production department and MAAIF's NSCS under public-private partnership.

The seed was majorly purchased by NGOs and fellow farmers and the major root customers were retailers and individual consumers. About 59% of the dual producers accessed seed from fellow farmers and about 25% procured from DVMs. SENAI Lts is only supplier of EGS in the Near Eastern Uganda. The NGOs (VEDCO, SACU, HarvestPlus and CARITAS) and the district production departments are instrumental interlinkages along the seed chain.

Most of the seed accessed is of unknown quality and ~21% of the producers accessed Certified 2 seed. The major preferred varieties were Kakamega-OFSP and NASPOT 8-OFSP, also landraces with better DMC and quality traits were preferred, such is "Muwulu-aduduma". Other factors that influence preferences were availability, high yields and mode of access.

The demand for seed is influenced by peaks of production seasons and the quantity demanded is usually high in April, May and September, thus underpins the importance of production calendars in seed production businesses. The major suppliers of quality seed were root producers and small seed multipliers. Majority of the vine and root producers (73%) access seed for free, which is not a sustainable approach in building a seed system.

In production year, the producers received about 2 bags (100kg), while the average seed purchased was 19 bags. This information can be used for forecasting seed demand. The average price per bag was UGX10,000 (USD2.78/bag) and seed acquisition cost was largely influenced by the price of basic seed and transport costs.

Under commercial seed production, the multipliers majorly supplied Certified 2 of Kakamega-OFSP, NASPOT 8 and NASPOT 130 and supply is usually synchronized with the peak planting months of March and April. Root producers and seed traders (progressive farmers) were the major customers, though the seed supply to producers was partly supported by NGOs and government programmes. Seed demand depends of the gender and type of the customers with varying preferences for the different varieties.

Although at farm level seed is regarded as a public good, most seed multipliers sell on monetary terms, which provides stimulus for commercializing seed production. However, the nature of transaction is farmer to farmer which implies limited aggregate demand. Leveraging on the formal seed networks, the multipliers averagely sold 129 bags of seed in the past 12 months and sales volume are affected by low demand.

Generally, seed production business was viable based on seed and root revenue streams. The five top most varieties preferred for production of roots were “Umbrella”, “Muwulu-aduduma”, Kakamega- OFSP and NASPOT 8- OFSP and “Bunduguza (similar to Dimbuka Bukulula)”. Their preference was influenced by high root yield, good taste, big size of the root, high dry matter content and early maturity, which are prioritized traits under breeding program.

Access to institutional services such as extension service, markets and credit was characterized by social networks instead of institutional linkages. Seed marketing was constrained by low demand, exploitation by commission agents, unstable prices and high transport costs, while limited access to suppliers, high cost and poor-quality marred seed access.

Sweetpotato was one of the major agricultural commodities traded in the rural and urban markets. The trade was largely informal driven by root consumers and producers on the demand and supply sides respectively. Averagely, the root traders sold about 15 bags daily. The significant bottlenecks to root traders included unstable prices, competition from other sellers, seasonality of root supply and high transport costs.

The following strategic interventions are recommended to ensure that successful implementation of the sweetpotato seed systems project in Near East Uganda: (1) Promote information symmetry on seed through platforms such as radios (through jingles), quick SMS

and popular versions of print media (brochures and leaflets); (2) Training on GAP for seed production and marketing for both informal and formal seed producers, this should be backed by supply of IEC materials; (3) Strengthening institutional linkages among the stakeholders along the value chain to ensure accountability for roles and responsibilities; (4) Operationalize demand-driven Sweetpotato breeding and seed system to integrate wider end-user preferences and enhance dissemination and adoption of improved varieties; (5) Streamlining Sweetpotato seed quality assurance and inspection both at central and decentralized levels; (6) Operationalize mechanisms for matching supply and demand, one key is the use of seed production calendar; (7) Institute incentives for seed access along the chain to promote the use of improved seed and promote seed production businesses; and (8) Promote root marketing and value addition to increase the demand for seed and improved sustainability of the seed production, thus resulting in increased food and nutrition security and income.

## CHAPTER 1: INTRODUCTION

### 1.1 Introduction

Sweetpotato is a predominant food and nutrition security and income crop in sub-Saharan Africa (SSA). In Uganda, it is a strategic food security and income crop recently earmarked to attain economic development and the crop is produced by more than 80% of the farming households. Despite the crop's popularity among resource-poor farmers being an annual crop and given its drought resilience and low input requirements, yields at farm level have remained low compared to yields achieved at research. This yield gap is attributed to a myriad of challenges, the most pressing being access to quality planting materials of the vegetatively propagated crop.

The National Agricultural Research Organization (NARO) and partners have developed and disseminated 27 improved sweetpotato varieties., However, due to the predominantly informal nature of the seed systems coupled with nascent formal seed systems, adoption has remained low. Current concerted efforts to build a robust seed system may not be sustainable due to their public nature, hinged on free seed distribution. It is envisaged that commercializing seed production will provide incentives to the seed actors at different nodes along the value chain thus ensuring sustainability.

One such incentivised approach is “building commercial sweetpotato seed systems” under the Sweetpotato Genetic Advances and Innovative Seed Systems (SweetGAINS) project, which will be implemented by the National Crops Resources Research Institute (NaCRRI) in collaboration with International Potato Centre (CIP). This will be implemented in the district of Kamuli and Iganga in Eastern Uganda. To generate bench information to support the implementation of the seed systems component under Work package 4 (WP4) of the SweetGAINS project, a rapid assessment was conducted to understand the modus operandi of the sweetpotato seed system. Therefore, this report highlights the perspectives of different actors involved in sweetpotato production and seed systems in Kamuli and Iganga districts. These include root and vine producers, seed producers, Nongovernmental Organizations (NGOs), district agricultural production department staff, root traders, processors, private Tissue Culture (TC) companies and NaCRRI staff.

### 1.2 Objectives of the rapid seed assessment

Through this study, NaCRRI and CIP aim to determine the market preferred Sweetpotato varieties and their attributes. The study provides information on the linkages, including seed and information flows, among the nodes of the seed distribution channels. Furthermore, the

study provides information on seed purchases by seed producers and disposition of the seed, sources of new varieties, information, and marketing strategies. Further, the study provides insights on variety and seed replacement strategies by seed producers, existing varieties and marketing systems, and concludes by describing the economic benefits and challenges of seed and root production and marketing.

## **CHAPTER 2: METHODOLOGY**

### **2.1 Research design**

The study was a mixed-methods study involving qualitative and quantitative approaches. Data was collected through both primary (i.e., Key informant interviews, Focus Group Discussion, personal interviews with traders and farmers using semi-structured questionnaire) and secondary survey (desk reviews of reports and secondary dataset). The semi-structured individual household questionnaires, and key informant interview (KII) guides were used to generate benchmark information on sweetpotato seed system. The stakeholders reached during the study included root producers, seed producers, representatives of NGOs, private processors, Agricultural Officers, private tissue culture companies and National Agricultural Research Institutes.

Questions in the individual interviews focused on socio-demographic characteristics, seed access, production and disposition, root production and disposition, access to institutional services, dimensions of social networks, and constraints and opportunities along the Sweetpotato value chain. While the key informant checklist focused on seed distribution channels, quality assurance and inspection and marketing channels.

### **2.2 Sample selection and size**

The study objectives were realized by using purposive, random and snowball sampling techniques. First, the districts of Kamuli and Iganga were purposively selected based on high sweetpotato production, consumption and marketing. In the two districts, we held focus group discussions (FGDs) with root traders in selected rural and urban markets to understand the market preferred varieties and attributes. Based on the preliminary findings of the FGDs, we traced the sources of major market preferred varieties using snowball approach.

At the household level, the root and vine producers were randomly selected for inclusion in the study and these identified other actors along the value chain such as seed suppliers and produce buyers. Whilst using the snowball approach, actors such as processors, nongovernmental organizations and regulatory agencies were selected as key informants.

Overall, we conducted 24 key informant interviews with representatives of NGOs, processors, seed producers, agricultural officers, private TC company staff, and NARI staff. The key informants (KIs) comprised of different gender categories. A total of 122 households (62 and 60 households in Kamuli and Iganga districts respectively) were randomly selected and interviewed as root and vine producers.

### **2.3 Data analysis**

Preliminary analysis of qualitative data was done in the field. A final analysis of information from the key informant interviews and other open-ended questions involved examining the respondents' views using content analysis to summarize the discussions. For quantitative data from household interviews, the data collected using a web-based Open Data Kit submitted to Ona program was downloaded and imported into Stata (version 13.0) for analysis. Analysis generated frequencies and some measures of central tendency. Comparisons were made by cross tabulations on background characteristics and other key variables of the assessment. Tables, graphs, and charts were drawn in Excel to display and present the results. The next sections of the report highlight perspectives of the stakeholders, conclusions and recommendations.

## **CHAPTER 3: RESULTS AND DISCUSSIONS**

### **3.1 Socioeconomic and demographic characteristics of root and vine producers**

Majority of root and vine producers included in the study sample were female. This can be attributed to the fact that Sweetpotato is considered as women's crop. According to 2009 study by Andrade et al., Sweetpotato is grown on small plots, thus considered as 'poor person's crop' whose production is dominated by women. Results in Table 1 indicate that there were no significant differences in household headship among men and women. More than half (55%) of the producers had primary level education and were largely preoccupied with crop farming as the major livelihood activity (Table 1). While household work, animal husbandry and petty trader were complementary activities to crop farming.

**Table 1.** Farmer and farm characteristics

Variable	Kamuli (n=62)	Iganga (n=60)	Pooled (n=122)
Sex of respondent			
Male	26.9	38.3	32.3
Female	73.1	61.7	67.7
Male headed household (%)	54.2	50.6	52.7
Female headed household (%)	45.8	49.4	47.3
Household type (%)			
Dual (male and female spouses)	87.1	81.7	84.4
Female headed with adult male decision-maker	1.6	3.3	2.5
Male headed with adult female decision-maker	1.6	0.0	0.8
Female headed, without adult male decision-maker	9.7	15.0	12.3
Education level (%)			
Primary	61.2	48.3	55.1
Secondary	37.3	38.3	37.8
Tertiary	0.0	6.7	3.2
University	0.0	1.5	0.8
No formal education	1.5	5.0	3.1
Main occupation of respondent (%)			
Crop farming	96.8	90.0	93.4
Animal husbandry	0.0	3.3	1.6
Formal employment	3.2	3.3	3.3
Pension/allowances	0.0	1.7	0.8
Produce trade/ business	0.0	1.7	0.8
Secondary occupation (%)			
Household work	30.0	24.4	27.4
Animal husbandry	34.0	17.8	26.3
Petty trade	16.0	26.7	21.1
Produce trade/ business	8.0	8.9	8.4
Crop farming	0.0	13.3	6.3
Tailoring	6.0	2.2	4.2
Livestock trade	2.0	2.2	2.1
Casual labour	0.0	2.2	1.1
Formal employment	2.0	0.0	1.1
Social support (cash)	2.0	0.0	1.0
Boda-boda cycling	0.0	2.2	1.0
Whether attended agricultural vocational training (%)	26.1	35.0	30.2

The average age for men, and women were 42 and 39 years respectively. The respondents mostly belonged to the most productive age group (18 - 45 years). Education levels were

generally low, on average, seven years of formal schooling (Table 3). The labor capacity, in terms of the number of people that can provide farm labor was four persons per household.

**Table 2.** Socioeconomic and demographic characteristics of root and vine producers

Variable	Kamuli (62)	Iganga (60)	Pooled (122)
Age of respondent	43.7 (10.6)	41.6 (10.1)	42.7 (10.4)
Age of respondent by sex			
Male	43.9 (12.8)	39.2 (12.9)	41.6 (13.0)
Female	39.5 (12.3)	37.9 (11.9)	38.7 (12.1)
Age of household head	46.1 (11.3)	43.5 (10.2)	44.9 (10.9)
Education level (years)	6.9 (2.7)	7.6 (3.7)	7.2 (3.2)
Household size	8.8 (2.9)	8.0 (3.1)	8.4 (3.0)
Labor capacity (number of persons in the productive age group)	0.0 (0.0)	3.7 (2.1)	3.7 (2.1)
Number of members under 5 years	1.6 (1.1)	1.7 (1.4)	1.6 (1.3)
Farming experience (years)	22.9 (10.9)	19.3 (9.0)	21.2 (10.2)

Their estimated total access to land for agricultural production averaged 2.99 acres. Households with more land at their disposal rented out land, while those with limited access to land rented in land for agricultural production (Table 3).

**Table 3.** Land access and disposition

Variable	Kamuli (62)	Iganga (60)	Pooled (122)
Total land access (acres)	4.41 (4.02)	2.91 (2.57)	3.71 (3.49)
Total arable land (acres)	3.75 (3.42)	2.13 (2.16)	2.99 (3.00)
Total land rented out (acres)	1.46 (1.12)	1.50 (0.00)	1.47 (1.04)
Total land rented in (acres)	1.58 (1.66)	1.54 (2.07)	1.56 (1.90)

### 3.2 Seed production and marketing

A number of seed production interventions exist within informal and formal sweetpotato seed sectors. One of the predominant interventions in the informal sector is seed production by the producers for own use, sharing with fellow farmers and partly for sell. In this sector, it is difficult to ensure quality of seed distributed unlike in the formal sector. Within the formal sector, seed is produced by both untrained and trained seed multipliers, some of whom double as root producers as indicated in Table 4. Therefore, the farmers produced



sweetpotato for the dual purpose of seed and root sale. Findings from key informant interviews indicate that the trained seed producers mainly focus on the production of quality sweetpotato seed with support of stakeholders such as HarvestPlus and tissue culture (TC) laboratories (SENAI). This ensures conformity to quality standards of the National Seed Certification Services (NSCS) under the umbrella of Ministry of Agriculture, Animal Industry and Fisheries (MAAIF).

The producers mainly receive training on seed production and marketing from nongovernmental organizations (NGOs) along the sweetpotato value chain. These include HarvestPlus, Volunteer Efforts for Development Concerns (VEDOC), International Potato Center (CIP), and Integrated Seed Sector Development (ISSD). Results in Table 4 indicate that seed producers (10%) obtain pre-basic seed from a particular TC laboratory with support of NGOs and sell through the same support system. This implies that seed production and marketing is more of a closed system, which contravenes the tenets of free market economy.

**Table 4.** Sweetpotato root and seed production and marketing

Variable	Kamuli (n=68)	Iganga (n=60)	Pooled (n=128)
Sweetpotato produce grown (%)			
Roots	91.2	88.3	89.8
Roots and vines	8.8	11.7	10.2
Training on seed production (count) for those who produce vines			
Trained	4	4	8
Not trained	4	2	6
Trainers on seed production (count) for those who produce vine			
Local NGOs	4	1	5
Government/NAADS/MAAIF	0	1	1
Big commercial multipliers	0	1	1
International NGOs	0	1	1
Nature seed production (count)			
Seed trade (commercial)	5	5	10
Own used (produces own seed)	3	1	4
Sell or share sweetpotato seed (%)	7.4	13.3	10.2
Seed pricing strategy (count)			
Lower the price	4	2	6
Provide discount	3	2	5
Maintain the same price	1	0	2
Number of seed suppliers and buyers			
Seed suppliers	1	1	1
Seed buyers	2	1	2

### 3.3 Producers' access to sweetpotato seed and root markets

Sweetpotato root and vine production and marketing is enhanced by a number of actors along the value chain. The results of rapid assessment in Figure 1 indicate that the major seed customers in the districts of Kamuli and Iganga were fellow farmers, nongovernmental organizations (NGOs) and decentralized vine multipliers (DVMs) or trained seed multipliers. Results in Figure 2 show that individual consumers, schools/ institutions, retailers and wholesalers were the main sweetpotato root customers along the root supply chain.

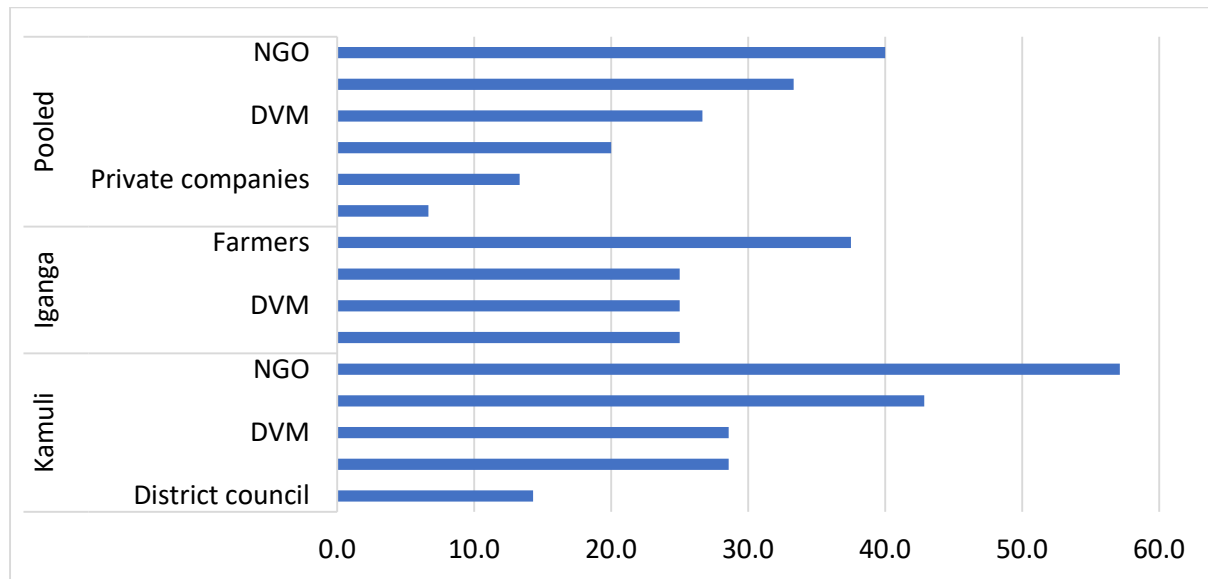


Figure 1. Type of seed buyers

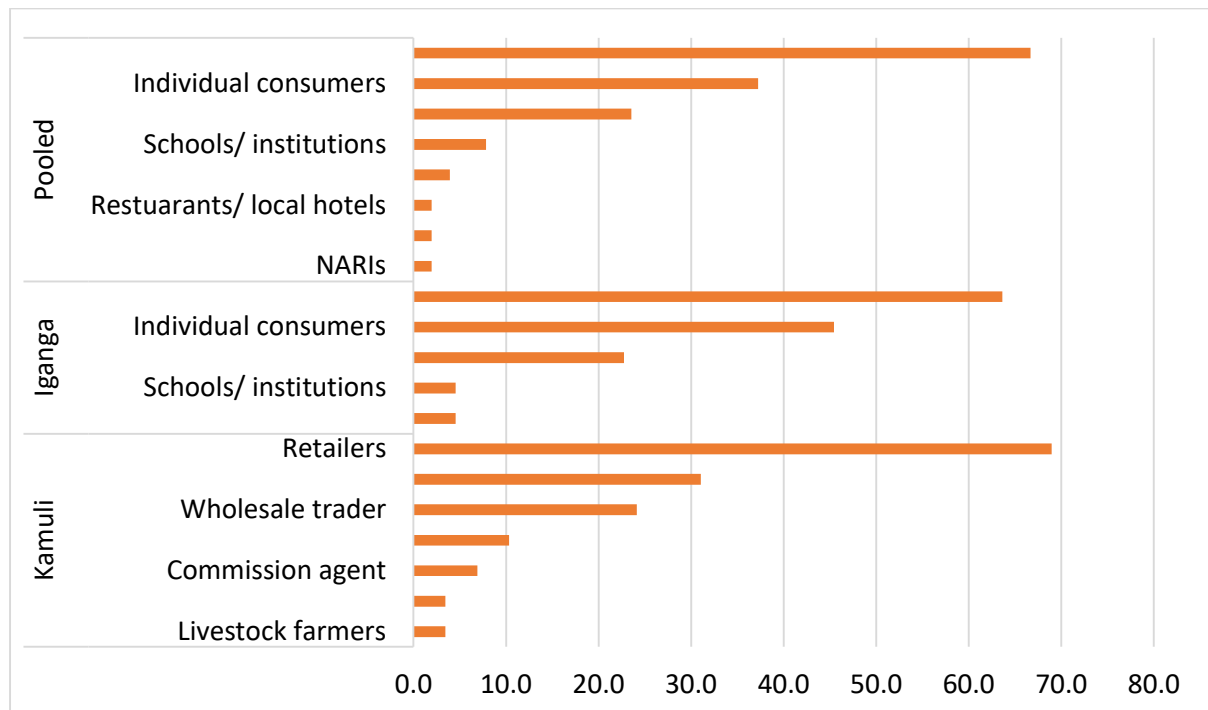


Figure 2. Type of sweetpotato root buyers

More than half of the root and vine producers access their seed mainly of Orange-Fleshed Sweetpotato (OFSP) varieties from fellow sweetpotato farmers or NGOs. This channel of seed access was equally important in both Kamuli (64.3%) and Iganga (50.0%) districts. In Iganga district, 25.0% of the root and vine producers obtain sweetpotato seed from private seed companies and DVMs respectively. The major private company is SENAI which supplies pre-basic seed. Other producers are connected to seed vendors by NGOs such as Volunteer Efforts for Development Concern (VEDCO), Send A Cow Uganda (SACU), HarvestPlus, and CARITAS. Additionally, the districts production departments supply seed through several projects.

### 3.3.1 Sweetpotato seed received from suppliers or providers

Although farmers mainly conserve own seed, they also acquire quality seed of new preferred varieties or replace the existing seed after several cycles of production. The major sources include small seed multipliers and root producers (Table 5).

**Table 5.** Types of seed provider and seed class accessed

Type seed provider						
District	Small seed multiplier	Root producers	Local NGOs	TC Private companies	DVMs	Seed traders
Kamuli	11.1	66.7	11.1	-	-	11.1
Iganga	46.7	13.3	6.7	13.3	13.3	6.7
Pooled	33.3	33.3	8.3	8.3	8.3	8.3
Seed class						
District	Basic seed	certified 1	Certified 2	Unknown		
Kamuli	-		22.2	77.8		
Iganga	13.3	13.3	20.0	53.3		
Pooled	8.3	8.3	20.8	62.5		

However, most (62.5%) of the class of seed accessed by root and vine producers from other sources is not known. This is attributed to unregulated sweetpotato seed system and the seed system is largely informal characterised by free seed distribution regardless of quality and disease infections status. The results of the assessment showed that a higher proportion (77.78%) of producers in Kamuli accessed of unknow seed class compared to more than half (53.3%) in Iganga. A small proportion of the producers in Iganga accessed certified seed from other sources; certified 1 (13.3%), certified 2 (20.0%) and Basic seed (13.3%). Most of the vine and producers that access certified are those involved seed multiplication business.

