NATIONAL AGRICULTURAL RESEARCH LABORATORIES-KAWANDA

SEED POTATO MARKET STUDY

FINAL REPORT



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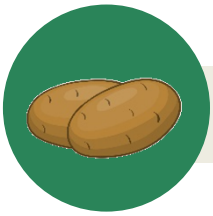


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LIST OF ACRONYMS

AMA	Agribusiness Management Associates Ltd
BugiZARDI	Buginyanya Zonal Agricultural Research and Development Institute
CIP	International Potato Center
DLS	Diffused Light Stores
FGD	Focus Group Discussion
KASPPA	Kapchorwa Seed Potato Producers Association
KAZARDI	Kachwekano Zonal Agricultural Research and Development Institute
KII	Key Informant Interview
KWESPPA	Kween Seed Potato Producers Association
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MIFA	Mengya Integrated Farmers Association
NAADS	National Agricultural Advisory Services
NGOs	Non-Government Organizations
OWC	Operation Wealth Creation
QDS	Quality Declared Seed
RwebitabaZARDI	Rwebitaba Zonal Agricultural Research and Development Institute
RACs	Rooted Apical Cuttings
TC	Tissue Culture
UNSPPA	Uganda National Seed Potato Producers Association
WASPPA	Wanale Seed Potato Producers Association

EXECUTIVE SUMMARY

NARL-KAWANDA commissioned a Seed Potato Market Study in Uganda to analyze the demand of the seed potato with emphasis on commercialization of the clean seed technology. The study defined the seed potato demand, how transactions are carried out, the volumes, the timing, payments, consistence of demand and its impact on supply. In addition, the study also discussed the marketing trends to find out whether the demand was increasing or decreasing during the last five years. Supply analysis discussed the production trends, projections and the growth