**Table 6.** Frequency of varieties of seed acquired from other sources

Variety	Kamuli	Iganga	Pooled
Ejumula-OFSP	1	1	2
Kakamega-OFSP	3	3	6
NASPOT 4	1	0	1
NASPOT 7 OFSP	1	0	1
NASPOT 8 OFSP	0	7	7
NASPOT 9 OFSP	2	0	2
NASPOT 10 OFSP	0	1	1
NASPOT 12O	0	2	2
NASPOT 13O	0	2	2
Muwulu-aduduma	2	4	6
Umbrella	1	2	3
Tontanulula	0	1	1
Bunduguza Omukaaire	0	2	2
Bunduguza	1	2	3
Kinana	2	0	2
Topenawena	1	0	1
Kipapali	2	0	2
Yongera-abalenzi Empooli	0	4	4
Namugwere	0	1	1
Nakasoma	0	1	1

Results in Table 6 shows that a larger number of vine and root producers preferred the seed of OFSP varieties, the leading being Kakamega-OFSP and NASPOT 8-OFSP. Other vine and root producers prefer to grown local varieties. From the key informant interviews reasons advanced for the preference of the landraces were better dry matter content and quality traits.

The reasons for variety preference for seed acquired from other sources are presented in Figure 3. The mostly cited reasons for variety preference by farmers across the two districts were: seed availability, high yields and free access (Figure 2). Other factors such as price, market preference, and susceptibility to disease also relatively influenced choice of varieties of seed acquired.

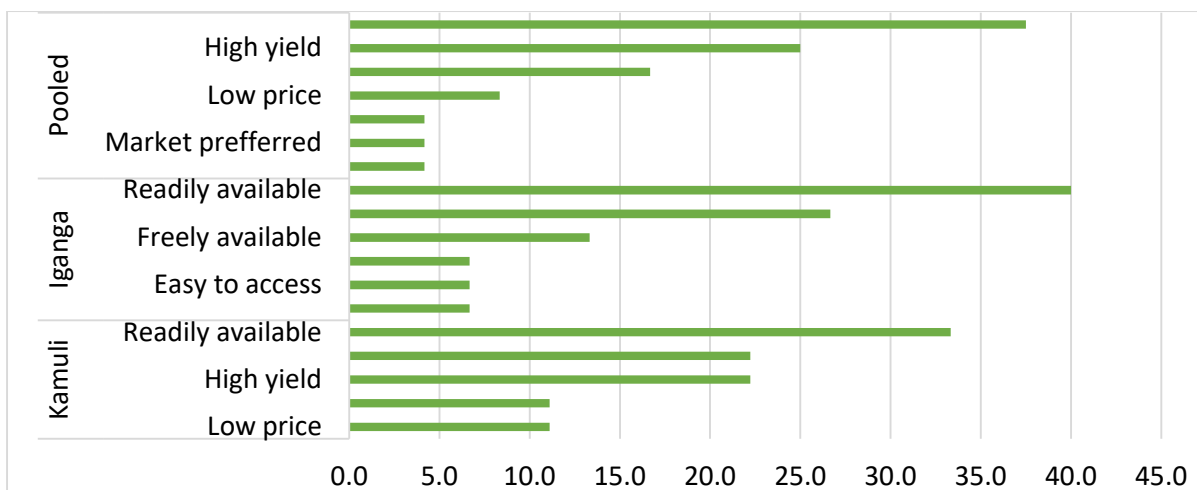
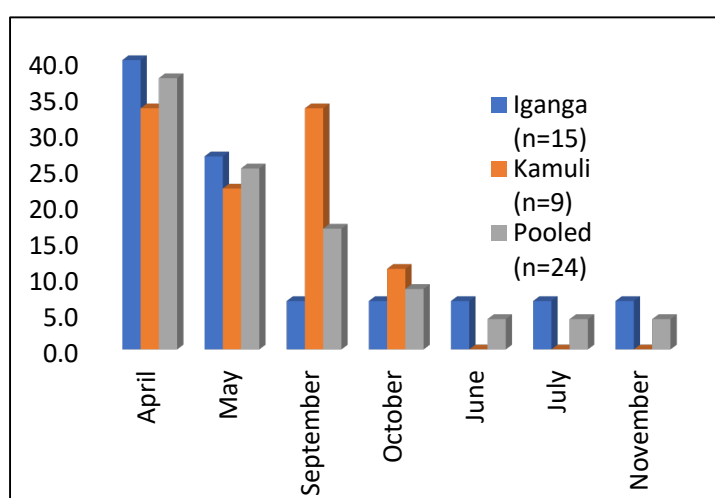
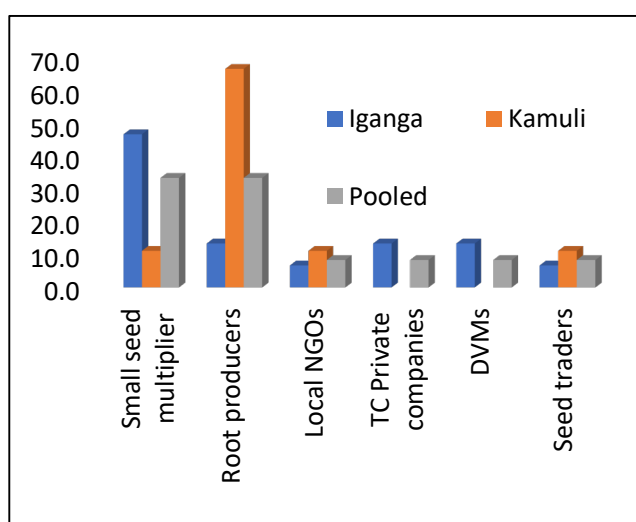


Figure 3. Major reasons for acquiring seed from other sources



Root and vine producers mainly obtained seeds in April and May which coincide with the peak planting period in the first production season and September in the second production season. Therefore, it is imperative to integrate the peak months of seed acquisition in the seed production calendar to ensure that supply matches demand and hence improve seed business.

Small seed multipliers and root producers were the main suppliers of seed in Iganga and Kamuli districts, respectively. The high proportion of seed accessed from small seed multipliers in Iganga was attributed to a network of seed multipliers under nuclear basic seed multipliers through initiatives implemented by various stakeholders like HarvestPlus, CIP Uganda, Integrated Seed Sector Development (ISSD) and



Coalition for Health Agriculture and Income Network (CHAIN). The last two are nongovernmental organizations which are responsible for training farmers on seed production as a business. While SENAI, a private tissue culture laboratory supports the initiative by supplying basic seed. Most of root and vine producers had close relationships

with seed providers; friend (45.8%), political leaders (25.0%), neighbours (16.7%), religious leaders (8.3%) and relatives (4.2%) as shown in Table 7.

Results in Table 7 indicate that more than half (52.9%) of the seed providers were male and most of them (52.9) hailed from the same village where root and vine producers operate. Others 17.7% were from neighbouring villages and within the district, respectively. Majority (87.5%) of the seed providers were located in the same region and few were from Northern and Central regions (Table 7). The seed provider from the central region (Mpigi district) was the private TC company (SENAI), responsible for supply of pre-basic seed to basic seed multipliers.

The findings of the rapid assessment revealed that seed providers were selected mainly because of close relationship with the root and vine producers (50.0%), consistent seed supply (29.2%) and provision of lower prices per bag (16.7%) as presented in Table 7.

**Table 7.** Details of Sweetpotato seed providers

Variable	Iganga	Kamuli	Pooled
	Relationship to seed provider		
Friend	46.7	44.4	45.8
Political leaders	26.7	22.2	25.0
Neighbours	6.7	33.3	16.7
Religious leaders	13.3		8.3
Relatives	6.7		4.2
Sex of the seed provider			
Male	44.44	62.5	52.94
Female	55.56	37.5	47.06
Location of seed provider			
Within the village	44.44	62.5	52.94
Neighbouring village/ parish	33.33		17.65
Within the district	22.22	12.5	17.65
Different district		25	11.76
Region of seed provider			
Eastern	86.67	88.89	87.5
Northern	6.67	11.11	8.33
Central	6.67		4.17
District of seed provider			
Iganga	86.67	-	54.17
Kamuli	-	100	37.5
Mpigi	13.33	-	8.33
Reasons for choice of seed provider			
Close relationship	53.33	44.44	50.00
Consistent supply	26.67	33.33	29.17
Provides lower prices	13.33	22.22	16.67
Deals in many varieties	6.67	-	4.17

### 3.3.2 Sweetpotato seed access transactions

Basing on the last major transaction, majority (71.4%) of the root and vine producers access seed for free compared to 28.6% who purchased seed. It should be noted that quality seed is still considered a public good at the farm level. Therefore, initiatives to promote seed production as a business should focus on integrating approaches that create incentives to shift the current seed access behaviour. On average, root and vine producers received about 2 bags of seed free in a production year (12 months). A large proportion of the seed accessed for free is of unknown seed class which infers poor quality (Table 9).

During the last major seed transaction, the producers purchased up to 19 bags and Iganga district had the highest average quantity (22.8 bags of 100kg). This is attributed to seed multipliers who access early generation seed (EGS) of OFSP varieties after first harvest and 2 - 3 ratoons. The multipliers are trained through various project interventions on good agronomic practices (GAP) for seed production, thus they replenish their planting material following agronomic recommendations. Since the EGS is expensive, HarvestPlus normally supports the vine multipliers by paying for 2 bags out of every 5 bags purchased from SENAI Ltd. Based on the discussions with the vine multipliers, part of seed is sold to Certified 1 and 2 producers at subsidized prices. While the rest of the quality seed is sold to various projects supported by government (MDAs) and nongovernmental organizations.

**Table 8.** Mode of seed acquisition and quantity of seed accessed

District	Accessed for free seed (%)	Purchased seed (%)	Quantity accessed free (100 kg bag)	Quantity purchased (100kg bag)	Unit price per 100 kg bag (UGX)	Seed expenditure (UGX/year)
Kamuli	84.62	15.38	2.21 (2.19)	8.50 (9.19)	8,500	62,500
Iganga	60.00	40.00	1.06 (1.18)	22.83 (38.93)	12,500	55,00
Pooled	71.43	28.57	1.67 (1.84)	19.25 (33.74)	10,000	55,000

The unit price of seed was estimated at UGX10,000<sup>1</sup> per bag of 100kg (USD2.78/bag), this varied between the districts; Kamuli (UGX8,500/bag) ≈ to USD2.36/bag and Iganga (UGX12,500/bag) or USD3.47/bag. Averagely, a root and vine producers spent UGX55,000 (USD15.28) on seed purchase in a production year and the high cost is associated with price of basic seed (UGX40,000/bag) or USD11.11/bag accessed by seed multipliers in Iganga district.

<sup>1</sup> Exchange rate as on Aug 2020, US\$ 1 = UGX 3,600

**Table 9.** Comparison of seed class accessed through different modes

Seed class	Kamuli		Iganga		Pooled	
	Free	Monetary	Free	Monetary	Free	Monetary
Basic seed	-	-	-	33.33	-	25.00
Certified 1	-	-	11.11	16.67	6.25	12.5
Certified 2	28.57	-	22.22	16.67	25.0	12.5
Unknown	71.43	100.00	66.67	33.33	68.75	50.0

Overall, 88% of the producers mutually negotiated seed transactions terms with seed providers especially price and all payments were made on cash. In regard to purchase of EGS material, 33.3% of the multipliers in Iganga paid advance ( $\approx$  UGX20,000/bag) to the tissue culture laboratory (SENAI) to support mass multiplication of EGS material. The balance is offset by HarvestPlus that pays for 2 bags out of every 5 bags purchased. However, a few seed multipliers purchase their EGS from SENAI on cash basis following a prior production order.

While most (87.5%) of seed purchase transactions took place at the client location (Table 10) and average distance to the access point for pre-basic seed was over 30 Km. This translates to high transaction costs with producers on average spending about UGX11,750/bag on transportation, packaging and other costs. The major modes of transport to the transaction location were motorbikes (50.0%) and cars (33.3%). Results in Table 10 show that packaging material included polythene bags (51.9%), bundles (29.6%) and sisal bags (18.5%).

**Table 10.** Details of seed transactions

Variable	Kamuli	Iganga	Pooled
	Seed transaction terms (price setting decision)		
Mutual negotiation	50.00	100.00	87.50
Buyer/ receiver	50.00	-	12.50
	Whether paid advance for seed		
Yes	-	33.33	25.00
No	100.00	-	66.67
	Location of seed transaction		
Client location	100.00	83.33	87.50
Own field location	-	16.67	12.50
	Mode of transport to seed transaction location		
Motor bikes	100.00	40.00	50.00
Car	-	40.00	33.33
Bicycle	-	20.00	16.67
	Seed packaging material		
Polythene bags	58.33	46.67	51.85
Bundle	25.00	33.33	29.63
Sisal bags	16.67	20.00	18.52



### 3.4 Sweetpotato seed provision and sales

A total of 28 out of 122 producers reached during the rapid assessment sold or provided seeds to other actors. The results in Table 11 show that the vine producers mainly provided or sold seed of OFSP varieties; NASPOT 8 OFSP, NASPOT 130, and Kakamega OFSP.

**Table 11.** Frequency of vine producers that sold seeds of various varieties

Variety	Kamuli	Iganga	Pooled
Kakamega-OFSP	3	2	5
NASPOT 8 OFSP	0	5	5
NASPOT 130	0	4	4
NASPOT 9 OFSP	2	1	3
Ejumula-OFSP	1	1	2
Umbrella	2	0	2
NASPOT 10 OFSP	0	1	1
NASPOT 120	0	1	1
Kipapali	1	0	1
Mununuzi	1	0	1
Silk	1	0	1
Nakayima	1	0	1
Kateteyi	0	1	1

Majority of the vine multipliers provided seed of unknown class for free except 30.8% who sold the seed of the same class. While Certified 2 (53.8%) was the major seed class provided to producers on monetary terms (Table 12). Other seed classes sold by the vine multipliers included Certified 1 and Quality Declared Seed (QDS).

**Table 12.** Seed classes provided by the seed multipliers

Seed class	Kamuli		Iganga		Pooled	
	Free	Monetary	Free	Monetary	Free	Monetary
Certified 1	-	-	-	14.29	-	7.69
Certified 2	-	66.67	-	42.86	-	53.85
QDS	-	-	-	14.29	-	7.69
Unknown	100.00	33.33	100.00	28.57	100.00	30.77

Most of the seed were provided during the peak production months of March, April, and May (Figure 4). This creates a match between seed supply and demand and, thus critical for commercial seed production based on seed calendar.

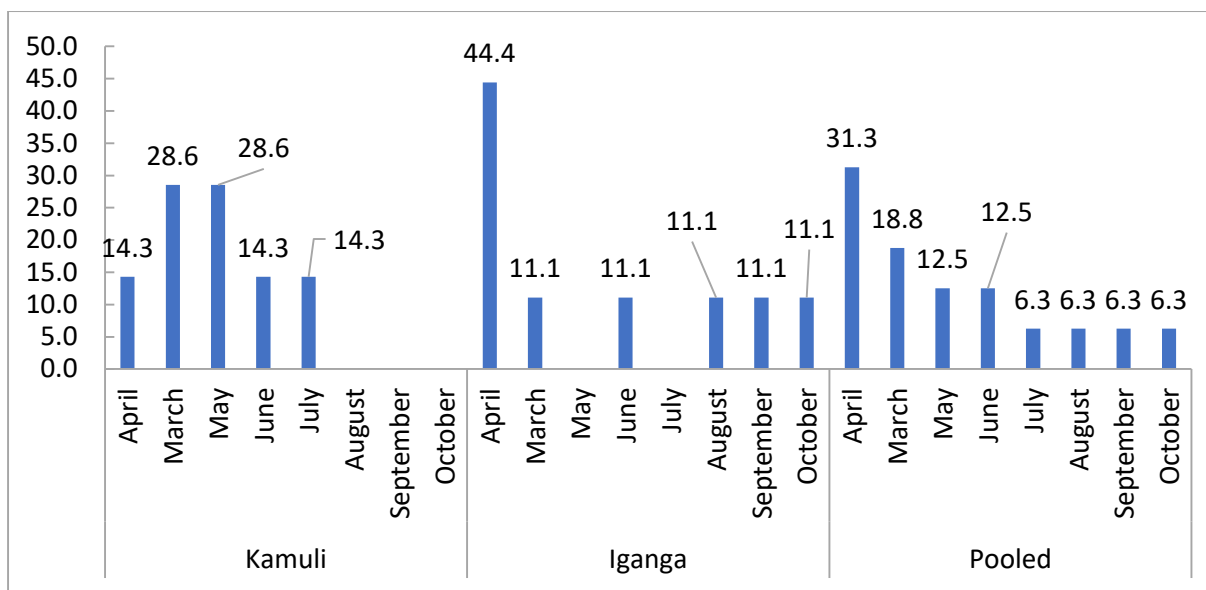


Figure 4. Months of seed provision by multipliers

Overall, the major customers for the seeds supplied by vine multipliers were root producers (57.1%) and seed traders (buy and sell seed) (42.9%). While across the districts, institutions/schools, small seed multiplier and local NGOs provide demand for vines (Figure 5). Institutions/schools that purchased the seed were mainly involved in the “Multi-sectoral Nutrition project” (MSNP) implemented by the Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF). Since majority of the customers were root producers who demand cost-effective quality seeds and recycle seed for about 2 - 3 production cycles, it imperative for the multipliers to integrate production calendar to match seasonal seed demand.

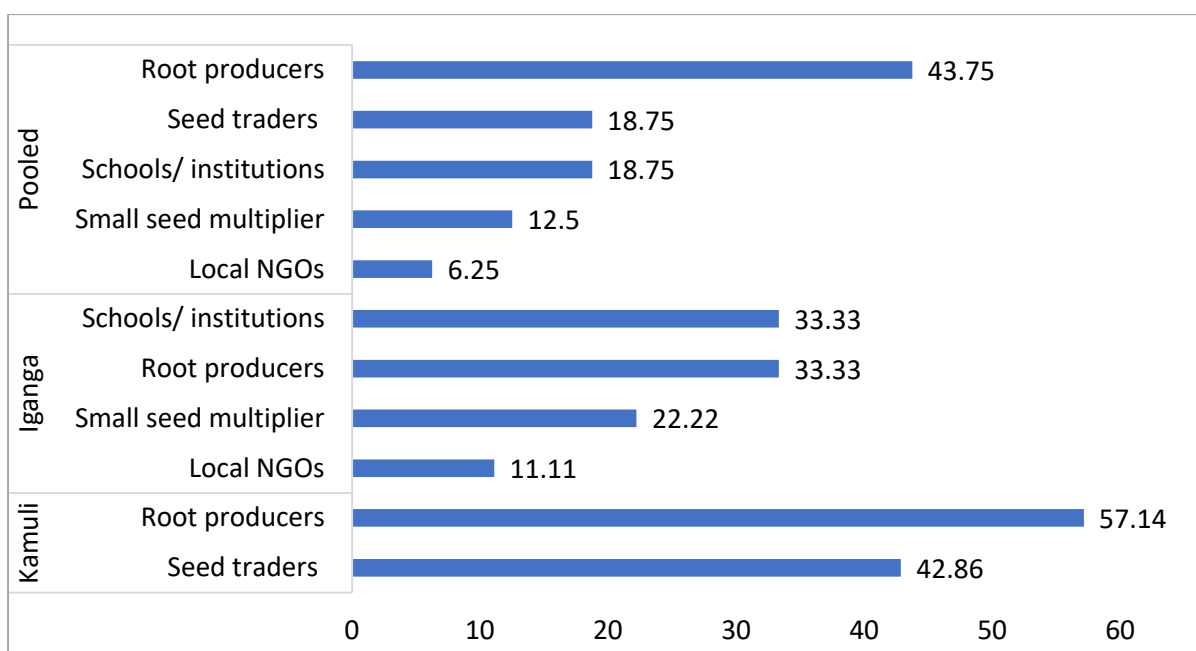


Figure 5. Major types of customers for seed sold by multipliers

A high proportion (62.5%) of the seed customers were male. Male and female customers preferred different varieties and generally, they preferred Orange-fleshed Sweetpotato varieties. Results in Table 13 show that Kakamega-OFSP was the most demanded variety by male customers. Also, the male customers preferred buying planting material of landraces. While the female customers mostly purchased seed of NASPOT 13O and NASPOT 8-OFSP. In relation to key informant discussions with some customers, the OFSP varieties are majorly preferred for their suitability for value addition and enrichment with vitamin A.

**Table 13.** Sweetpotato varieties sold to customer of different sex

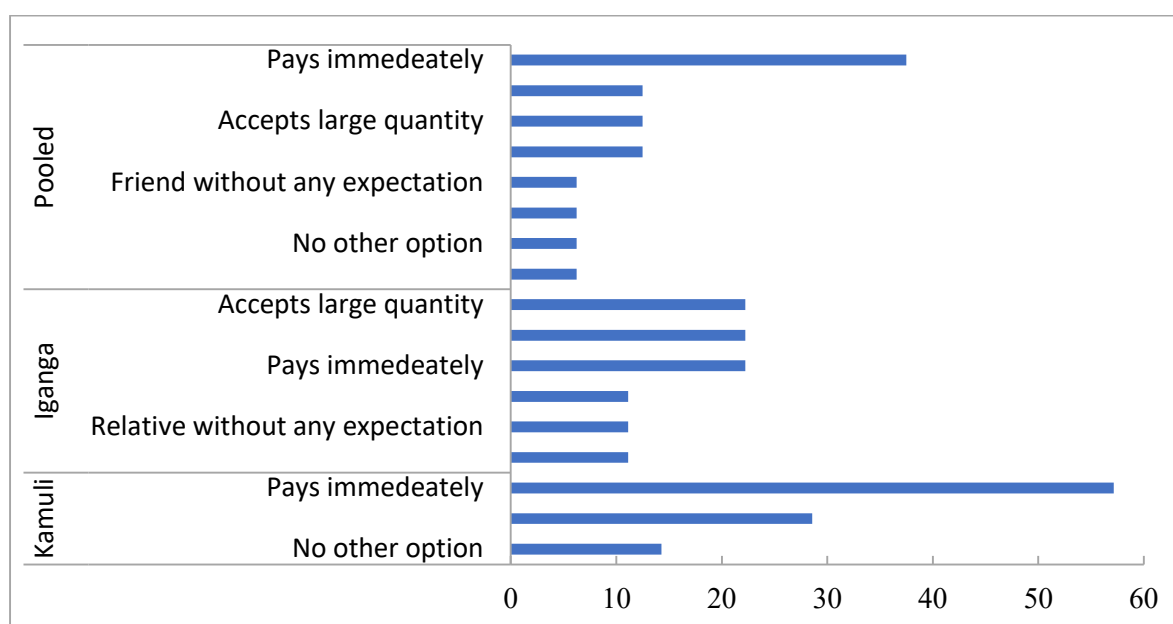
Variety sold	Kamuli		Iganga		Pooled	
	Male	Female	Male	Female	Male	Female
Ejumula - OFSP	20.00	-	-	25.00	10.00	16.67
Kakamega – OFSP	60.00	-	20.00	25.00	40.00	16.67
NASPOT 8 - OFSP	-	-	60.00	50.00	30.00	33.33
NASPOT 9 - OFSP	20.00	50.00	20.00	-	20.00	16.67
NASPOT 10 - OFSP	-	-	-	25.00	-	16.67
NASPOT 11	-	-	-	-	-	-
NASPOT 12 O	-	-	-	25.00	-	16.67
NASPOT 13 O	-	-	20.00	75.00	10.00	50.00
Local varieties	60.00	50.00	20.00	-	40.00	16.67

In regard to preference of varieties by different customers, root producers were more disposed to buy planting material of local varieties. While institutions/schools mainly purchased seed of NASPOT 8 - OFSP (Table 14). Over 66% of the seed traders who buy seed from multipliers and sell to other actors in the seed chain preferred Kakamega - OFSP and Local varieties respectively. In Table 14, the small seed multipliers preferred several OFSP varieties with NASPOT 13O being the predominantly demanded variety. While the NGOs such as SACU, VEDCO and CARITAS mainly purchased NASPOT 8 - OFSP for distribution to other value chain actors.

**Table 14.** Sweetpotato varieties provided/sold by customer types

Variety sold	Root producer	Institutions/schools	Seed traders	Small seed multiplier	Local NGOs
Ejumula - OFSP	-	-	33.33	50.00	-
Kakamega – OFSP	14.29	33.33	66.67	50.00	-
NASPOT 8 - OFSP	14.29	66.67	-	50.00	100.00
NASPOT 9 - OFSP	28.57	-	33.33	-	-
NASPOT 10 - OFSP	-	-	-	50.00	-
NASPOT 12 O	-	-	-	50.00	-
NASPOT 13 O	14.29	33.3	-	100.00	-
Local varieties	42.86	-	66.67	-	-

All seed sales were conducted in the districts of production and neighbouring districts such as Buyende, Luuka and Kaliro. Figure 6 indicates that multipliers choose seed customers based on the following: immediate payment at the point of sale, price paid per bag, quantities of seed purchased and availability when needed. The latter criterion prevents loss of vines and/or extra costs associated with maintenance of seed production fields due to limited demand.



**Figure 6.** Major reasons for selecting varieties of seed customers

Results in Table 15 show that more than half (56.3%) of the seed customers were friends, neighbours, and relatives to the root and vine producers. This may not be a sustainable channel for commercializing sweetpotato seed production. Hence, increased training on farming as business (FAAB) is critical to improving business and marketing skills. Table 15 shows that multipliers create customer awareness on Sweetpotato seeds through friends along the value chain, colleagues and professional networks. Examples of professional networks include farmers’ cooperatives and seed producers’ networks.

**Table 15.** Location for seed sales and customer networks

Variable	Kamuli	Iganga	Pooled
	Location of seed customers		
Iganga	-	88.89	50.0
Kamuli	57.14	-	25.00
Buyende	28.57	-	12.50
Luuka	14.29	-	6.25
Kaliro		11.11	6.25
	Relationship to the seed customers		
Unknown relationship	14.300	66.70	43.80
Neighbors	28.600	22.20	25.00
Friends/ colleagues	28.60	11.11	18.18
Relatives	14.30	-	6.30
Professional leaders in the seed chain	14.30	-	6.30
	Channel for customer awareness		
Through friends	85.70	33.33	56.30
Professional network	-	33.33	18.80
Referrals by colleagues	14.30	22.20	18.80
Family members	-	11.11	6.30

### 3.4.1 Sweetpotato seed provision or sales/ transactions

Majority (72.2%) of the sweetpotato seed was provided on monetary terms, while the rest was provided free. The high proportion of seed provided on monetary terms implies that there is potential for commercializing sweetpotato seed production within the region. However, it should be noted that most of the transaction is farmer to farmer. This implies that quantities purchased and prices are low, thus can result in mismatch in demand and supply.

**Table 16.** Mode and quantities of seed provided by multipliers

District	Provided free seed (%)	Sold seed (%)	Free quantity (100kg bag)	Quantity Sold (100kg bag)	Price per bag (UGX)	Max unit price (UGX)	Min unit price (UGX)
Kamuli	33.33	66.67	1.67 (0.58)	10.50 (8.38)	8,500	2,5000	25,000
Iganga	22.22	77.78	11.50 (12.02)	230.85 (258.17)	8,000	2,000	10,000
Pooled	27.78	72.22	5.60 (8.08)	129.15 (215.47)	8,000	2,000	25,000

Overall, the average quantity provided free was 5.6 bags over the past 12 months from the period of the rapid assessment. Within the same period, more seed (11.5 bags) was provided free in Iganga district. In Table 16, averagely across Kamuli and Iganga, multipliers sold over 129 bags over a period of 12 months. On average, the producers in Iganga district recorded seed sales of over 230 bags compared only 10.5 bags in Kamuli (Table 17). The large average quantity sold is attributed to a few formal seed multipliers who operate within a formal network supported by governmental and nongovernmental organizations. While the low sales volume in Kamuli can be associated to the following factors along the seed chain: limited seed demand, low intensity of production and seed supply (market) conditions.

**Table 17.** Summary statistics of seed sales

District	Statistics	Quantity sold (bags)	Unit price (UGX/bag)	Total income (UGX)	Transaction cost (UGX)	Gross margin (UGX)
Kamuli	Mean	11	11,250	74,083	55,000	24,214
	Std.dev	8	9,486	42,793	67,268	80,846
	Minimum	4	2,500	24,000	10,000	(107,500)
	Maximum	25	25,000	150,000	170,000	135,000
Iganga	Mean	231	6,714	1,768,571	1,116,200	971,286
	Std.dev	258	3,592	2,271,119	1,510,325	1,499,675
	Minimum	26	2,000	200,000	39,000	(500,000)
	Maximum	770	10,000	6,160,000	3,367,000	3,425,000
Pooled	Mean	129	8,808	986,500	585,600	497,750
	Std.dev	215	7,034	1,831,063	1,152,668	1,132,481
	Minimum	4	2,000	24,000	10,000	(500,000)
	Maximum	770	25,000	6,160,000	3,367,000	3,425,000

Results in Table 17 show that the quantity of seed sold ranged from 4 bags to 770 bags in last production year and a bag was sold at UGX8,800. The price of seed per bag ranged from as low as UGX2,000 to about UGX25,000. Averagely, the producers recorded a revenue equivalent to UGX986,500 in a production year. While other seed multipliers obtained over six million Ugandan Shillings. The high revenue can be attributed to those involved in formal seed production business. During seed sales, the producer incurred on average transaction costs of UGX585,600. On average, the multipliers earned gross margin of UGX497,750 (UGX5,284 per bag). Only 7.8% of the seed customers paid an advance for seed during the transactions.

Basing on the results in Table 18, all seed sales or transactions were cash based. Majority of the multipliers (76.9%) received payments immediately at the time of seed sales. About 7.7% of the multipliers were paid after a week and later a week of the transaction. A large proportion (93.3%) of seed sales were completed on the same day, thus, addressing the issue of deterioration of the planting material. Majority (86.7%) of producers sold the seed within the production fields (Table 18). A few that sold seed in locations as far as 25 Km from the production site, they only required an hour to reach the transaction location. On average, a transaction took a little over 2 hours. The major transport means were trucks and motorcycles.

**Table 18.** Seed provision transactions details

Variable	Kamuli	Iganga	Pooled
<b>Duration of receiving payment for seeds</b>			
Immediately at sales	83.33	71.43	76.92
Days after sales	-	14.29	7.69
A week after sales	16.67	-	7.69
Later than a week after sales	-	14.29	7.69
<b>Whether transaction was concluded same day</b>			
Yes	83.33	100.00	93.33
No	16.67	-	6.67
<b>Location of seed sales transaction</b>			
Own field location	100.00	77.78	86.67
Client location	-	22.22	13.33
<b>Mode of transport to seed sale location</b>			
Trucks	-	50.00	50.00
Motor bikes	-	50.00	50.00
<b>Methods of handling excess seed</b>			
Let them grow	55.56	50.00	52.63
Store them in damp places	-	-	-
Convert to animal feed	44.44	50.00	47.37
<b>Seed packaging material</b>			
Bundle	11.11	-	5.56
Polythene bags	77.78	100.00	88.89
Sisal bags	11.11	-	5.56
<b>Whether packaged seed is labelled</b>			
Yes	44.44	11.11	27.78
No	55.56	88.89	72.22

Producers that had excess seed after sales handled the excess in several ways; let them grow in the field (33.3%), store seed in damp places (33.3%) and converted excess seed to animal feed (33.3%). Most seed multipliers (88.9%) used polythene bags for packaging the planting material; however, these packs were rarely (72.2%) labelled according to quality standards.

### 3.4.2 Sweetpotato root production and sales to buyers/ farmers

Root and vine producers normally pursue two revenue streams; seed and root sales. Seed multipliers may rotate the same seed field for two to three times before harvesting the roots for home consumption, processing or direct root sales. However, a few root producers sell the seed, most rather provide the seed freely to fellow farmers.

**Table 19.** Frequency of seed multipliers that prefer different varieties for production and sale

Variety	Kamuli	Iganga	Pooled
Umbrella	9	7	16
Muwulu-aduduma	8	7	15
Kakamega-OFSP	10	3	13
NASPOT 8 OFSP	3	8	11
Bunduguza	6	5	11
NASPOT 9 OFSP	7	1	8
Bunduguza Omuyaka	5	2	7
NASPOT 13O	1	5	6
Kipapali	5	1	6
NASPOT 10 OFSP	4	1	5
Bunduguza Omukaaire	1	2	3
Kinana	3	0	3
Sula-oluti	2	0	2
Mununuzi	2	0	2
Yongera-abalenzi empooli	0	2	2
Nakayima	2	0	2
Kateteyi	0	2	2
Bukukola	1	1	2
Dibyala	0	2	2

Several sweetpotato varieties were preferred to produce roots for sale and are summarized in Table 19. Overall, varieties preferred for root production and sale were both improved varieties and landraces. The major preferred varieties were “Umbrella”, “Muwulu-aduduma”, Kakamega-OFSP, NASPOT 8 OFSP, “Bunduguza” and NASPOT 9 OFSP. Results presented in Figure 7 indicate that root and vine producers sold mixed sizes of roots as well as grades.



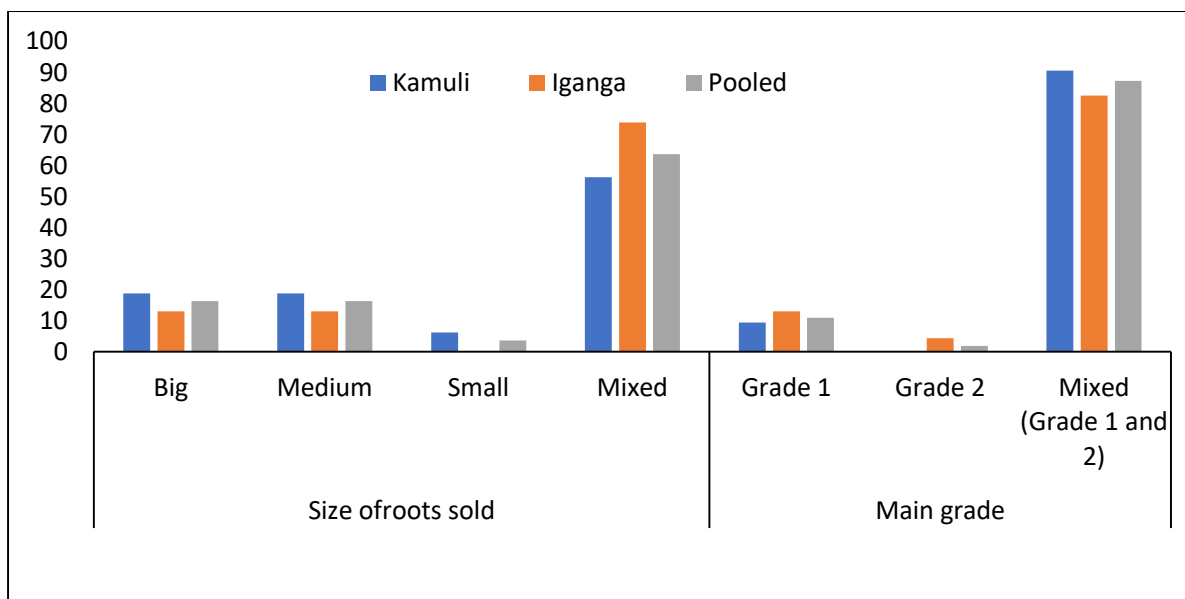


Figure 7. Size and grade of roots sold to customers

### 3.5 Preferences for sweetpotato varieties

#### 3.5.1 Most preferred sweetpotato varieties

The choice of sweetpotato varieties varies among farming households and across locations. Farmers' preferences are mostly influenced by agronomic and quality traits. The findings of the rapid assessment revealed that a significant proportion (66.4%) of the root and vine producers preferred landraces due to better quality characteristics compared to the improved varieties. Of those who preferred landraces, 61.3% and 71.7% were from Kamuli and Iganga respectively. Overall, the top five most preferred varieties were "Muwulu-aduduma", "Umbrella", "Bunduguza", NASPOT 8 OFSP, and NASPOT 9 OFSP". While the order of preference of the varieties varied within the specific districts (Table 21). This implies that the differences in agronomic and quality traits between improved and local varieties influence the choice of the most preferred sweetpotato varieties.

In Kamuli, the top five most preferred sweetpotato varieties were NASPOT 9 OFSP, "Muwulu-aduduma", "Kipapali", "Bunduguza" and Kakamega OFSP. During the survey, the research team profiled the traits of the different varieties. It was found out that "Bunduguza" is similar to Dimbuka Bukulula, one of the earlier released improved Sweetpotato varieties. While "Muwulu-aduduma", "Umbrella", NASPOT 8 OFSP, "Bunduguza" and "Yongere-abalenzi Empooli" were the top five most preferred varieties by the root and vine producers in Iganga district as shown in Table 20.

**Table 20.** Frequency of the most preferred improved and local varieties

Varieties	Kamuli (n=62)	Iganga (n=60)	Pooled (n=122)
Muwulu-aduduma	8	16	24
Umbrella	3	9	12
Bunduguza	7	5	12
NASPOT 8 OFSP	3	8	11
NASPOT 9	9	2	11
Kipapali	8	1	9
Kakamega-OFSP	6	2	8
NASPOT 130	2	4	6
Bunduguza Omukaaire	4	1	5
Yongera-abalenzi Empooli	0	5	5
NASPOT 10 OFSP	3	0	3
Bunduguza Omuyaka	2	0	2
Kinana	2	0	2
Namugwere	0	2	2
Kateteyi	0	2	2
Ejumula-OFSP	1	0	1
NASPOT 120	0	1	1
Bugina	0	1	1
Nakato	1	0	1
Mununuzi	1	0	1

### 3.5.2 Traits that influence choice of varieties to grow and sell by producers

The choice of the sweetpotato varieties presented in Table 21 was influenced by the different agronomic and quality traits. Additionally, market and seed-related traits affect variety selection decisions. From the rapid assessment results, high root yield, good taste, big size of roots, high dry matter content and early maturing were the top five traits that influenced respondents' preference for varieties. Most of the preferred traits revealed from the study are among the key traits in the ongoing sweetpotato breeding program. Therefore, optimizing breeding program to achieve end-user's thresholds for these traits coupled with increased awareness on improved varieties would increase the uptake among the farming households.

**Table 21.** Preferred traits of the sweetpotato varieties to grow and sell

Variable	Kamuli	Iganga	Pooled
High root yield	74.2	73.3	73.8
Good taste	61.3	66.7	63.9
Big size of the root	33.9	40.0	36.9
High dry matter content	33.9	38.3	36.1
Early maturity	27.4	40.0	33.6
Long storage shelf-life	22.6	30.0	26.2
Better nutritional & health benefits	29.0	15.0	22.1
Stress resistance	17.7	23.3	20.5
High demand/marketable	21.0	18.3	19.7
Flesh sweetness	8.1	28.3	18.0
Liked by children	16.1	6.7	11.5
Resistance to SPVD	9.7	8.3	9.0
Not fibrous	4.8	13.3	9.0
Good shape	6.5	6.7	6.6
Good skin texture	4.8	8.3	6.6
Good smell	4.8	6.7	5.7
Good color of the flesh	8.1	1.7	4.9
Availability of seed	1.6	6.7	4.1
Resistance to SPW	1.6	5.0	3.3
Hardness after cooking	6.5	0	3.3
Skin color	4.8	1.7	3.3
Easy to peel	3.2	1.7	2.5
High vine yielding		3.3	1.6
Better price	3.2	0	1.6
Hard raw root	1.6	0	0.8

The results presented in Table 22 indicate that “Muwulu-aduduma” was the most preferred for big root size, long storage shelf-life, high dry matter content, high root yield, and flesh sweetness. Generally, the Orange-Fleshed Sweetpotato varieties such as NASPOT 8 OFSP, NASPOT 9 OFSP, NASPOT 10 OFSP, NASPOT 120 and NASPOT 130 were mainly preferred for early maturity, and better nutritional and health benefits such as Vitamin A, flesh sweetness, high root yield, good taste and big size of roots. “Bunduguza” and “Umbrella” were mentioned among the top five most preferred varieties due to their early maturity and high dry matter content.

**Table 22.** Preference of specific traits of the sweetpotato varieties to grow and sell

Traits of the preferred varieties	Muwulu-aduduma	Umbrella	Bunduguza	NASPOT 8 OFSP	NASPOT 9 OFSP	Kipapali	Kakamega-OFSP	NASPOT 130	Bunduguza Omukaaire	Yongera-abalenzi	NASPOT 10 OFSP	Bunduguza Omuyaka	Kinana	Namugwere	Kateteyi	Ejumula-OFSP	NASPOT 120	Bugina	Nakato	Mununuzi	Getu	Nakayima	Mwezigumu	
Early maturity	2	6	6	5	2	4	3	2	1	2	3		1	1	2		1							
Long storage shelf life	12	2	1	1		1	2	2	2	1		1		1	1			1	1			1	1	1
Resistance to SPVD		1	2	2				2	1		2							1						
Resistance to SPW			1				1		1															
Stress resistance	4	1	4	3	1	1	1		4	1			1	1	2			1						
High vine yielding				1				1																
High root yield	9	1	4	2	4	3	2	1		2					1									
Good color of the flesh		1		2	1	1															1			
Good shape	4	1		1	1								1											
Big size of the root	13	5	1	3	5	2	2	1	2	4		1	1		2				1			1	1	
Good texture	2		2		1	1		1		1														
Good taste	5	1	5	5	6	5	4	3	2	1	2	1			1		1	1				1		
Good smell	3			1				1													1			1
Hardness after cooking	2							1	1															
Flesh sweetness	7	2	3	2	2		2	1		2	1													
Nutritional/health benefits				4	8	4	4	3			3						1							
Not fibrous	5	1			1				2					1										1
Liked by children				2	2	2	2	3				1				1	1							
Easy to peel	1			1			1																	
Availability of seed	1		2				1			1														
High demand/marketable	5	2	1	2	4	1	4	1						1		1			1	1				
High dry matter content	11	7	4	2	3	2	2		2	3	2	1							1	1	1	1	1	1
Skin color		1		1			1									1								

The findings from the rapid assessment revealed that some traits have relatively low influence on the choice of varieties and these included hard raw root, high vine yield, ease of peeling, skin color, and hardness after cooking (Table 22). It is important to note that the influence of the different traits on preference for sweetpotato varieties may vary across the stakeholders; root producers, seed producers, traders, processors and final consumers.

### 3.5.3 Traits of sweetpotato varieties preferred by men

Overall, the five key traits preferred by men were good taste, high dry matter content, flesh sweetness, big size of roots and better nutritional and health benefits. Similar traits influenced the choice of varieties by men in Kamuli (Figure 8). While the choice of varieties in Iganga was influenced by good taste, high dry matter content, flesh sweetness, big root size and good aroma. The findings indicate that men preferred production, consumption and market-related traits contrary to the notion that they mostly prefer market-related traits.

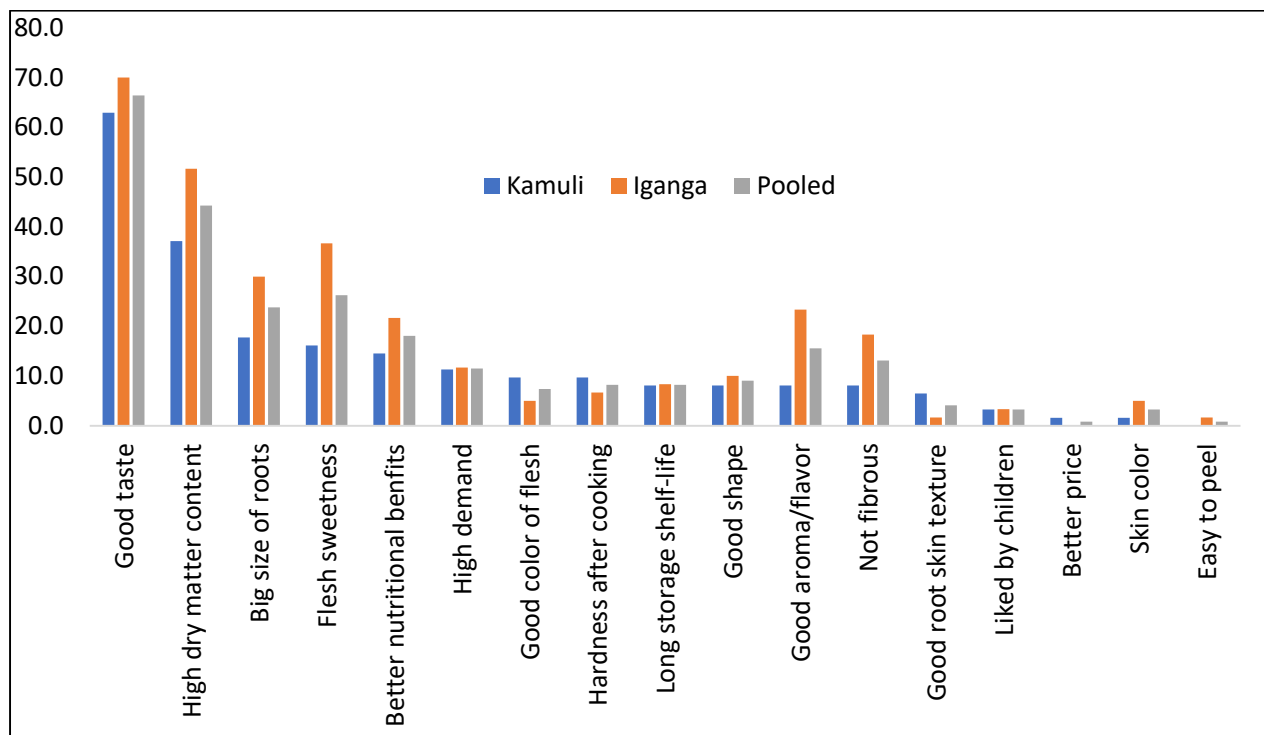


Figure 8. Traits of sweetpotato varieties preferred by men

Table 24 shows the influence of traits on men’s choice of the most preferred sweetpotato varieties. “Muwulu-aduduma” was the most preferred variety due to high dry matter content, good aroma, flesh sweetness, good shape and long storage shelf-life. High dry matter content and big size of the roots influenced selection of “Umbrella” as the second most preferred sweetpotato variety (Table 23). “Bunduguza” was preferred for high dry matter content, good taste and flesh sweetness. The choice of the fourth and fifth OFSP varieties was influenced by better nutritional and health benefits and big size of the roots.

**Table 23.** Men's preference of the traits of different sweetpotato varieties

Traits of preferred varieties	Muwulu-aduduma	Umbrella	Bunduguza	NASPOT 8 OFSP	NASPOT 9 OFSP	Kipapali	Kakamega-OFSP	NASPOT 130	Bunduguza Omukaaire	Yongera-abalenzi	NASPOT 10 OFSP	Bunduguza Omyayaka	Kinana	Namugwere	Kateteyi	Ejumula-OFSP	NASPOT 120	Bugina	Nakato	Mununuzi	Getu	Nakayima	Mwezigumu
High dry matter content	17	8	3	2	3	1	2	1	4	3			1	2	2				1		1	1	1
Good taste	3	3	5	3	5	7	2	3	1	1	2	1	1		1		1	1		1			
Flesh sweetness	5	3	3	4	2		4	3	1		1	1			2		1	1					1
Big size of the root	3	4	1	4	6	1	1	1		3				2	1				1				1
Nutritional/health benefits				5	6	3	2	4	1								1						
Good aroma/flavor	9		1	2	2	1		1	1					1			1						
Not fibrous	4	1		1	1	1	2		2	1			1	1				1					
High demand/marketable	1	3	2		2		2			2					1						1		
Good shape	5			3	1								1								1		
Long storage shelf life	5			2					1													1	1
Hardness after cooking	4	1						1	1	1			1		1								
Good color of the flesh	1	1		1	2	1	1	1								1							
Good texture		2	1								1										1		
Liked by children					2	1											1						
Skin color		1	1	1	1																		
Easy to peel	1																						
Better price							1																

### 3.5.4 Traits of sweetpotato varieties preferred by women or female consumers

The results from the rapid assessment indicate that women’s choice of sweetpotato varieties is influenced by good taste, high dry matter content, flesh sweetness, big size of roots, and better nutritional and health benefits (Table 24). In Kamuli, variety preference was influenced by good taste, high market demand, high dry matter content, flesh sweetness and better nutritional and health benefits. Apart from high market demand replaced with big size of roots, similar traits informed root and vine producers’ choice of sweetpotato varieties in Iganga district. Findings from the assessment revealed that the top five traits that influenced the choice of the most preferred sweetpotato varieties by men and women were relatively similar.

**Table 24.** Traits of sweetpotato varieties preferred by (gender)

Trait	Kamuli	Iganga	Pooled
Good taste	59.7	73.3	66.4
High demand/marketable	19.4	6.7	13.1
High dry matter content	19.4	40.0	29.5
Flesh sweetness	17.7	36.7	27.1
Better nutritional and health benefits	17.7	18.3	18.0
Big size of roots	16.1	31.7	23.8
Good aroma/ flavour	12.9	18.3	15.6
Long storage shelf-life	9.7	11.7	10.7
Easy to peel	9.7	23.3	16.4
Good shape	8.1	15.0	11.5
Good color of flesh	6.5	3.3	4.9
Good root skin texture	6.5	11.7	9.0
Not fibrous	6.5	16.7	11.5
Liked by children	6.5	16.7	11.5
Skin color	3.2	1.7	2.5
Short cooking time	3.2	5.0	4.1
Hardness after cooking	1.6	6.7	4.1
Better price	1.6		0.8

Women in Kamuli and Iganga district preferred “Muwulu-aduduma” as first variety due to flesh sweetness, high dry matter content, big size of roots, good root shape and good aroma (Table 25). While high dry matter content, ease of peeling, and flesh sweetness informed women’s choice of “Umbrella” as the second most preferred variety. Results in Table 5 indicate that better nutritional and health benefits and good taste majorly influence women’s preference for the Orange Fleshed Sweetpotato varieties. “Bunduguza” which has similar traits to Dimbuka Bukulula was preferred for good taste, flesh sweetness and high dry matter content. Therefore, efforts to promote highly yielding, disease resistant and early maturing improved varieties should focus on the combination of production, consumption and marketing traits that influence preferences.

**Table 25.** Women's preference of the traits of the different sweetpotato varieties

Traits	Muwulu-aduduma	Umbrella	Bunduguza	NASPO 8 OFSP	NASPO 9 OFSP	Kipapali	Kakamega-OFSP	NASPO 130	Bunduguza Omukaaire	Yongera-abalenzi empooli	NASPO 10 OFSP	Bunduguza Omyaka	Kinana	Namugwere	Kateteyi	Ejumula-OFSP	NASPO 120	Bugina	Nakato	Mununuzi	Getu	Nakayima	Mwezigumu
Long storage shelf life	3		1	2					1	1			1	1	1				1			1	
Good color of the flesh	1				2	2	1																
Good shape	5	3		1	1		1													1	1		1
Big size of the root	6	3	2	3	4	1	1	2		2				2	1		1		1				
Good texture	1	1	2	2		1		2							1	1							
Good taste	3	3	5	2	7	8	3	4			2		1		9		1					1	1
Good smell	5	1		3	1	1	2	1		2				1			1						1
Hardness after cooking	1			1					1									1					1
Flesh sweetness	10	4	3	3	2		3	2	2	1	1	1			1								
Nutritional/ health benefits				4	7	3	4	3									1						
Not fibrous	4			2	1	1	1		2	1				1				1					
Liked by children				3	3	1	2	3	1								1						
Easy to peel	4	6		2	1		1	2	1	1				1				1					
High demand/ marketable	4	1	2		2		2	3								1				1			
Better price							1																
High dry matter content	6	6	3	2	4		1		3	4		1		2	1						1	1	1
Skin color					1		1	1															
Short cooking time			1	3											1								



### 3.5.5 Least preferred sweetpotato varieties by root and vine producers

#### 3.5.5.1 Specific least preferred sweetpotato varieties

The least preferred sweetpotato varieties reported by root and vine producer during the rapid assessment are presented in Table 26. The assessment showed that the least preferred sweetpotato varieties were mostly landraces. Among the top five least preferred varieties by root and vine producers in Kamuli, NASPOT 10 OFSP was the only improved variety. While top five least preferred varieties in Iganga district were landraces. Although the landraces were preferred for superior quality traits, they also lack several good agronomic traits.

**Table 26.** Frequencies of least preferred sweetpotato varieties

Varieties	Kamuli (n=58)	Iganga (n=60)	Pooled (n=118)
Muwulu-aduduma	7	3	10
Umbrella	6	3	9
Bunduguza Omukaaire	4	5	9
Bunduguza	4	5	9
Bunduguza Omuyaka	4	4	8
Liira-awo	6	2	8
Silk	1	4	5
Kibiri-kya-mbidi	1	4	5
Kakamega-OFSP	3	1	4
NASPOT 10 OFSP	4	0	4
Bugina	1	3	4
Namugwere	0	4	4
Nakasoma	0	4	4
NASPOT 8 OFSP	0	3	3
Kyebandula	1	2	3
Malagala	3	0	3
Ejumula-OFSP	1	1	2
Kinana	2	0	2
Kipapali	1	1	2
Nakato	1	1	2
Yellow-yellow	2	0	2
Yongera-abalenzi empooli	0	2	2
Getu	2	0	2
Soroti	0	2	2

### 3.5.2.2 Disliked traits of the least preferred varieties to grow and sell by producers

The choice of varieties is influenced by the thresholds of specific traits preferred by root and vine producers, thus varieties preferred by one group may be least preferred by others and vice versa. The top least preferred traits by root and vine producers in Kamuli and Iganga districts were low root yield, poor taste, fibrous roots, small size of roots, later maturity and others as presented in Table 27.

**Table 27.** Traits of the least preferred varieties disliked by root and vine producers

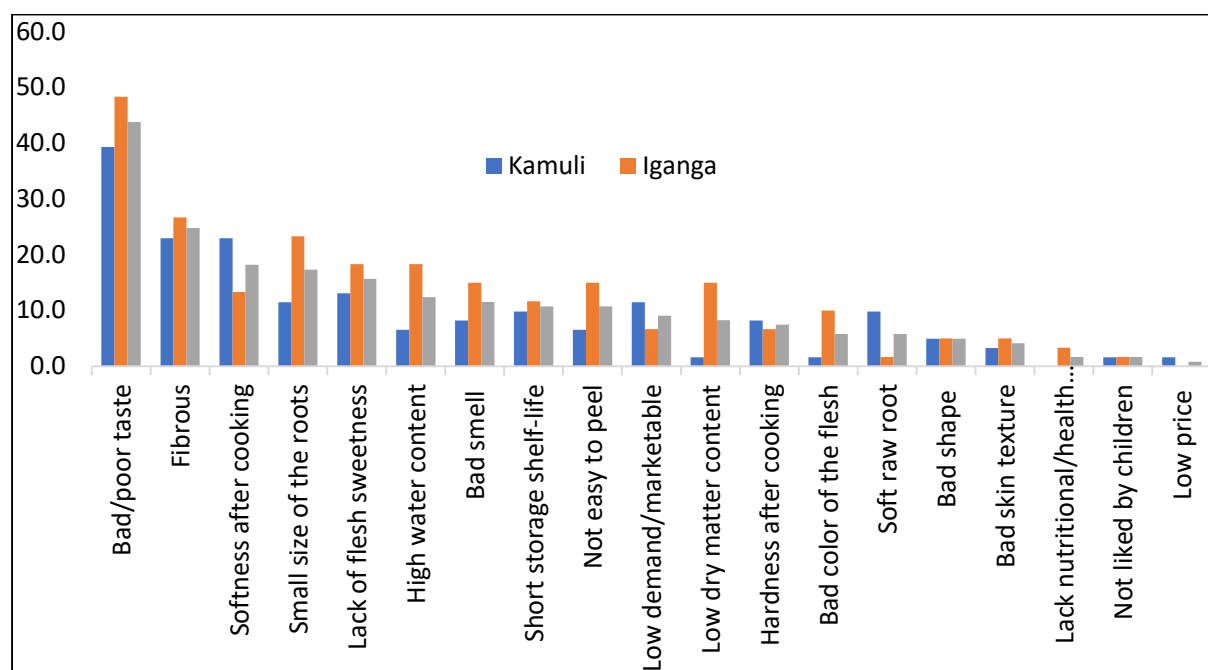
Variable	Kamuli	Iganga	Pooled
Low root yield	37.7	48.3	42.98
Bad/poor taste	44.26	36.7	40.5
Fibrous	26.23	23.3	24.79
Small size of the roots	14.75	25.0	19.83
Late maturity	16.39	21.7	19.01
Short storage shelf-life	18.03	18.3	18.18
Lack of flesh sweetness	14.75	21.7	18.18
Not resistant to SPW	8.2	26.7	17.36
Not stress resistant	9.84	25.0	17.36
Softness after cooking	18.03	15.0	16.53
Low dry matter content	16.39	8.3	12.4
High water content	6.56	15.0	10.74
Soft raw root	9.84	10.0	9.92
Hardness after cooking	11.48	6.7	9.09
Have disease/pest	13.11	3.3	8.26
Bad smell	6.56	5.0	5.79
Limited availability of seed	1.64	10.0	5.79
Low demand/marketable	6.56	5.0	5.79
Bad shape	3.28	5.0	4.13
Lack nutritional & health benefits	4.92	3.3	4.13
Not resistant to SPVD	1.64	3.3	2.48

During the assessment the respondents were asked about traits of the least preferred varieties by men. Results in Table 28 indicate that the top five traits included poor taste, softness after cooking, fibrousness, lack of flesh sweetness and small size of roots. These are associated with specific least preferred sweetpotato varieties.

**Table 28.** Traits of the least preferred varieties disliked by men

Trait	Kamuli	Iganga	Pooled
Bad/poor taste	39.3	41.7	40.5
Softness after cooking	29.5	25.0	27.3
Fibrous	23.0	31.7	27.3
Lack of flesh sweetness	18.0	21.7	19.8
Small size of the roots	8.2	26.7	17.4
Low dry matter content	3.3	21.7	12.4
High water content	6.6	16.7	11.6
Bad smell	6.6	15.0	10.7
Short storage shelf-life	8.2	6.7	7.4
Hardness after cooking	4.9	10.0	7.4
Low demand/marketable	9.8	3.3	6.6
Bad color of the flesh	0	11.7	5.8
Soft raw root	4.9	5.0	5.0
Bad shape	4.9	3.3	4.1
Lack nutritional/health benefits	0	8.3	4.1
Not liked by children	1.6	1.7	1.7
Not easy to peel	0	1.7	0.8

Regardless of the order of preference, the six top traits of the least preferred varieties disliked by male and female root and vine producers were similar (Table 28 and Figure 9).



**Figure 9.** Traits of the least preferred varieties disliked by women

Results in Table 29 indicate that consumers rarely prefer sweetpotato varieties with poor taste, fibrous roots, small size of roots, softness after cooking, lack of flesh sweetness and short storage shelf-life.

**Table 29.** Traits of the least preferred varieties disliked by consumers

Traits	Kamuli	Iganga	Pooled
Bad/poor taste	41.0	50.0	45.5
Fibrous	27.9	25.0	26.5
Small size of the roots	14.8	31.7	23.1
Softness after cooking	23.0	20.0	21.5
Lack of flesh sweetness	14.8	21.7	18.2
Short storage shelf-life	13.1	15.0	14.1
Low dry matter content	11.5	16.7	14.1
High water content	4.9	15.0	9.9
Bad smell	9.8	6.7	8.3
Low demand/marketable	8.2	8.3	8.3
Hardness after cooking	6.6	6.7	6.6
Bad color of the flesh		10.0	5.0
Bad shape	4.9	3.3	4.1
Lack nutritional/health benefits	1.6	6.7	4.1
Soft raw root	3.3	3.3	3.3
Not easy to peel	1.6	3.3	2.5
Bad skin texture	3.3		1.7
Not liked by children	1.6	1.7	1.7
Low price	3.3	0	1.7

### 3.5.5.3 Missing traits of the least preferred varieties

Consumers may defer purchase or consumption of certain varieties that do not conform to their preferences which is determined by a bundle of traits. From the rapid assessment, the root and vine producers who double as consumers indicated that several preferred traits were missing in the least preferred varieties. These included good taste, less fibrousness, big size of roots, flesh sweetness, and high dry matter content as shown in Figure 10.

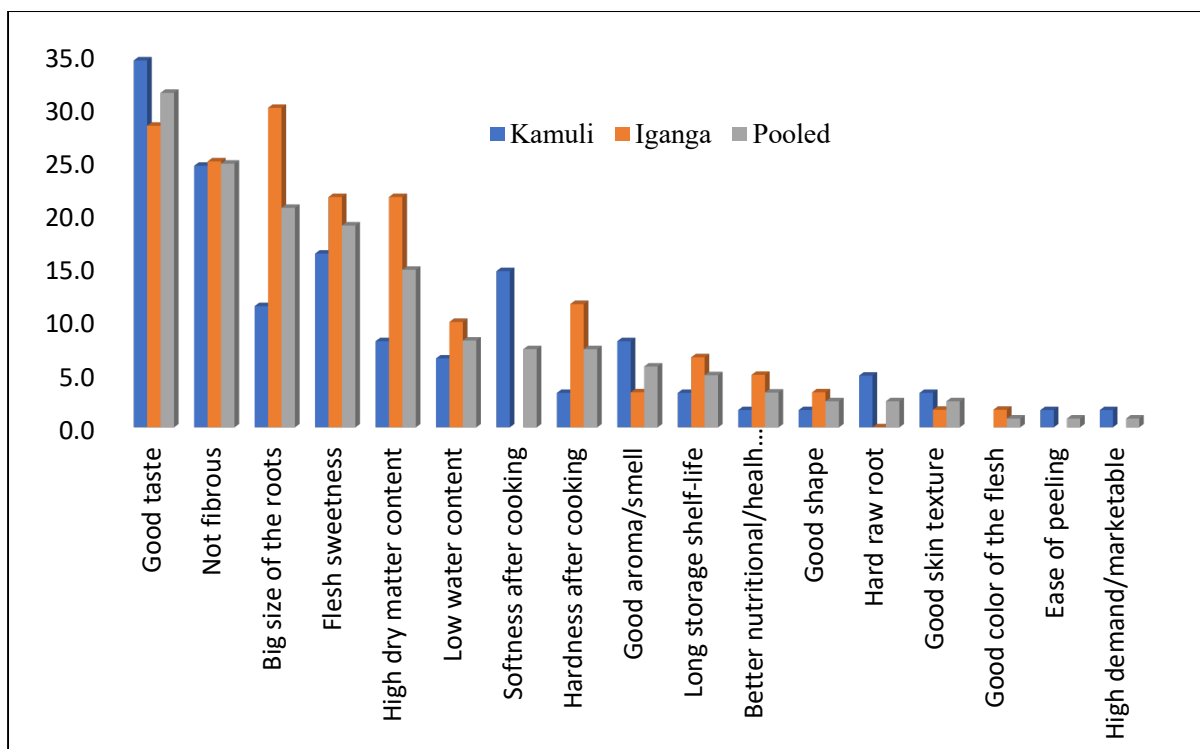


Figure 10. Missing traits of the least preferred varieties

### 3.6 Seed production and marketing challenges

Sweetpotato seed production is plagued by myriad of marketing challenges presented in Figure 11. The seed and root producers reported low market demand, exploitation by middlemen (commission agents), unstable prices, and high transport costs during sales as the major constraints to sweetpotato seed marketing. The other factors such as high wastage of seed along the supply chain and marketing information asymmetry were regarded insignificant.

An in-depth discussion with seed producers and district production officials revealed that the market demand for sweetpotato seed is distorted by free seed distribution by government, nongovernmental organizations and other partners. The stakeholders attested that treating seed as a public good is not sustainable, and derails efforts to build a robust commercial sweetpotato seed system. Additionally, root producers' persistent use of own-saved seed and sharing of seed with fellow farmers contribute to the low demand for quality seed. Therefore, efforts to address the challenges to sweetpotato seed marketing such as building of commercial seed production system need to integrate incentive-compatible approaches such as use of vouchers, seed loans and other seed credit models.

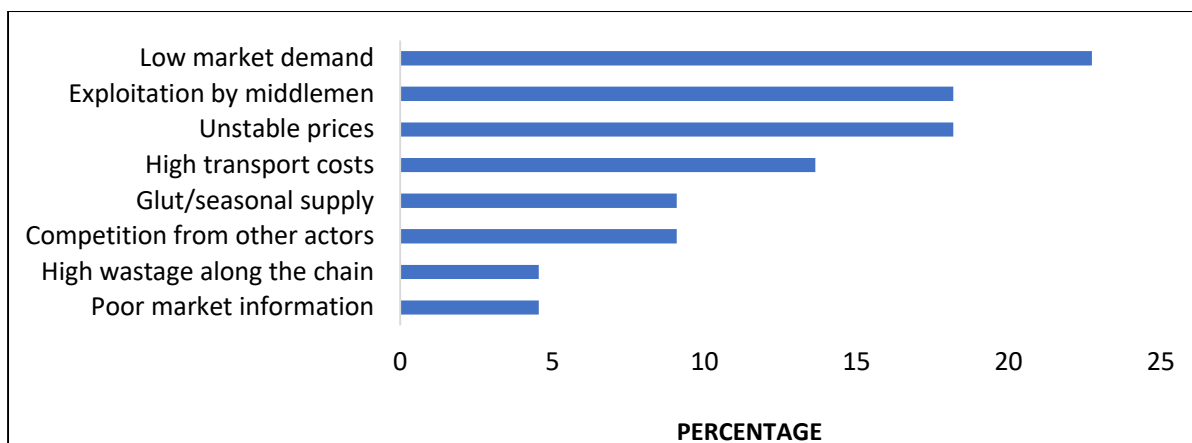


Figure 11. Challenges to sweetpotato seed marketing

### 3.6.1 Sweetpotato seed availability for multiplication

Availability of quality seed through the predominant sources among the sweetpotato producers is critical to improving distribution of quality seed within the seed system. The analysis of the root and vine producers' data revealed that about 75% of the producers in Kamuli and Iganga sourced sweetpotato seed for multiplication from fellow farmers. This illustrates the importance of own saved seed and social seed networks. The other major sources of the seed include National Agricultural Advisory Services (NAADS) and Operation Wealth Creation (OWC); both government parastatals and Nongovernmental Organizations. Limited sourcing from the formal sectors such as seed associations, decentralized vine multipliers (DVMs) and Research/ NARO was significant.

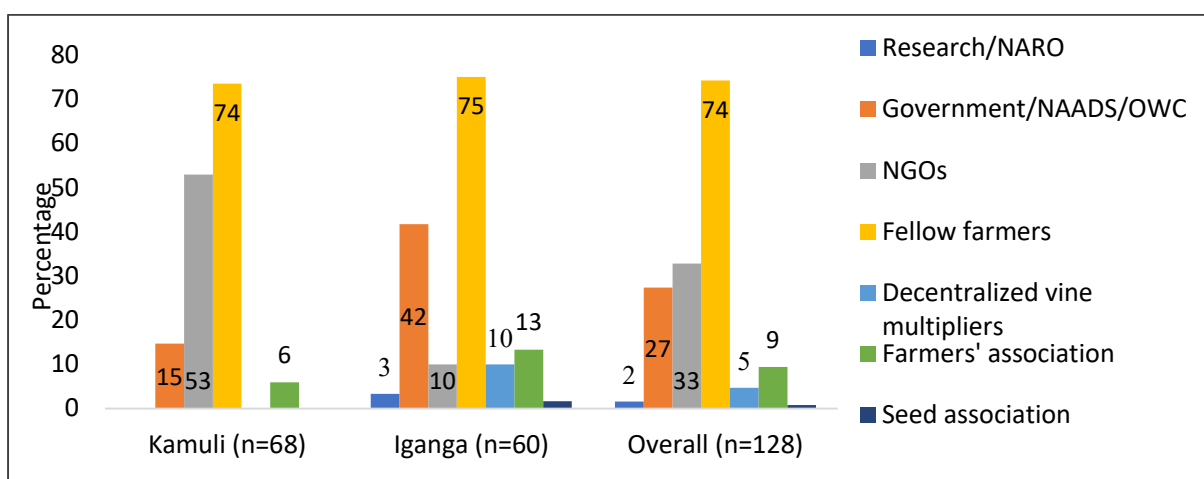


Figure 122. Source of sweetpotato seed/ planting material

Further analysis of the key informant interviews with the officials of the district production department and seed producers revealed that there is limited access of seed from the formal system. Most producers prefer to preserve own seed and sharing of seed among sweetpotato producers is common phenomenon. The seed from the formal system is viewed to be not cost-effective and often composed of varieties with unpreferred traits, especially quality traits.

### 3.6.2 Quantities of seed acquired and mode of access

The root and vine producers mostly access seed for free or purchase the seed. Results from the rapid assessment presented in Table 30 show that most of seed is mostly obtained for free, however, number of bags purchases by the root and vine producers per season exceed the quantity obtained for free.

**Table 30.** Sweetpotato seed acquisition details

Source	Kamuli (n=22)	Iganga (n=15)	Pooled (n=37)
Mode of seed access (%)			
Free	81.8	60.0	72.9
Monetary	18.2	40.0	27.0
Quantities access (count)			
Free	2.1	1.0	1.7 (1.7)
Purchased	8.5	22.8	19.3 (33.7)
Price per bag (UGX)	8,500	19,000	16,375

### 3.6.3 Sources of information on seed and sweetpotato seed production

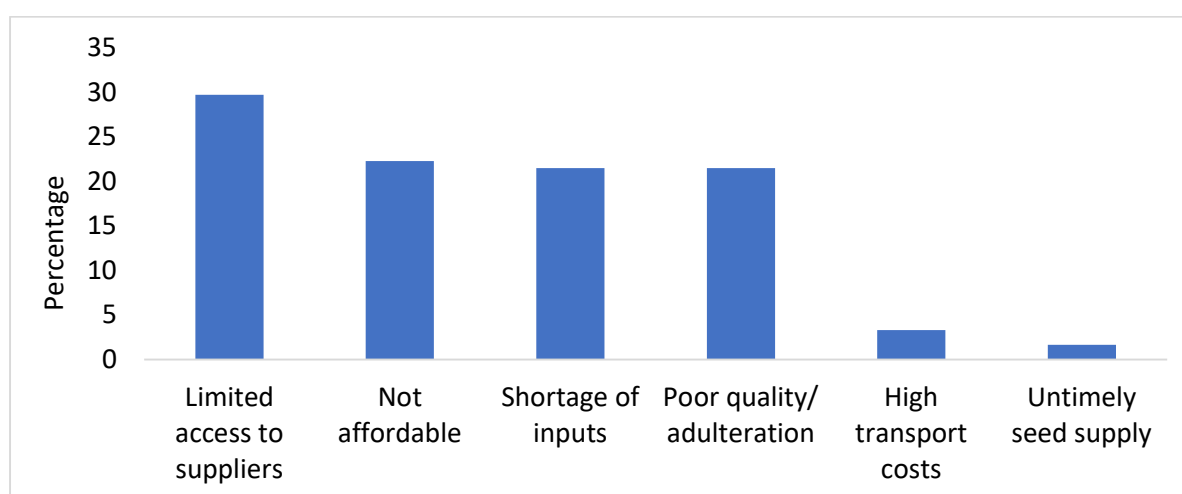
Results in Table 31 indicate that about 84% of the root and vine producers in the districts of Kamuli and Iganga received information on Sweetpotato seed and production from their fellow farmers. This highlights the importance of social networks in the provision of information, education and communication (IEC) on agricultural production. To some extent, government, NGOs, local traders and radio serve as important sources of information on sweetpotato seed and production. Developing better user-friendly platforms for information, education, and communication on sweetpotato production such as brochures, leaflets, quick SMS and radio jingles ensure information symmetry and promote efficient production and marketing.

**Table 31.** Sources of information on seed and sweetpotato production

Source	Kamuli (n=68)	Iganga (n=60)	Pooled (n=128)
Fellow farmers	83.8	83.3	83.6
Government/NAADS/OWC	22.1	55.0	37.5
Research/NARO	-	1.7	0.78
NGOs	44.1	11.7	28.9
Local trader	32.4	33.3	32.8
Radio	41.2	26.7	34.4
Television	-	1.7	0.78
Seed multipliers	5.9	6.7	6.3
Root trader	1.5	1.7	1.6

### 3.6.4 Access to sweetpotato seed

Access to quality seed has proven to be a key issue in crop production given the fact seed access is constrained by limited funds to purchase seeds. Seed access problems mainly falls on the demand side due to the effects of shocks on livelihood assets and income sources of the farming households. About 35% of the producers (43% and 27% for Kamuli and Iganga respectively) faced seed access challenges. From the analysis of the rapid seed assessment data from Kamuli and Iganga districts, the key reasons for not accessing adequate sweetpotato seed were limited access to suppliers, high cost of seed, shortage of seed and poor seed quality (Figure 13). This implies that poor access to seed is not only limited to lack of money, but also limited seed availability.



**Figure 133.** Challenges to sweetpotato seed access in Kamuli and Iganga districts

Addressing this issue requires both short-term and long-term interventions. In the short run, it is vital to increase the purchasing power of the producers to buy seed from seed producers by integrating seed voucher system. The voucher can be redeemed in seed fairs for the informal sector or with local seed producers in case of the formal sector.

### 3.6.5 Seed conservation

Seed conservation for the next planting season is common practice among sweetpotato producers, however, 46% and 28% of the producers interviewed in Kamuli and Iganga districts respectively during the rapid seed assessment conserved seed for the next planting season. However, sweetpotato producers' efforts to conserve adequate seed is majorly constrained by various pests and prolonged dry spell among other factors (Figure 13). Many of the producers (70.8%) faced seed conservation challenges, of which 77% of producers in Kamuli were affected. Similarly seed conservation by 58.8% of the producers in Iganga was constrained by the factors presented in Figure 14.



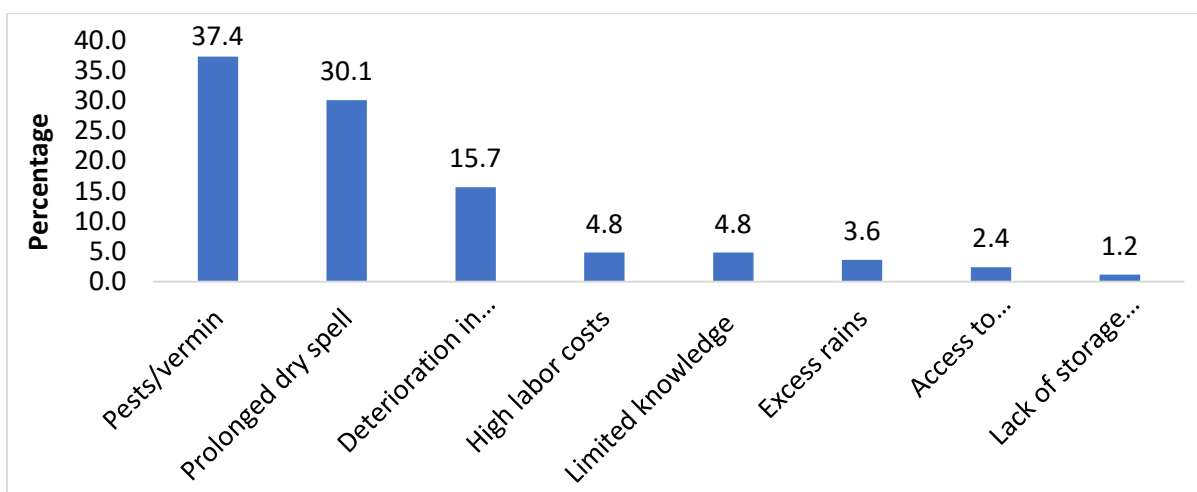


Figure 144. Challenges to sweetpotato seed conservation

### 3.7 Highlights of discussions with root traders on demand and supply

During the rapid assessment several root traders in rural and urban markets were interviewed and all of these were female. A total of 11 and 10 traders from Kamuli and Iganga districts respectively participated in the rapid assessment.

Table 32. Socio-demographic characteristics of traders

Variable	Kamuli (n=11)	Iganga (n=10)	Pooled (n=21)
Education level (%)			
Primary	54.5	50.0	52.4
Secondary	18.2	40.0	28.6
No formal education	27.3	10.0	19.0
Ownership of mobile phone (%)	100.0	90.0	95.2
Purpose of mobile phone (%)			
Communication	34.6	50.0	41.7
Business information gathering	19.2	-	10.4
Business information sharing	15.4	-	8.3
Money transfer (mobile money)	30.8	50.0	39.6
Type of root trader (%)			
Wholesaler	9.1	10.0	9.5
Retailer	90.9	90.0	90.5
Type of market (%)			
Rural market	27.3	60.0	42.9
Urban market	72.7	40.0	57.1
Membership in association or digital platforms (%)	45.5	60.0	52.4

Source: Primary Rapid Assessment data, 2020

In Kamuli, the markets visited were Bulopa, Buwange-Empya, Mbulamuti, Nawanyago, and Kasambira. While in Iganga, traders were interviewed from Namungalwe, Bukaye Town Council, and Abbey-Mukwaya markets. The markets operated on daily basis. Sweetpotato was a major commodity among all the agricultural commodities traded in the various markets.

Education levels were generally low among the traders, on average, five years of formal schooling, implying most of the traders attained primary education. Majority (95.2%) owned basic mobile phones and these were mainly used for communication and mobile money transfer (Table 32). Most of the traders (90.5%) were retailers and operated both in rural (42.9%) and urban (57.1%) markets.

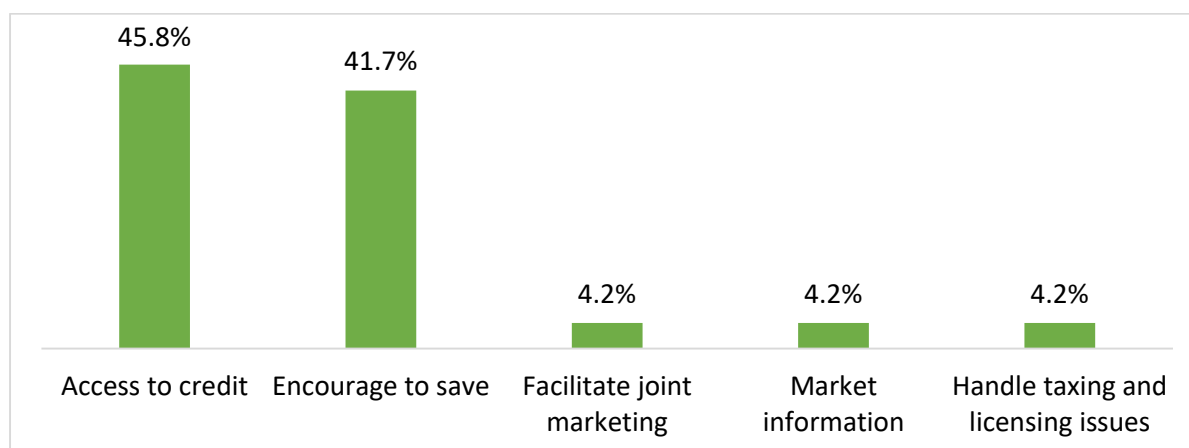
Results in Table 33 indicate that the average age of the traders was 43 years. Averagely, the traders had been involved in sweetpotato root trade for 9 years. Most of the markets were established over 27 years ago (Table 33), though some markets in Iganga were newly established. These served for trading agricultural commodities and other general merchandise.

**Table 33.** Socioeconomic and demographic characteristics of root and vine producers

Variable	Kamuli (11)	Iganga (10)	Pooled (21)
Age of respondent	42.7 (11.1)	43.2 (7.5)	42.9 (9.4)
Education level (years)	4.5 (3.9)	6.0 (3.6)	5.2 (3.8)
Experience in sweetpotato trade	12.0 (9.2)	6.2 (3.6)	9.2 (7.6)
Duration of market operation	47.5 (25.4)	5.9 (2.9)	27.7 (27.9)

Source: Rapid Assessment data, 2020

Results of the assessment indicate that more than half (52.4%) of the traders subscribed to trade associations or digital platforms. The major benefits obtained from the associations presented in Figure 15 include access to credit and knowledge on financial literacy.



**Figure 155.** Benefits from trade association membership

### 3.7.1 Market information and structure

Result in Table 34 indicate that sweetpotato root trade is predominantly women’s business. Overall, most sweetpotato traders were operating retail businesses. The proportion of traders that sold sweetpotato on retail among agricultural commodities was small (9.7% in Kamuli and 17.8% in Iganga). This implies that sweetpotato root trade is largely informal among farming households. Therefore, efforts to develop the root marketing chain would increase the volume traded, thus, increasing the demand for roots. Eventually, this would result in increased derived demand for sweetpotato planting material.

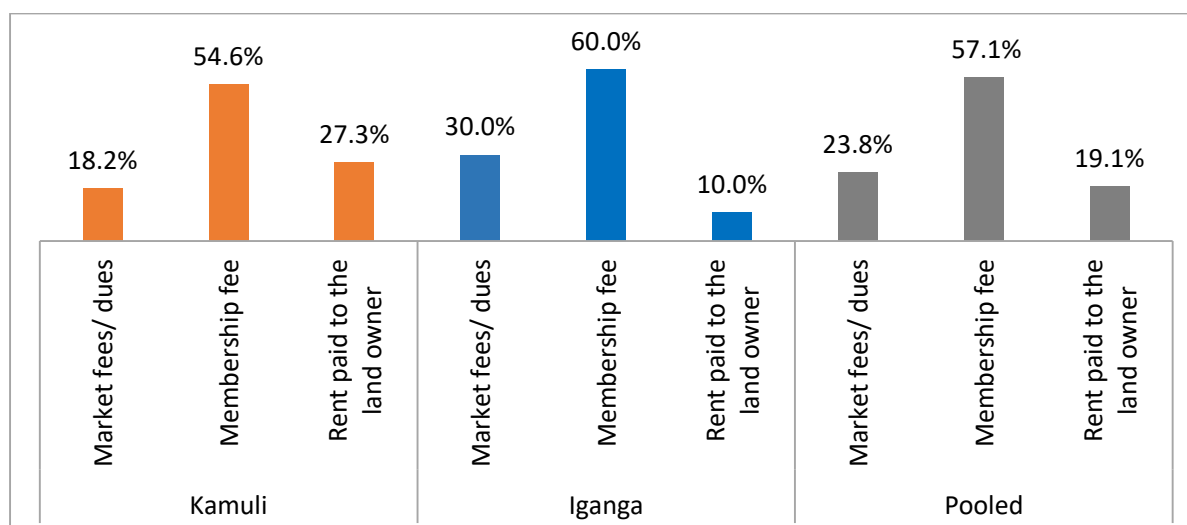
**Table 34.** Summary of numbers of traders of agricultural commodities

Variable	Kamuli (n=11)			Iganga (n=10)		
	Women	Men	Pooled	Women	Men	Pooled
	Mean (sd)	Mean (sd)	Mean (sd)	Mean (sd)	Mean (sd)	Mean (sd)
All traders	228.2 (149.5)	133.1 (140.6)	361.3 (281.3)	94.6 (89.9)	74.6 (58.5)	161.7 (135.9)
Sweetpotato wholesalers	1.0 (0.0)	3.0 (0.0)	2.3 (1.2)	9.4 (8.5)	4.8 (3.9)	13.7 (11.8)
Retailers of all products	228.1 (149.5)	132.6 (139.5)	360.6 (280.3)	82.4 (90.4)	76.9 (51.1)	136.2 (133.9)
Sweetpotato retailers	31.5 (17.3)	4.8 (3.5)	34.9 (17.2)	19.2 (18.0)	8.3 (2.6)	24.2 (22.1)

Source: Primary Rapid Assessment data, 2020

#### 3.7.1.1 Condition for market entry

More than half (57.1%) of the traders access the markets by paying membership fee. Other conditions of market entry presented in Figure 16 include market fees/ dues and rental payment to land owner especially for roadside markets. In some instances, the traders still paid the daily market dues besides membership fees and landlord’s rental payments. Thus, there is double taxation in organized markets, which may reduce the traders’ profit margins.



**Figure 166.** Condition for market entry

### 3.7.1.2 Weighing system and volume of sweetpotato roots traded

In the markets visited, there was no root weighing system, the roots were heaped or packaged in small containers using visual observation. On average, the traders sold about 2.5 bags of sweetpotato roots daily. The maximum volume of roots handled daily was about 15 bags (100 Kg), while some traders sold quantities as low as one-fifth of a bag (100 Kg) (Table 35). The quantities of sweetpotato traded daily were higher in Iganga compared to Kamuli district.

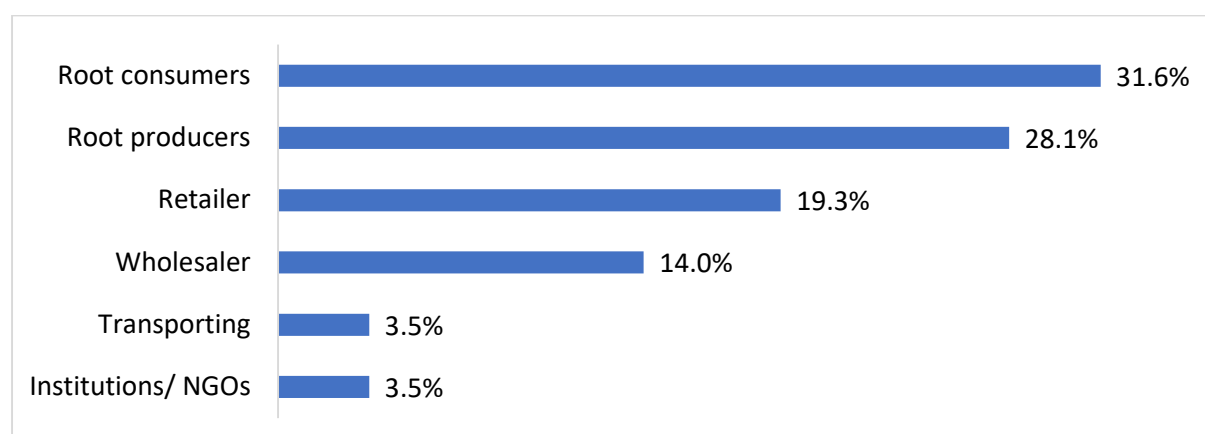
**Table 35.** Volumes of sweetpotato roots traded daily in bags

Variable	Mean (Sd)	Minimum (bags)	Maximum (bags)
Kamuli (n=11)	2.1 (4.3)	0.2	15.0
Iganga (n=10)	2.9 (2.1)	1.0	8.0
Pooled (n=21)	2.5 (3.4)	0.2	15.0

Source: Primary Rapid Assessment data, 2020

### 3.7.1.3 Major actors along the sweetpotato root supply chain

During the rapid assessment, the traders were asked to rank the major actors according to the level of importance along the sweetpotato root supply chain. The results presented in Figure 17 indicate that the most important category of actors along the supply chain was root consumers (31.6%). The second most important category of actors was the root producers. This implies the source of root supply and end-users (consumers) are key drivers in the sweetpotato trade. Actors such as wholesalers and transporters acted as a secondary supply source of sweetpotato roots. While institutions, mainly nongovernmental organizations provided a portion of the market for the sweetpotato roots.



**Figure 177.** Major actors along the sweetpotato root supply chain

The traders mainly (46.2%) sourced sweetpotato roots from the producers at farm-gate (Figure 18). The study results indicate that progressive farmers or early adopters (commission agents/middlemen) act as an important conduit in the supply of fresh roots. Some retailers purchased roots from the wholesalers within the markets.

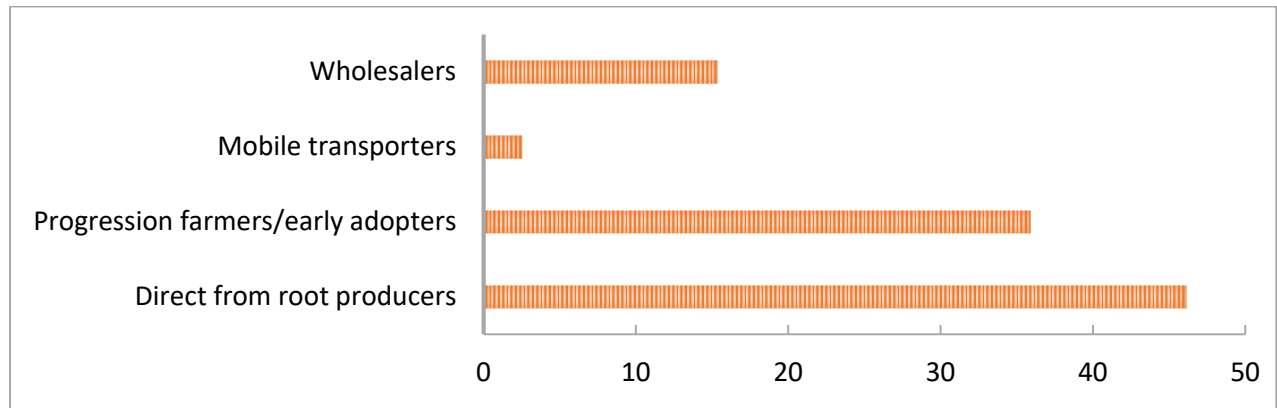


Figure 188. Source of sweetpotato roots

### 3.7.2 Sweetpotato trade seasons, supply and demand

Sweetpotato production depends on seasonal rainfall patterns, thus, the peak and off-peak trade seasons are aligned to the production patterns. The crop can be produced three times a year, including planting in swampy lowlands during dry season. In Uganda, producers sell about 17% of their total harvest and the bulk is retained for home consumption (C. Kpaka, M.K Gugerty, and C.L Anderson 2013). However, each producer at least sells a portion of their sweetpotato harvested in a production season.

#### 3.7.2.1 Major and minor trade seasons

In the different markets, sweetpotato was traded from February to April corresponding to last production season of the previous year. While the major months for sale of sweetpotato roots in the second season were July, August and December. The study results showed that July (34.6%) and April (23.1%) were the major months for sweetpotato trade (Figure 19). Congruently, months of February and August are characterized by low trade volumes.

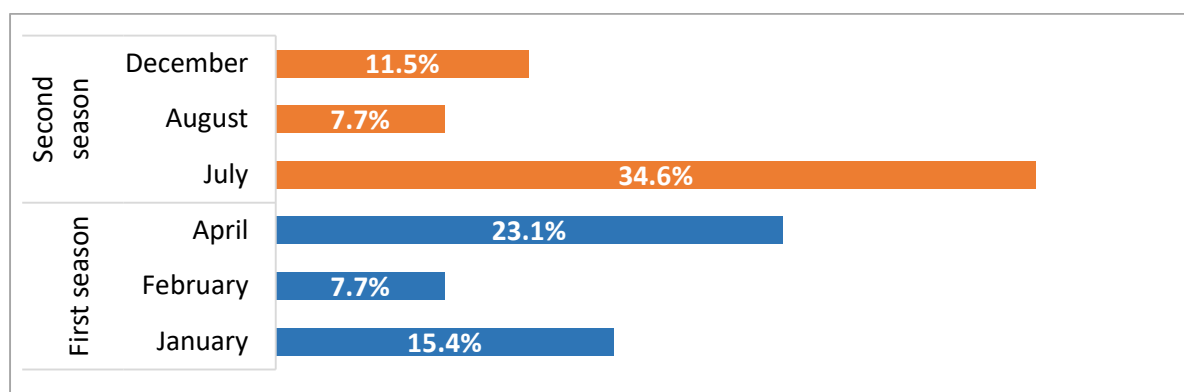
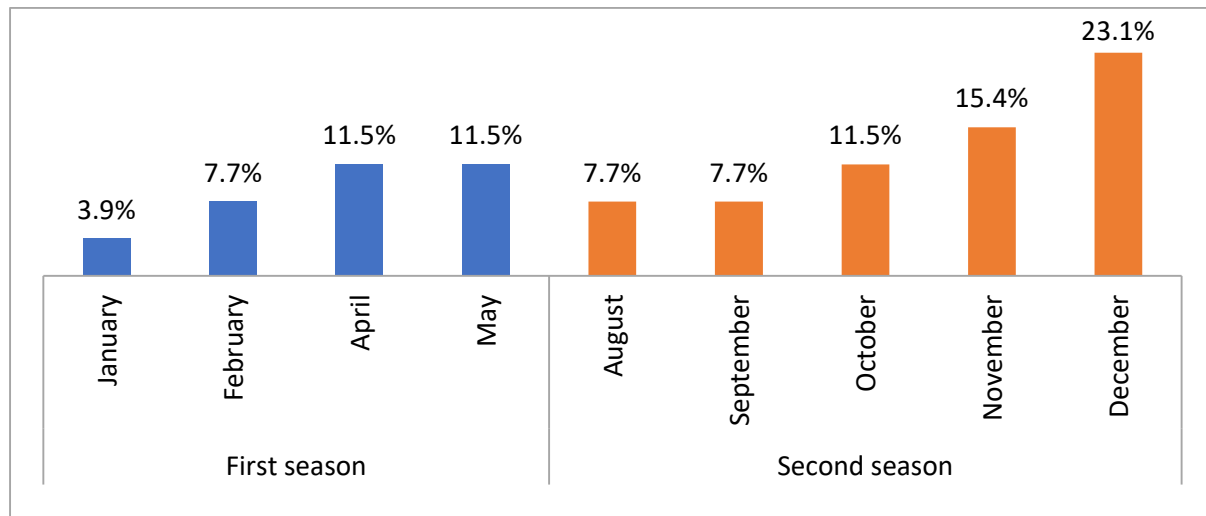


Figure 199. Major months of sweetpotato root trade

Depending on the production volumes, the minor months of sweetpotato root trade can be interrelated to the planting and harvesting periods. Results in Figure 20 indicate that the minor months for sweetpotato trade were November and December.



**Figure 20.** Minor months for sweetpotato root trade

The findings from the rapid assessment indicate that November and December correspond to peak harvest period in the second production season. Therefore, the volume of sweetpotato roots supplied will be high, thus resulting in surplus. In the economic sense, the traders record losses due to low prices since consumers aim to maximize utility. Due to the variance in trade volumes related to fluctuating quantities of sweetpotato produced, the development of value addition capacity overbearingly would have a positive effect on traders' marketing margins. Additionally, a robust value addition system along the chain would contribute greatly to increased derived demand for sweetpotato planting material, thereby improving the functionality of a formal sweetpotato seed system.

### 3.7.2.2 Sweetpotato varieties traded in the major and minor season

The landrace "Muwulu-aduduma" was predominantly traded in the major and minor seasons. "Umbrella" was the second most traded local variety across the trade seasons. Among the top five varieties traded varieties were "Tontanula", "Kinana" and "Kagina" (Table 36). From the rapid assessment results, NAROSPOT 1, Dimbuka-Bukulua and NASPOT 8 were prevalent in the markets among the improved varieties. It emerged from key informant interviews with processors that improved varieties are preferred for value addition, hence their limited availability in the market. Thus, most processors source the roots directly from the producers.

Results in Table 36 show that the ranking of varieties traded over the last 12 months prior to the rapid assessment was dissimilar to ranking in the different seasons. The leading varieties traded in the last 12 months were "Muwulu-aduduma", "Tontanula" and "Umbrella".

**Table 36.** Sweetpotato varieties traded across the major and minor trade seasons

Variety	Major season (%)	Minor season (%)	Last 12 months (%)
Muwulu-aduduma	32.1	30.8	29.6
Umbrella	15.1	15.4	11.4
Tontanulula	11.3	13.5	15.9
Kinana	9.4	9.6	9.1
Kagina	5.7	5.8	6.8
Tompenawena	5.7	5.8	2.3
NAROSPOT 1	3.8	3.9	4.6
Dimbuka-Bukulula	3.8	3.9	4.6
Bunduguza Omukaaire	3.8	3.9	4.6
NASPOT 8-OFSP	1.9	1.9	2.3
Bunduguza Omuyaka	1.9	1.9	2.3
Bunduguza	1.9		2.3
Bugina	1.9	1.9	2.3
Sarah	1.9	1.9	2.3

Source: Primary Rapid Assessment data, 2020

The findings of the assessment showed that the two predominantly traded varieties were in congruence with the sweetpotato varieties that the producers preferred for production and sale presented in Table 19. This depicts relative matching between demand and supply. Caveat, this result may change over time depending on the forms of root utilisation which results in changes in preference of varieties in conformity with the consumption, processing and marketing patterns. It is also worthwhile relating the sweetpotato varieties produced and traded with the preferences of producers and consumers from Focus Group Discussions.

### 3.7.2.3 Sweetpotato root supply, demand and pricing

Overall, the wholesalers sold larger quantities of sweetpotato than the retailers; averagely the latter only demanded 43.2 bags (100 kg) compared to 450.0 bags (kg) by the wholesalers (Table 37). The study results indicate that there was a deficit in the quantity supplied per month. Generally, retailers and wholesalers recorded deficits equivalent to 26 bags and 105 bags per month. Results in Table 37 show that more supply deficit was recorded in Kamuli district. However, it would be important to ascertain the supply deficit in particular months to relate to the causes of short supply as well as provide rational solutions to supply chain actors.

**Table 37.** Summary of quantities of roots demanded and supplied

District	Type of trader	Obs.	Quantity demanded (bags)	Quantity supplied (bags)	Quantity sold (bags)
			Mean (sd)	Mean (sd)	Mean (sd)
Kamuli	Retailers	10	31.3 (20.2)	18.5 (11.8)	18.5 (11.8)
	Wholesalers	1	600.0 (0.0)	450.0 (0.0)	450.0 (0.0)
	All traders	11	83.0 (172.5)	57.7 (130.6)	57.7 (130.6)
Iganga	Retailers	9	56.3 (51.5)	33.2 (32.2)	32.7 (31.2)
	Wholesalers	1	300.0 (0.0)	240.0 (0.0)	240.0 (0.0)
	All traders	10	80.7(91.1)	53.9 (72.1)	53.5 (71.8)
Pooled	Retailers	19	43.2 (39.3)	25.5 (24.2)	25.3 (23.6)
	Wholesalers	2	450.0 (212.1)	345.0 (148.5)	345.0 (148.5)
	All traders	21	81.9 (136.4)	55.9 (104.3)	55.7 (104.2)

Source: Primary Rapid Assessment data, 2020

Traders obtained sweetpotato roots from within the districts of operation and other districts. Iganga, Mayuge, and Soroti districts were the sources of sweetpotato traders. While the traders in Kamuli district were supplied by producers, wholesalers and commission agents from Kamuli, Buyende and Mukono districts.

#### 3.7.2.4 Root price variation in the main trade season

Results in Table 38 indicate that prices of sweetpotato roots varied between main and minor trade seasons across districts and also within a specific season between districts. Additionally, sweetpotato varieties attracted different prices depending end-user preference ranking (see Appendix 1), and the variation was attributed to preference for different attributes which influences the demand for the varieties.

**Table 38.** Sweetpotato root price variation across seasons in US\$ per bag

Trade seasons	Statistics	Kamuli	Iganga	Pooled	Test statistics
Main season	Maximum	125,091	97,000	111,714	$t=2.28, p=0.03$
	Minimum	105,273	71,500	89,190	$t=2.99, p=0.01$
Minor season	Maximum	74,545	65,000	70,000	$t=1.03, p=0.32$
	Minimum	58,364	49,500	54,143	$t=1.08, p=0.29$

Source: Primary Rapid Assessment data, 2020. Test statistics estimated at 5% level significance



The results indicate that there was statistically significant difference between mean price of sweetpotato roots in Kamuli and Iganga districts ( $t=2.28$ ,  $p=0.03$ ). This implies that, the price of roots per bag (100 kg) in Ugandan shillings in Kamuli (125,091) were significantly higher than in Iganga (97,000). Similar statistical price difference across districts was observed for the minimum price in the major trade season. The prices in the minor season did not vary significantly. One plausible explanation for price variation is the variation in supply volume of sweetpotato roots across seasons. However, the variation in prices in a specific season could be attributed to demand and supply within months. Further investigation on seasonal price variation for an extended period would be relevant to reach a conceivable conclusion.

### 3.7.2.5 Transaction costs of sweetpotato roots traded in last 12 months

Table 39 summarizes the different costs incurred in sweetpotato root trade. Results of study indicate that the highest proportion of transaction costs was incurred on transportation of the roots from the farm-gate to the markets. The stems from fact that sweetpotato roots are bulky. Other costs incurred on loading and off-loading, bagging and packaging and storage costs contributed substantial share of the transaction costs incurred by the traders. It is worthwhile for the traders find cost-reduction strategies to ensure higher marketing margins.

**Table 39.** Summary of transaction costs per bags (100 kg)/USh

Variable	Kamuli (n=11)			Iganga (n=10)			Pooled (n=21)		
	Median	Min	Max	Median	Min	Max	Median	Min	Max
Transport	9,500	3,000	25,000	9,500	1,000	35,000	9,500	1,000	35,000
Load and off-loading	3,000	1,000	6,000	2,500	1,000	4,000	3,000	1,000	6,000
Bagging/ packing	2,100	1,000	2,500	2,000	500	6,500	2,000	500	6,500
Sorting/ grading	1,000	500	2,000	500	400	2,000	500	400	2,000
Market fees/ dues	500	300	1,200	500	200	1,500	500	200	1,500
Storage costs	500	500	1,000	4,000	350	8,000	1,000	350	8,000
Other costs	500	500	1,000	1,000	1,000	1,000	750	500	1,000

Source: Primary Rapid Assessment data, 2020

Additional costs incurred along the marketing chain include market stall fees, paying night guards, and others which have lumped as other costs in Table 39. These average to Ush1,000 per bag. Transaction costs are useful in calculating costs of goods sold which is a component of gross profit. However, to determine the marketing margins along the sweetpotato chain, there is need to collect more data on costs and sales of the roots.

### 3.7.2.6 Sweetpotato trade modes

Results in Table 40 indicate that individual consumers were the major buyers of the sweetpotato root traded in markets reached during the study. These were both male and female, however, a higher proportion was comprised of female buyers. This can be related to their productive roles within households as well as involvement in hotel and restaurant businesses.

**Table 40.** Modes of sweetpotato root trade

Variable	Kamuli (n=11)	Iganga (n=10)	Pooled (n=21)
<b>Main Customers of roots (%)</b>			
Individual consumers	81.8	90.0	85.7
Retailers	18.2	10.0	14.3
<b>Sex of customers (%)</b>			
Male	9.1	-	4.8
Female	27.3	50.0	38.1
Both male and female	63.6	50.0	57.1
<b>Main mode of transport (%)</b>			
Motorcycle	33.3	55.6	44.4
Small truck/ pick-up	22.2	33.3	27.8
Bicycle	22.2	11.1	16.7
Large truck/ lorry	11.1	-	5.6
Public transport	11.1	-	5.5

Source: Primary Rapid Assessment data, 2020

The traders mainly transported the fresh roots on motorcycles from farm-gate or sourcing point to the markets. Further, discussions revealed that most of the traders hired boda-boda cyclists. Small trucks were cited as the second predominantly used means of transport by the traders. To maintain transactions costs to manageable levels and break even or remain profitable, some traders used own bicycles for transporting roots.

In several urban market is not uncommon to pay an annual trading license fees as prerequisite for business operation, this was not the case in the markets in Kamuli and Iganga districts. Out of all the traders interviewed, only one had paid an annual trading licensing fee equivalent to USD 10,000. However, it was not possible to attach the licensing fee to the unit of sale of sweetpotato roots since the license served for a basket of agricultural commodities traded.

### **3.7.2.7 Traders' preferences for sweetpotato varieties**

Similar to producers' preferences for sweetpotato varieties to produce and sale, traders preferred to sale sweetpotato varieties with good taste, high demand/ marketability, big size roots and good smell/ aroma. Traders' preferences align to demand patterns of different customers (Table 30). The views of traders expressed in Table 41 indicate that the male customers prefer to buy sweetpotato roots with good taste, good smell or aroma, high dry matter content, flesh sweetness and root skin smoothness or texture.

According to trade patterns and purchase behavior, the traders revealed that female customers prefer to buy sweetpotato roots with good taste, good smell, high dry matter and flesh sweetness (Table 32). The differences in the preferred attributes of sweetpotato among the customers provide important information for targeting the different marketing segments. Further inquiry into the socio-economic characteristics of the different categories would greatly improve customer targeting, thereby increasing market performance and efficiency.

**Table 41.** Attributes of sweetpotato varieties preferred by traders

Attributes	NAROSPOT 1	Dimbuka-Bukulula	Muwulu-aduduma	Umbrella	Tontanulula	Bunduguza Omukaaire	Kinana	Pooled
Good taste	1	1	9	1	7	1	1	21
High demand/marketable	1	1	8		3	1	1	15
Big size roots	1		5	1	1			8
Good smell			5		3			8
Good shape			5		1			6
Root skin smoothness/ texture			5		1			6
Flesh sweetness		1		1	4			6
Good flesh color			1	1	2		1	5
Not fibrous			1		1	1		3
Long storage shelf-life					1		1	2
Hardness after cooking					2			2
Low water content			1					1
High DMC	1		1	1	5	1	1	1
Good skin color					1			1

**Table 42.** Attributes of sweetpotato varieties preferred by male customers

Attributes	NAROSPOT 1	Dimbuka-Bukulula	Muwulu-aduduma	Umbrella	Tontanulula	Bunduguza Omukaaire	Kinana	Pooled
Good taste	1	1	9	1	7	1	1	21
Good smell	1		8		2		1	12
High DMC	1		4		5	1	1	12
Flesh sweetness		1	1	1	4	1		8
Root skin smoothness/ texture			4		2			6
Good flesh color	1		1		2		1	5
Good shape			4					4
Not fibrous			2		1	1		4
Long storage shelf-life					2		1	3
Low water content			1		2			3
Hardness after cooking					2			2
Big size roots	1		8		1			1
High demand/marketable		1						1

**Table 43.** Attributes of sweetpotato varieties preferred by female customers

Attributes	NAROSPOT 1	Dimbuka-Bukulula	Muwulu-aduduma	Umbrella	Tontanulula	Bunduguza Omukaaire	Kinana	Pooled
Good taste	1	1	9	1	7	1	1	21
Good smell	1		8		3		1	13
High DMC	1		3		5	1	1	11
Flesh sweetness		1		1	4	1		7
Good flesh color	1		1		3		1	6
Easy to peel			4					4
Root skin smoothness/ texture			2		1			3
Not fibrous			2			1		3
Long storage shelf-life					2			2
Good shape			5		3	1	1	1
Big size roots	1		8		1			1
Hardness after cooking					1			1
Low water content			1					1
High demand/marketable					1			1

### 3.7.2.8 Challenges faced in sweetpotato trade

Unstable prices, competition from other sellers and exorbitant transport costs have been cited by traders as bottlenecks to sweetpotato trade (Figure 21). High market fees/ dues and exploitation by commission agents (middlemen) were noted as constraints, in addition to poor infrastructure including roads and markets along the marketing chain.

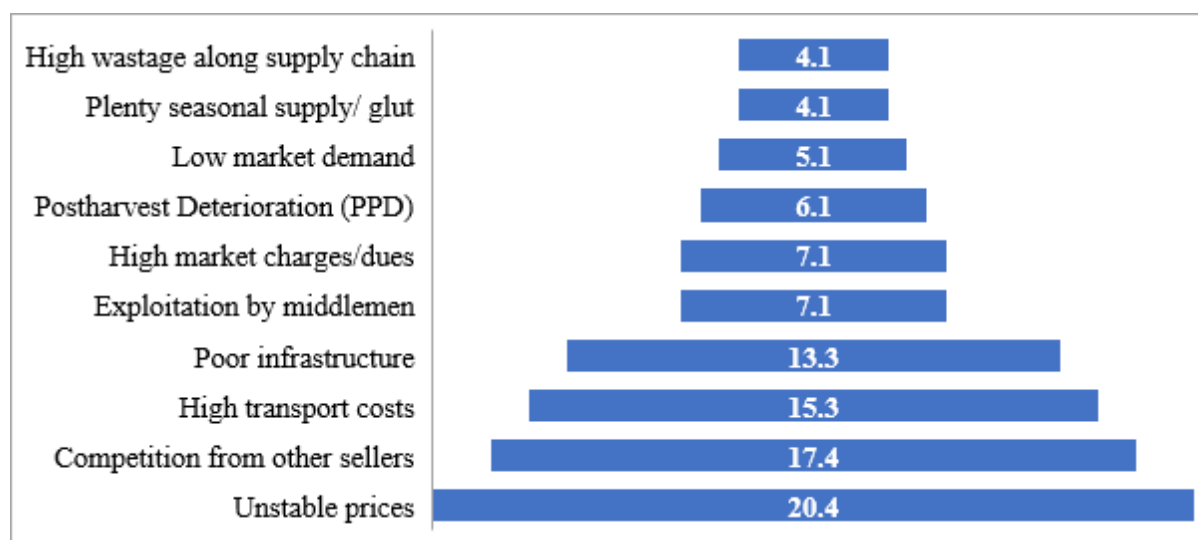


Figure 21. Percentage of challenges faced sweetpotato trade

## 4.0 Insights on certified seed supply and demand from extension, NGOs and seed producers

### 4.1.1 Stakeholders supporting the Sweetpotato seed chain

To ascertain synergistic linkages along the Sweetpotato seed chain, we held key informant discussions with several stakeholders. The district production departments are pivotal in building a robust seed system due to their role in quality assurance and inspection and linkage with different stakeholders such as MAAIF, NGOs and research and academic institutions.

The department also supports group formation and farmer trainings in collaboration with the department of trade, industry and cooperative. For a broader understanding of the role of the department, we held discussions with the District Production Officer (DPO), District Agricultural Officer (DAO), and Agricultural Officers (AOs) of the selected sub-counties. Additional information was sought from the District Commercial Officer (DCO).

We also held five discussions with actors producing different classes of seed including research institutions (NaCRRRI), tissue culture laboratory (SENAI) and decentralised vine multipliers (DVMs) provided more information on Sweetpotato seed system and seed business. Further discussions were held with the representatives of NGOs CIP, HarvestPlus, VEDCO, ISSD, EADEN under CARITAS, Iowa-State University (Uganda programme) and SACU.

## **4.1.2 Availability of quality seed and accessibility**

### **4.1.2.1 Adequacy and supply of certified or quality declared seed**

Basing on the discussions with extension officers, there is inadequate certified seed and quality declared planting material (QDPM) due to increasing demand for OFSP varieties by root producers and NGOs involved in building seed systems. At basic seed class, SENAI TC produces adequate seed since mass multiplication is based on volume required. The scarcity is experienced with certified seed and QDS produced by primary multipliers (DVMs) and secondary multipliers respectively. The multiplication of these seed classes is still on small scale and besides some multiplier sell planting material of local varieties.

A few of the multipliers involved in the production of certified seed are trained by the district production department. The training on GAP for seed production is supported by several NGOs; namely Harvest Plus, VEDCO, CIP and ISSD. Partly, skilling of the seed multiplier is conducted by SENAI Ltd, a private TC laboratory under public private partnership (PPP).

The trained seed producers obtain basic seed from SENAI TC laboratory, and multiply in net tunnels provided by HarvestPlus using rapid multiplication approach. They first tier of seed producers at the farm level, multiply the basic seed in net tunnels to produce certified 1. Thereafter, they bulk the seed in mother gardens before supplying to certified 2 seed producers. These provide seeds to QDPM producers or supplied to root producers. The root producers also receive quality declared planting material (QDPM).

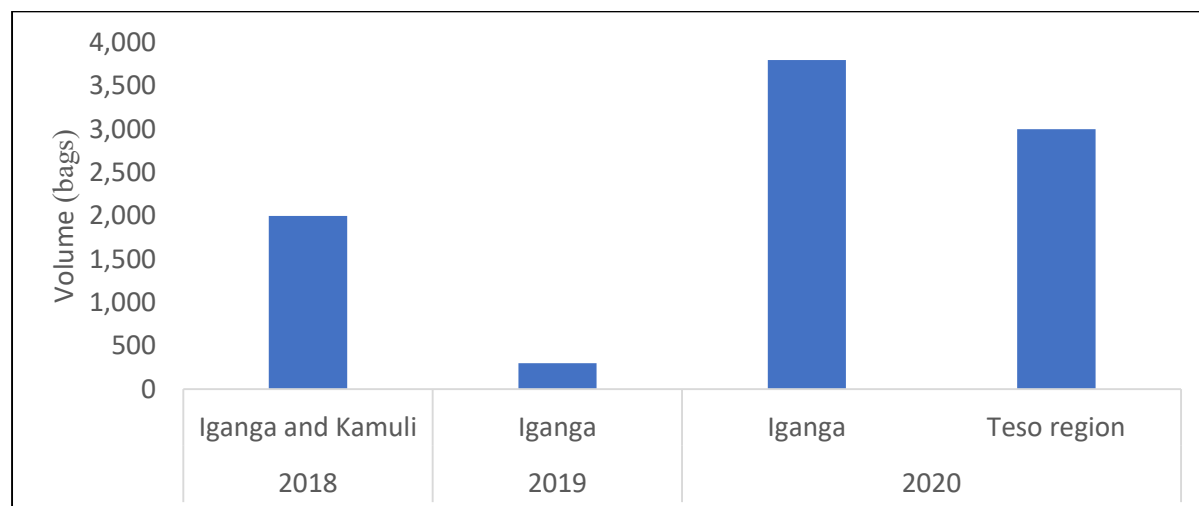
The seeds are inspected and certified by the appointed seed inspector for the Eastern region, who doubles as the DAO of Iganga. The Certified 1 and certified 2 are inspected three times, while the QDPM is inspected at harvest. The DAO has been trained by the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) to inspect and certify the seed produced in the Eastern cluster. The activities include site selection, assessing seed sources and quality, inspecting planting, checking for pests and diseases and certification.

In regard to seed supply by NGOs, the agronomists are responsible for sourcing seed from the multipliers to distribute to seed and root producers. The key informant from Iowa State university indicated that seed especially certified 1 is sourced from the institutions under NARO such as NaCRRI. Within its programming, the university also sources roots for value addition interventions in the Eastern region. The Area Manager, EADEN (operates in Iganga, Luuka and Bugiri) indicated that the current supply of certified seed is inadequate especially the OFSP varieties.



#### 4.1.2.2 Seed supply in the last five years

In Iganga district, the production department is implementing the nutrition project under MAAIF, and this has enhanced the distribution of OFSP varieties. The volume of seed distributed in the last three years is indicated in Figure 22.



**Figure 222.** OFSP Seed distributed by the MAAIF Nutrition project in Iganga district

Iganga district production department also supplied seeds to other districts within the last five years, Namutumba (300 bags) and Karamoja sub-region (20,000 bags). A total of 560 bags were distributed from one the sub-counties in Iganga district. Between 2017 and 2018, substantial quantity of seed was distributed by NGOs such as VEDCO and Eastern Archdiocesan Development Network (EADEN) under CARITAS, though actual figures can be estimated. These mainly sourced the seed from multipliers within the district. In Kamuli district, over 1000 bags of seed were distributed, but most farmers expressed preference for local varieties with good quality attributes such as fast cooking and less fibrous.

Under its Uganda programme, Iowa State University supplied over 300 bags of seeds and roots respectively. The major varieties included NASPOT 9-OFSP (Vita), NASPOT 10-OFSP (Kabode) and NASPOT 8-OFSP. NASPOT 10-OFSP is the most preferred variety due to its high yield but it is too soft after cooking and not tasty. The nongovernmental are neither involved in seed production nor contract farming. EADEN relies on farmer networks to supply OFSP varieties with the support CARITAS network. In the last three years, the organization supplied about 100 bags to 20 starter farmers, each received five bags and the farmers are currently supplying farmers within their networks.

#### **4.1.2.3 Estimating demand for certified seed, challenges and recommendations**

Predicting seed demand is key to improving the supply by the different actors. The department of production staff indicated that it is possible to predict the demand based on the number of farmers growing sweetpotato, mean plot size, planting system (ridges or mounds) used and number of cuttings per ridge or mound. For instance, 60% of the farmers within the near East Uganda plant Sweetpotato on mounds and about 4 – 5 cuttings are planted per mound. Based on the number of mounds per acre, the seed demand can be estimated. Demand estimation also depends on the experience of the agricultural officers and one estimated the annual seed demand per sub-county at 16,000 bags per year.

However, the stakeholders cautioned on the reliability of demand estimates using this approach due to limited reliable data on seed volume requirements. Additionally, sweetpotato seed system is predominantly informal, where producers recycle seed for several seasons, thus making estimation of seed requirements difficult. This is exacerbated by the low adoption of improved varieties due to preference for quality traits of the landraces. Currently, the price of the planting materials of improved varieties is low to incentivise commercial seed production.

Accordingly, the demand for seed could be derived for demand for roots, but largely roots are produced for consumption with a small proportion marketed informally. Hence the root marketing system is not also streamlined to provide accurate predictions. Besides, the NPA and MAAIF's Agricultural Sector Strategic Plan (ASSP) has not prioritized sweetpotato as a major food security and income crop, thus weak value chain linkages. Seed demand estimates are also distorted by weather vagaries coupled with lack of technical capacity and robust infrastructure to capture data for demand and supply forecasts. Other challenges include small field and volume of QDPM and limited knowledge of the benefits of certified seeds.

According the Area Manager, EADEN, it is not possible to predict the annual seed demand. The demand fluctuates with increasing population and other shocks such as the current COVID-19 pandemic. However, seed demand can be estimated from the multiplier effects of the supplies to farmer groups, but this requires good record keeping. While the key informant from VEDCO indicated that demand estimation is affected variety mixing at farm level.

#### **4.1.2.3.1 Recommendations to overcome seed demand estimation challenges**

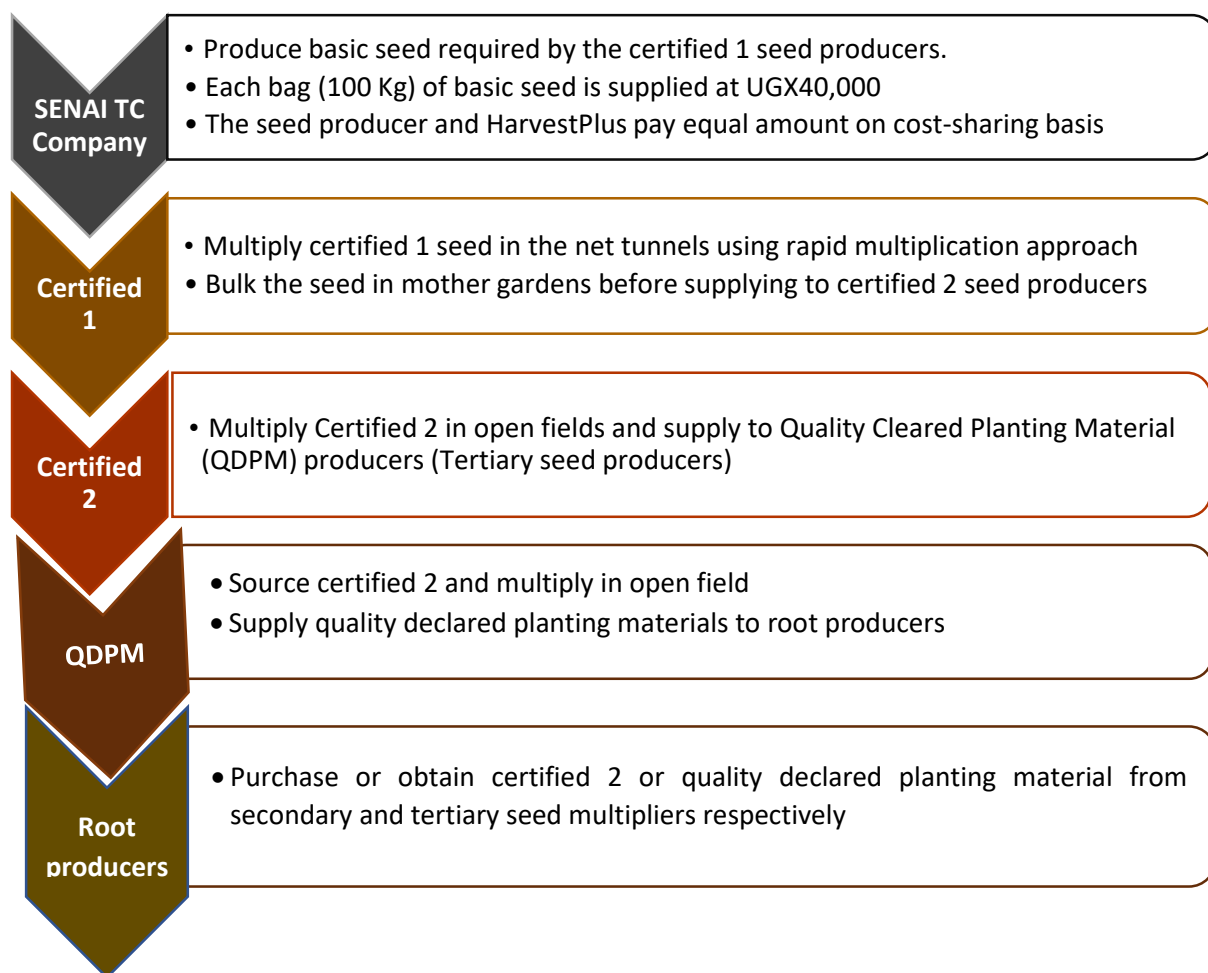
The stakeholders made the following recommendations to improve seed demand estimation:

- Promoting use of improved varieties in efforts to strengthen the formal seed system would contribute to improving seed demand predictions
- Organizing farmers in groups to access seed will improve the capture of accurate production statistics
- Strengthen value addition within the value which increases derived demand
- Developing and operationalizing seed tracking system would greatly improve demand estimates
- Adequate training of the district production and marketing department staff and provision of information, education and communication (IEC) materials are prerequisites for improving demand estimation
- The departments should also be adequately facilitated to capture data and create awareness among the farmers
- There is need to provide information on any varieties introduced and released by NARO
- All demand estimation should be gender focused
- Improve marketing of seed and evaluation system along the seed chain

#### **4.1.3 Accessibility of sweetpotato seed**

##### **4.1.3.1 Delivery channels**

The seed producers within Iganga district, access basic seed from “Seed and Novel Agricultural Innovation: (SENAI) company, private TC laboratory with support of HarvestPlus on cost-sharing arrangement. The seed producers and HarvestPlus pay half the price of UXG40,000 per bag respectively. Other key actors involved in seed delivery include certified 2 seed producers, QDS producers, and root producers.



**Figure 233.** Sweetpotato Seed flow from basic seed producer to root producers

Within the region, there are a multitude of informal vine multipliers who supply certified seed or quality declared planting material. These directly serve a large proportion of the root producers in the Kamuli and Iganga. Further, governmental projects such as Multi-stakeholder Nutrition Project (MSNP) supply planting material of OFSP material to selected multipliers and institutions/ schools. The supply of certified seed or QDPM is reinforced by nongovernmental interventions. These include VEDCO, IOWA-State University, SACU, EADEN of CARITAS, HarvestPlus, and One-Acre Farm. In Kamuli, the NGOs, especially HarvestPlus and CARITAS provide most of the certified seed or QDPM. Iowa State University in particular support disadvantaged groups such as mothers with nutritional issues. These are trained on nutrition and Sweetpotato production. The Uganda programme also supplies flour from OFSP varieties for porridge as nutritional supplement.

#### **4.1.3.1.1 Seed producers', NGOs, TC and labs experiences on seed access**

Seed producers access the vines from fellow multipliers producing certified 1 within the same district. In relation to access to certified seed or QDPM, EADEN sources the seed from multipliers of OFSP varieties belonged to the seed access network under CARITAS.

#### **4.1.3.2 Barriers to obtaining seed/ planting material**

Access to quality seed is one of the major production constraints at farmer level especially among smallholder farmers. During the rapid assessment, the key informants indicated that seed access is constrained by a number factors; including but not limited to inadequate funds (expensive seed), poor transport, limited knowledge on seed quality and benefits, mismatch between demand and supply, late delivery of seed and unwillingness to pay for quality seed.

Among barriers to seed access, the seed producers outlined high transport costs as a major hindrance to seed production. This affects gross margins obtained from seed production business. Other challenges include high prevalence of pests and vermin such as rodents/ mole rats, caterpillars, mites, snails, aphids and whiteflies especially in open fields.

The major barriers to access to certified seed expressed the EADEN, Area Manager included in availability and loss of viability of the varieties due to seed recycling. Reliance on free seed distributed by various agencies is a major bottleneck in promoting quality seed.

#### **4.1.3.3 Seed delivery channel**

Generally, the production departments mainly rely on distribution networks of partners. Delivery is mostly tendered to local seed multipliers with technical backstopping of the department with focus on quality assurance. Also, the department utilizes the local government structures with support of sub-county based Agricultural Officers. Some production departments utilize institution to farmers distribution channel. To ensure effective distribution, the department facilitates linkage between seed multipliers and end-users through the extension system. Further, the department trains farmers' groups on GAP and creates awareness on benefits of certified seeds to stimulate demand.

One of the NGOs, EADEN delivers certified seed through CARITAS institutionalized seed delivery network.

#### 4.1.3.4 Category of beneficiaries and seed access equity

The departments of production mostly distribute seed to farmers' groups, mainly mixed groups (men, women and youth) involved in different agricultural enterprises including Sweetpotato. The efforts to maintain equity in seed distribution is affected by limited information on seed requirements of the different gender and disadvantaged groups. Other beneficiaries include schools and champion farmers especially under the MSNP supported by MAAIF.

In seed distribution, the department ensures that there is equitable access. For instance, out of 100 farmers, the following ratio of women to men are employed; 33: 67, 50:50 or 67:33. In regard the three gender groups, they use the ratio of; women (60%), youth (20%) and men (20%). In one of the sub-counties in Iganga district, ratio employed is as follows: 30% men: 20% youth and 50% women. To ensure equity in seed distribution, the production departments rely on structures of formal farmer groups in collaboration with the department of trade, industry and cooperatives.

In Iganga districts, the production department distributes certified seed to 100 schools and each school has community comprising two planting groups of 30 members. Part of the beneficiaries also include lead farmers who produce seed on demonstration gardens equivalent to 2 acres. In total, there are 300 multiplication sites which provides planting material for 60 members (households). In Kamuli, the department selected beneficiaries from the 912 villages (within 71 parishes and 14 Divisions). The varieties distributed include Ejumula-OFSP, NASPOT 8-OFSP, NASPOT 10-OFSP and NASPOT 130.

Under EADEN, efforts are made to ensure seed access equity among the women, men, youth and other disadvantage groups. The beneficiaries are organized as farmer groups of mixed gender categories and these consist of about 30 members in the ratio of 17 women: 2 youth: 11 men. The organization utilizes participatory gender mainstreaming approaches such as Gender Actual Learning System (GALS) by Oxfam and SAP by CREAM. Further, EADEN bases on seed requirement of the different groups during recruitment. In Iganga, other disadvantaged groups are identified through schools and these are supplied with seven bags of seed in production season. They also linked to other parent group actively involved in the seed system.

#### **4.1.4 Affordability and profitability issues along the seed chain**

##### **4.1.4.1 Terms of payment for seed supplied by production department**

Largely, seed is provided for free and in some cases, seed loans are issued to vine and root producers. The major aim of free seed distribution is to increase access to quality planting material and promoted OFSP varieties to increase production and productivity, hence increasing food security and income. Relying on village distribution approach, Kamuli production department provides one bag of certified seed for forward multiplication through farmer-to-farmer seed network. However, the KII indicated that free distribution is not a sustainable approach, in particular for commercial production. Hence recommended implementation of cost-based approaches such as cost-sharing.

In cost-based seed supply, the departments ensures that prices are cost-effective and charge as low as UGX10,000 per bag of 100kg. While in Iganga, the price for QDPM is varies between farmers (UGX5,000 - 10,000/bag) and institutions (UGX14,000/bag). However, most times the buyer meets the cost of transport and labor for seed harvest.

One of the approaches to promote seed access would be provision of subsidies. Currently, the departments of production do not have subsidy strategy in place, instead, they are implementing seed voucher approach. This is implemented in collaboration with commercial banks and agro-dealers through electronic-vouchers (E-voucher), an initiative of the Agriculture Cluster Development Project (ACDP) under MAAIF.

As an incentive compatible approach, the E-voucher system can be piloted in the Sweetpotato seed chain to promote access to quality seeds. The key informants recommended that this should be cost-sharing based to stimulate ownership among the farmers which in the long run will increase adoption of improved varieties. This should be implemented through farmers' groups and accompanied by sensitization and training on seed quality and agronomic practices.

The NGOs such as Iwona State University supply seed at subsidized prices to mothers (a group of 100 mothers) and these are expected to distribute to about five mothers within the community. The church-based NGOs such as EADEN under CARITAS deliver seed for free based the principle of deed to the community and believe that this in the long run will promote the use of certified seed. They recommended that instead integrating voucher system to promote seed access, there is need to build robust community seed management system such as Local Seed Businesses (LSBs).

#### **4.1.4.2 Profitability and affordability issues experienced by seed producers**

In order to ensure profitability of seed production business, the seed producers pursue a cost-based pricing and employ their business acumen to negotiate better prices. They also minimize cost of production by acquiring seed fellow seed multipliers at subsidized prices. The demonstrate the benefits of certified seeds, seed producers freely distribute quality seeds to root producers which in turn stimulate demand for the seeds. The viability of the seed business is plunged by limited capital and high transport costs especially during sales. However, solutions such as acquiring starter planting material on loan and using own transport means have improved viability.

#### **4.1.5 Seed demand and awareness creation**

From the KII, it emerged that the production departments rarely promoted use of improved varieties compared to other enterprises such as coffee, bananas except in Iganga district which requires support from other projects. This is mainly conducted through training and dissemination of IEC materials. While the new varieties are promoted during follow up visits. Due to linkage with projects, OFSP varieties are mostly promoted with focus on QDPM. Farmers are trained mainly on use of quality seed and maintaining quality and seed standards.

The nongovernmental organizations such as Iowa State University and EADEN promote Sweetpotato varieties through trainings and linkage to seed multipliers of OFSP varieties. The trainings on general agronomic practices are conducted on-farm. Majorly, beneficiaries are trained on benefits of OFSP versus white-fleshed Sweetpotato varieties, pest and disease management, benefits of ratooning (three planting cycles recommended) and record keeping. Besides training on good agronomic practices, EADEN trains the farmers on seed access through village referral system. The organization promotes use of clean seeds that are highly nutritious, early maturing and acceptable by the farming community.

##### **4.1.5.1 Drivers variety selection for the seed system and demand for varieties**

The selection of varieties depends on farmers' preferences, existing seed demand, local weather pattern and tolerance to pests and diseases. The demand for Sweetpotato varieties for seed is influenced by gender, for instance lead female farmers prefer high yielding, stress tolerant, fast cooking and less fibrous varieties. The demand is estimated during farmer selection. In Kamuli, the production departments learn about demand for seed through media talk shows, extension outreaches and by host demonstration gardens which act as farmer-field schools.



Majorly, the NGOs such as Iowa State University supply OFSP varieties such as NASPOT 8, NASPOT 9 and NASPOT 10. These preferred varieties are highly acceptable by the beneficiaries for vitamin A enrichment and good taste. Other NGOs such as EADEN promote early maturing and high yielding varieties. Among the OFSP varieties, farmers mostly prefer NASPOT 9 with limited preference differences among men, women and youth. Under VEDCO OFSP varieties are promoted in relation market segment. For consumption, NASPOT 130, NASPOT 8 and Ejumula-OFSP are promoted. While NASPOT 9 and NASPOT 10 are preferred by the market. Based on the key informant interviews with VEDCO staff, other drivers of variety selection include marketability of vines, preference by children and ability to meet household food security demands (related to high yields and in-soil storage).

#### **4.1.5.2 Sources of information on certified seeds and demand creation**

In Kamuli and Iganga districts, the multipliers receive advisory services on preferred varieties and availability from NGOs such as VEDCO and HarvestPlus. Other information sources include radio talk shows, extension workers and fellow seed producers. While the seed multipliers create awareness and demand through farmer trainings, radio talk shows, fellow farmer networks and extension personnel. Based on the discussions with the seed producers, dry matter content is one the key drivers of demand for varieties, thus the higher preference for Kakamega-OFSP and NASPOT 9-OFSP. The continuous interaction with the farming community informs EADEN agronomy department on seed demand.

#### **4.1.6 Seed quality**

##### **4.1.6.1 Variety identification and seed conservation and procurement**

Seed producers identify varieties by observing foliar features, root skin and shape and flesh colour. For instance, Ejumula-OFSP has green leaves with lobes whereas NASPOT 120 has no lobes and triangular and purplish leaves. Seed conservation is affected by weather vagaries; thus, conservation is easier in the first season when rains are plenty compared to the second production season. Relatedly, in the first season the seed fields are established in upland, while the second season requires multiplication in swampy land. Besides maintaining moisture content, seed quality is maintained through use of pesticides and timely planting.

The quantity of seed procured depends on seasons, in the last three years, the seed producers procured on average 120 bags (20 bags per multiplier per season and 40 bags per year). The major varieties procured included NASPOT 8-OFSP, Kakamega-OFSP, NASPOT 10-OFSP (Kabode) and Ejumula-OFSP. NASPOT 8-OFSP is majorly preferred for high yield, high dry

matter content, adaptability to different soil types and tolerance to diseases (SPVD). While preference for Kakamega is influenced by sweetness and high dry matter content. Besides other attributes, NASPOT 10-OFSP is preferred for high yield and big-sized roots. Generally, the seed producers noted that current improved varieties have no missing attributes.

#### **4.1.6.2 Maintenance of quality seed**

The production department promotes on-farm quality seed management to increase seed volume and increase adoption of improved varieties. This is done through training farmers on GAP including use of protected production structures, weed control, pest and disease control and accessing quality starter planting material. In Kamuli, the department organizes plant and mobile clinics and trainings to increase farmers' awareness on health of seed or varieties.

To maintain physical quality, seed producers pack the planting material in partly perforated polythene bags and store in damp places before planting in open fields. They also plant seed in swampy land during periods of prolonged dry spell. In regard to seed health, the multipliers monitor the fields for symptoms of disease and pest damage and apply pesticides in case of pest infestation. One strategy to maintain genetic purity and health is to procure seed from certified multipliers and inspected fields. Additionally, the fields are inspected by the district production department officials and agronomists from NGOs, specifically VEDCO to ensure seed production standards and quality.

#### **4.1.6.3 Access to quality seed and training on quality**

The training on seed quality is gender-inclusive, however, in Kamuli, it was noticed women mostly participate in trainings related to household food security. To ensure access to quality planting material for on-farm management, the production department ensures that farmers are linked to the formal seed access networks. To ensure seed quality, the sub-county production department train farmer on seed quality and pests and diseases. Through the DAO, the agricultural officers support seed quality inspection and certification.

Since the extension officers are aware of pests and diseases of Sweetpotato, they have the capacity to ensure production of quality seed. Several NGOs (e.g., EADEN) rely on the integrate extension approach to manage pests and diseases. However, the extension officer urged the NARI to provide more capacity building on seed agronomy with emphasis on pests and disease identification and control.

## **5.0 Summary of discussions with root processors**

Several determinants influence the demand for Sweetpotato seed including farm-level constraints, economic and policy related. Partly, the demand for seed is derived from utilisation of roots for processing/ value addition. During the rapid assessment, we held discussion with root processors to understand the influence of value addition on the Sweetpotato seed system.

### **5.1 Availability/ supply of Sweetpotato roots**

#### **5.1.1 Sources of roots for processing**

Regarding acquisition of roots processing, the processors source from their own garden and other root producers. This implies that the root producers double as processors, referred to as forward integration which improves the benefits accruing to root producers. Root producers' involvement in processing avoids wastage/spoilage and selling of the roots at dumping prices as a result of surplus supply. Other processors inspect the roots source in the field to ensure quality. The processed into dry chips and confectionary products such as bread and cookies.

#### **5.1.2 Quantities of roots procured and variety preferences**

On average, the seed producers processed about 8 - 12 bags of fresh roots in last three years, this produces about 4 bags of dried chips which can be processed into other products. Cumulatively, the information can be used to determine the derived demand for Sweetpotato seed. The major varieties preferred for valued include Kakamega-OFSP, NASPOT 8-OFSP and NASPOT 130, of which NASPOT 8-OFSP is known to be best for processed products.

Although the varieties are preferred for various attributes in regard to processing, NASPOT 8 and NASPOT 130 (both OFSP varieties) are preferred for the sweet taste, while Kakamega-OFSP has high dry matter content. Some processors prefer NASPOT 9 due to drought and pest tolerance, early maturity and good taste. Ejumula-OFSP is preferred for making bread.

The OFSP varieties are commonly preferred for processing due to their enrichment with Vitamin A. The varieties also produce better products preferred by customers such as pancakes and half cakes. Despite their preference of the OFSP varieties for processing, they miss some processing-related attributes. Specifically, NASPOT 8 misses the deep orange flesh colour and NASPOT 130 has low dry matter content. Roots of other varieties become spongy during dry season, while other rot during rainy season.

### **5.1.3 Prospects of backward integration among the root processors**

Since the processors double as root producers, they already source their seed from multipliers in the proximity especially tertiary seed multipliers. Therefore, the formalizing access to quality seed through contract farming would increase the supply of roots of preferred varieties and quality. In efforts to understand the demand along the value chain, the processors indicated that future prediction of demand for seed and roots is not possible and this is partly constrained by weather vagaries.

## **5.2 Accessibility of Sweetpotato roots for value addition**

### **5.2.1 Seed delivery channels and access by processors**

The roots processors mentioned that they already distribute quality seed to root producers in ensure that root quantity and quality are met. Most of the processors operationalize the informal contract farming through informal farmer groups. This ensures that roots of the preferred varieties for processing are supplied through collective marketing or bulking. Processors conserve seeds in the swamps and conduct rigorous pest control to ensure supply of quality seed to farmers to produce quality roots.

### **5.2.2 Affordability of the products and profitability**

Some of the processors that double as seed producers, sell quality seed to the informal farmers groups to ensure steady supply of quality roots. The prices per bag are collectively determined and most payments are made on cash basis, sometimes seed credit is extended depending on the type of relationship between the processor (also seed producer) and the root producers. Root processing is generally profitability venture and the demand for dried chips is influenced by root harvest quantities in a season, scarcity of roots drives up demand and prices and vice versus when there is surplus or bumper harvest.

### **5.2.3 Awareness and demand creation by processors**

Farmers mainly prefer varieties with high nutritive value (Vitamin A enriched), high dry matter content and ability to make good dried chips. The processors promote their products and information on roots quality through radio talk shows and group meetings. It is possible to estimate demand based on land allocated to the various crops and production shocks such as COVID-19. Further, institutional demand is dynamic based on school study systems.

### **5.3 Quality of Sweetpotato roots for value addition**

#### **5.3.1 Varieties and their attributes preferred for processing**

The processors majorly prefer roots of NASPOT 8, NASPOT 130 and Kakamega-OFSP for making value-added Sweetpotato products. The varieties should possess the following attributes; highly nutritive value (enriched with Vitamin A), high dry matter content and high yielding. Kakamega-OFSP is the most suitable for value addition and possesses attributes such as high nutritive value, high yielding and good dry matter content. NASPOT 8 has similar preferred traits besides having sweet taste. NASPOT 130 is preferred for high nutritive value, softness after processing and sweet taste. However, the latter two varieties still require more Vitamin A enrichment according to the root processors.

#### **5.3.2 Quality standards**

To ensure quality of the Sweetpotato products, the processors follow strict hygienic protocols, including washing and drying on raised and clean platforms. The processing flows as follows: peeling of fresh roots, washing, chipping into slices, drying the fresh chips on tarpaulin, packaging the dried chips in sacks and storing in dry places. The processors dry the chips for about three weeks until the appropriate moisture content is achieved, thus preventing infestation by storage pests especially weevils.

## **6.0 Highlights of operation of the private tissue culture laboratory**

### **6.1 Profile of the tissue culture laboratory**

The SENAI Ltd, private tissue culture laboratory deals in mass multiplication Sweetpotato, bananas, cassava and coffee plantlets and cuttings. It was established in 2015 with private capital equivalent to UGX300 million to produce pre-basic, basic and certified seed of vegetatively propagated crops. It is directed by a renown plant virologist. To meet demand target and ensure production all year-round production of cuttings, the company has installed irrigation systems comprised of sprinklers and horse pipers. While manual irrigation with watering cans is handy for certain operations. All the hardening of the plantlets is conducted in the screen houses. The company partners NGOs, institutions and projects such as HarvestPlus, CHAIN, Makerere University, Dan Church Aid, CIP and NARO institutes.

## **6.2 SENAI's activities and Sweetpotato production**

### **6.2.1 Seed production systems**

The seed production and multiplication activities are conducted both on low and upland, totaling to four acres. These are fitted with irrigation systems based on growth requirements. The plantlets are hardened in protected screen houses, while demonstration plots serve as promotional facilities. About four different varieties are multiplied in one screen house with size of 200 m<sup>2</sup>. Planting in the screen house is continuous based on the target planting season. For instance, to supply the planting material in September, the production should commence in May.

### **6.2.2 Varieties under multiplication**

SENAI also conserves different varieties of the crops to ensure variety purity and diversity. This is done in boxes of 2 by 2 meters dimensions placed in quarter of the area of the screen house. In regard Sweetpotato, 20 varieties have been conserved. The company multiplies both local and improved varieties. The landraces include Kyebandule, Semanda, Tanzania, Namiraabaana, Lady gay and Lira-lira. While the improved varieties include NASPOT 8, NASPOT 9, NASPOT 10, NASPOT 11, NASPOT 130, NAROSPOT 1, Kakamega - OFSP and Ejumula. Besides, the company has also introduced SENAI 1, Polyester, B.Gard, Jewel and Busega Mataya from Tanzania.

### **6.2.3 Input used in seed multiplication**

SENAI Ltd uses assorted inputs for seed production. Insecticides such as sprays are used for whitefly and snail control. To ensure all year-round production, the company has installed irrigation systems made of horse pipes and sprinklers. The production is conducted in a tissue culture laboratory and protected screen houses. The major suppliers of input include farmers, Makerere University laboratory and NARO/NaCRRI under a formal contract agreement. Besides supply of pre-basic seed from NARO/NaCRRI, the company produces pre-basic seed of nutritional-enhanced varieties in the tissue culture laboratory.

## **6.3 Market information and structure**

### **6.3.1 Profitability issues**

To enhance revenue from seed multiplication, SENAI sells Sweetpotato roots to about 20 regular customers. NASPOT 8, NASPOT 130, Ejumula, NASPOT 1 and Semanda form bulk of seed sales. The peak sales months coincide with planting periods of March – April and August – September. SENAI Ltd largely sell to individual farmers and NGOs such as HarvestPlus. In

efforts to attract demand, the company trains farmers under nongovernmental organizations such as HarvestPlus and also establishes demonstrations at selected farm location.

### 6.3.2 Market-oriented seed production

Seed production involves sourcing vines and cuttings per bag should be counted to ensure a total of 210 cuttings are package per bag. The company targets to plant 200 – 300 bags per season and makes two harvests per year. The seed is inspected by agricultural officers from MAAIF’s NSCS.

### 6.3.3 Information on demand creation

The SENAI Ltd sells the bulk of the seed to agencies such as HarvestPlus through public-private partnership to deliver seeds to Sweetpotato farmer comprised of males and females with details presented in Table 44.

**Table 44.** Summary of profile of farmers supplied by SENAI Ltd

No.	Name of the person	Sex	District
1.	Lwanyaga	Male	Mpigi
2.	Ecabu	Male	Serere
3.	Otuda	Male	Bukedea
4.	Sekiyanja	Female	Luwero
5.	Ekinyu	Female	Serere
6.	Namsobe Rehema	Female	Iganga
7.	Kibambo	Male	Kamuli
8.	Regina	Female	Isingiro

The farmers majorly prefer NASPOT 130, NASPOT 8, Ejumula – OFSP, Kakamega, NASPOT 10 and NASPOT 9. The quantities supplied vary within seasons, for instance, in the first season in 2020, the company the following quantities of different varieties:

- NASPOT 8: 143 bags
- NASPOT 10: 18 bags
- NNASPOT 12: 15 bags
- Kakamega: 53 bags
- NASPOT 130: 109.5 bags
- NAROSPOT 1: 76 bags
- Ejumula: 0.5 bags

The company has robust linkage with the farmers supplied with improved varieties, thus uses their profiles to estimate demand for the different varieties as shown in Table 43.

**Table 45.** Summary of farmers' land allocation to improved varieties

Name of farmer	District	Acreage	NASPOT 10	NASPOT 8	NASPOT 13	Ejumula
Lwanyaga	Mpigi	22		15	15	2
Lwanyaga	Mpigi	20		10	10	
Kasekende	Kyotera	32		15	12	
Sekabunya	Masaka	10		4	6	
Kanya Agnes	Buikwe	15		8	7	
Namubiru Rehema	Luwero	30	5	15	5	
Mbogo	Luwero	16	1	10	5	
Namubiru Joweria	Luwero	24	2	10	10	2
Wokurungi Maria	Mityana	7		2	5	

### 6.3.4 Pricing of seed

Though the company uses cost-based pricing, this is categorized according to seed classes. Basic seed is sold at UGX40,000 per bag of 100kg and certified seed is sold at UGX20,000 per bag of 100kg. However, the prices bag does not vary for the different Sweetpotato varieties.

### 6.3.5 Seed supply chains

The company does not directly deliver seed, however, links with farmers through telephone calls who collect the package seed from the field locations. In terms of current sales, SENAI sells 15 bags of 100kg daily, which may be harvested and packaged in two days. The surplus seed is distributed to surrounding farmers for free. Besides the farmers under contractual agreement with HarvestPlus, SENAI also sells about 15 bags to other individual farmers on daily basis. To increase attractiveness, the company labels and brands the packing bags with information such as seed class, variety and quantity.

## 7. Conclusions and recommendations

### 7.1 Conclusions

The National Agricultural Research Organization (NARO) and partners have developed and disseminated 27 improved sweetpotato varieties. Despite the substantial progress in breeding improved varieties, adoption and adoption rate have remained low. This is associated with informal nature of the seed systems characterised by free seed distribution which is incapable of supporting dissemination of new varieties. Preliminary analysis indicates



that commercializing seed production will greatly enhance adoption of the varieties, hence resulting in increased food security and income among farming households.

Predominantly, Sweetpotato is produced by women of productive age. Some of the producers double as untrained and trained vine multipliers. Most trained seed multipliers are involved in the production of certified 1 or 2 and operate in a network with several tiers. The tertiary seed multipliers produce quality declared planting material which is supplied for root production. The seed multipliers' networks are supported by NGOs, private laboratory (SENAI), district production departments and MAAIF's National Seed Certification Services. Under this public private partnership, the services provided include training on seed production, supply of EGS and seed marketing. Thus, production and marketing of certified Sweetpotato seed is a closed system which is not sustainable in the long run.

In seed marketing, the major customers include NGOs, fellow farmers and DVMs. While the major buyers of the roots include retailers, individual consumers and wholesalers. In regard to access to seed, more than half (59.1%) of the root and vine producers relied on fellow farmers and about 25% procure seed from DVMs. Among the private companies supplying EGS, SENAI Ltd is the sole supplier in the Near Eastern Uganda. Several NGOs such as VEDCO, SACU, HarvestPlus and CARITAS in collaboration with the district production departments are instrumental interlinkages between vine and root producers and multipliers of quality seed.

Since the seed system is predominantly informal, most of the seed accessed is of unknown quality which reinstates the importance of a formal system. About 21% of the vine and root producers accessed Certified 2, though most of these are involved in commercial seed production. The producers mostly prefer seed of OFSP varieties, of which Kakamega-OFSP and NASPOT 8-OFSP were the most preferred. Despite the preference for OFSP varieties, landraces with better DMC and quality traits were also preferred, such is "Muwulu-aduduma". Seed preference was majorly influenced by availability, high variety yields and mode of access.

At farm level, seed demand is hinged on peak production seasons and the quantity demanded in the peak planting months of April, May and September is usually high. This underscores the importance of seed production calendar in efforts to strengthen seed business. The major suppliers of seed were root producers and small seed multipliers. The latter category relishes on the support of NGOs and a TC laboratory in efforts to promote production of certified seed.

Sweetpotato seed is mostly accessed for free (72.9%) since seed is considered as a public good. This is not sustainable approach in building seed systems to accelerate the

dissemination and adoption of improved varieties. Thus, efforts in commercializing the production of quality seed should be incentive compatible.

On average, root and vine producers received about 2 bags of 100kg in a production year, while a few purchased 19 bags in a year. Based on the number of producers in a district, the quantity demanded can be used to forecast seed demand. The price per bag varied within districts with an average of UGX10,000 (USD2.78/bag). Seed acquisition cost is largely influenced by the price of basic seed accessed from the private tissue culture laboratory and transport costs.

Under commercial seed production, the multipliers majorly supplied Certified 2 seed class (~54%) comprised of OFSP varieties (Kakamega-OFSP, NASPOT 8 and NASPOT 130). The multipliers synchronized seed supply with the peak planting months of March and April, thus matching demand. Root producers and seed traders (progressive farmers) were the major customers, though the supply to producers is partly supported by NGOs and government programmes. Seed demand depends on the gender and type of the customers who have varying preferences for the different varieties with Kakamega-OFSP, NASPOT 8-OFSP and NASPOT 130 being the most preferred.

Most seed multipliers sell on monetary terms, which provides stimulus for commercializing seed production. But the nature of transaction is farmer to farmer which implies limited aggregate volume of seed purchases across the region. While leveraging on the formal seed network supported by NGOs and governmental projects, on average the seed multipliers sold 129 bags of seed in the past 12 months. Seed sales volume are affected by limited seed demand, low intensity of production and seed supply conditions.

Based on the findings of the study, seed production business was generally viable based on seed and root revenue streams. The five top most varieties preferred for production of roots were “Umbrella”, “Muwulu-aduduma”, Kakamega- OFSP and NASPOT 8- OFSP and “Bunduguza (similar to Dimbuka Bukulula)”. The key traits that influenced variety preference included high root yield, good taste, big size of the root, high dry matter content and early maturity which relates to traits prioritized by the Sweetpotato breeding program.

Access to institutional services such as extension advisory service, markets and credit are critical in improving production and marketing at the farm level. Most of the producers received information on Sweetpotato seed and production from fellow farmers and government /NAADS. This highlights the importance of social networks in provision of information, education and communication on agricultural production. Other relatively important sources of agricultural information were NGOs, local trader and radio.

The major Sweetpotato seed marketing challenges included low demand, exploitation by commission agents, unstable prices and high transport costs. The low seed demand was assorted with distortion by free distribution by government and nongovernmental agencies. Besides farmers consider Sweetpotato seed is a public good, this coupled with persistent use of own-saved seed and seed sharing further exacerbate the problem of low demand. While access to seed was constrained by limited access to suppliers, high cost and poor quality. Efforts to conserve seed is constrained by pest prevalence and prolonged dry spell.

Sweetpotato was one of the major agricultural commodities traded in the rural and urban markets. However, the trade is largely informal driven by root consumers and producers on the demand and supply sides respectively. On average, the traders sold about 15 bags daily. Increased trade in Sweetpotato and value addition to the roots is envisaged to increase seed demand and hence key in commercializing production of quality seed. The major challenges faced in Sweetpotato root trade include unstable prices, competition from other sellers, seasonality of root and high transport costs.

## **7.2 Recommendation**

In efforts to strengthening sweetpotato seed systems, the following strategic intervention may be considered:

***Training on GAP for seed production and marketing:*** A region-wide training of both informal and formal seed producers is necessary to streamline the supply of quality seed. This should be backed by the supply of information, education and education materials for continued learning. Through the training, roles of the different actors can be echoed including provision of refresher training to the seed producers to ensure sustainable production of quality seed.

***Strengthening institutional linkages:*** For robust seed system, there is need to strengthen institutional linkages to ensure accountability for the roles and responsibilities of the stakeholders along the Sweetpotato seed chain. Herein, the supply of early generation seed should be enhanced by utilizing the synergies from the public-private partnerships. The NARI could liaise with private tissue culture laboratories to bulk basic seed and certified 1 to increase supply to the DVMS. Further, there is need to enhance the number and capacity of DVMS involved in the production of certified 2 to increase seed supply to other tiers of producers. The linkages should be reinforced through routine dissemination and experience sharing.

***Operationalize demand-driven Sweetpotato breeding and seed system:*** Breeding based on product profiles using the stage-gate approach should focus on wide preferences of the end-users. The demand-driven approach should be integrated with the seed system to enhance

dissemination and adoption of preferred improved varieties. As result, this would increase seed demand, thus promoting commercialization of Sweetpotato seed production.

***Streamlining quality assurance and inspection:*** Limited quality assurance is a precursor for poor seed quality along the value chain. Therefore, concerted efforts to implement quality assurance and inspection along the seed chain especially by empowering decentralized inspectors such as District Agricultural Officers (DAOs) would improve seed quality and adherence to seed production and marketing standards.

***Matching supply and demand:*** Excess Sweetpotato seed cannot be stored, but only conserved which has cost implication. Thus, it is imperative to ensure that seed supply relatively matches demand to avert the loss due to deterioration. Therefore, multipliers should develop and operationalize seed production calendars based on current production cycles and seed access patterns. This will ensure timely supply of quality seed during peak demand periods.

***Institute incentives for seed access along the chain:*** Most vine and root producers access seed for free and recycle for a few production seasons before acquiring new seed. Therefore, to change the public good notion on seed access, there is need to develop incentives to improve seed purchase and use of improved varieties. Such incentives include provision of seed loans or credit and use of voucher system to access seed. Under loan system, producers are provided seed and pay after sale of produce (vines and roots). While the voucher system allows users to extend seed to the subsequent producers within a network of farmers. The voucher can be redeemed in seed fairs for the informal sector or with local seed producers in the formal sector.

***Promote root marketing and value addition:*** Besides other factors, seed demand is influenced by the demand for roots and root products. Therefore, the stakeholders such as district production departments and NGOs should strengthen root marketing and value addition interventions to promote the derived demand for Sweetpotato seed. In the long run, this will ensure the sustainability of seed production business as well as improve Sweetpotato production and productivity. Ultimately, this will improve food and nutrition security and income among the farming households.

***Promote information symmetry on seed and seed access:*** Generally, there is information asymmetry on seed quality, sources and mode of access. Thus, to promote information symmetry, there is need to develop user-friendly information, education and communication platforms such as radios (through jingles), quick SMS and popular versions of print media (brochures and leaflets). Whereas, NARO has a satellite station in Kamuli, there is no

information to the farmers compared to Iganga, thus utilizing government extension advisory system would enhance the sustainability of information on quality seed.

***Avail seed through predominant channels:*** The stakeholders should ensure that predominant seed access channels are utilized along the supply chain. These include farmer-to-farmer seed distribution and own-production of quality. In the long-run, this will enhance sustainability of seed supply along the Sweetpotato value chain.

### **Additional responses from Sam for the Nigel's comments**

#### ***Challenges raised included:***

- Low market demand
- High transport costs
- Exploitation by middlemen
- Distortion by free vine distribution
- Glut seasonal supply
- Poor market information

#### ***Recommendations:***

- Private sector led
- Promote voucher system
- Avail seed through predominant sources e.g the fellow farmers or own saved seed (3.6.1 – table 8) – How do we improve the seed/root model. Whereas, NARO has a satellite station in Kamuli, there is no information to the farmers compared to Iganga. Information on vines in Iganga is mainly by Gov't involvement which could be an indicator of sustainability.
- The limited sourcing from DVMs and research (Fig 9) – Formal sector and EGS which is very expensive
- 3.6.4: Fig 10 shows the majority have limited access and not affordable meaning the distributions in Iganga not effective and may be benefiting the few individuals. WE NEED A MODEL THAT AVAILS PLANTING MATERIAL AT MORE AFFORDABLE COST TO THE MAJORITY
- Respondents indicated 3,000 – 10,000 per bag. Tab 20 – give 8,500 in Kamuli and Iganga
- Table 22: More business information sharing in Kamuli IMPLYING BUSINESS ORIENTATION and more urban trading in Kamuli WHICH MEANS MORE PRODUCER-TRADER LINKS.
- 3.6.5. Seed conservation – 46% Kamuli and 28% Iganga
- (Huge distributions in Iganga were produced by few individuals).

## ANNEXES

### Annex 1: List of contact persons

#### Kamuli

- |    |                        |                       |               |
|----|------------------------|-----------------------|---------------|
| 1. | Ms. Rebecca Abisabobwe | Processor             | +256751104753 |
| 2. | Mrs. Naome Lubega      | Processor             | +256771827364 |
| 3. | Mr. James Kibogo       | IOWA state University |               |
| 4. | Ms. Mourine            | IOWA state University |               |

#### Iganga

- |    |                             |                             |                         |
|----|-----------------------------|-----------------------------|-------------------------|
| 1. | Mrs. Gomati Alalo           | Area Manager EADEN-CARITAS  | +256789235059           |
| 2. | Mr. James Lubambo           | District Commercial Officer | 56776562594/750551032   |
| 3. | Mr. Bizaala Kisule Nantalya | DAO                         |                         |
| 4. | Mr. Richard Hwahaha         | Agricultural Officer        | +256785451224           |
| 5. | Mrs. Mary Mukyala           | Processor                   | +256786207088/70213730  |
| 6. | Mrs. Oliver Mugonzi         | Processor                   | +256755869181           |
| 7. | Mrs. Rehema Namsubo Edith   | Seed producer               | +256786207088/702131730 |
| 8. | Nakisuyo Florence           | Seed producer               | +256786867343           |

#### Kampala

- |    |                       |                     |               |
|----|-----------------------|---------------------|---------------|
| 1. | Mr. Charles Musoke    | HarvestPlus         |               |
| 2. | Prof. Mukasa Ssetumba | SENAI TC Laboratory | +256782670041 |

#### Wakiso

- |    |                  |              |  |
|----|------------------|--------------|--|
| 1. | Dr. Bonny Oloka  | NARO/NaCRRRI |  |
| 2. | Mrs. Agnes Alajo | NARO/NaCRRRI |  |
| 3. | Mr. Paul Musana  | NARO/NaCRRRI |  |

### Annex 2: Household Questionnaire for root and vine producers

### Annex 3: Interview guide for extension and NGOs

### Annex 4: Interview guide for root processors

### Annex 5: Interview guide for seed producers

### Annex 6: Interview for TC laboratory and NARIs

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CIP is a research-for-development organization with a focus on potato, sweetpotato and Andean roots and tubers. It delivers innovative science-based solutions to enhance access to affordable nutritious food, foster inclusive sustainable business and employment growth, and drive the climate resilience of root and tuber agri-food systems. Headquartered in Lima, Peru, CIP has a research presence in more than 20 countries in Africa, Asia and Latin America.

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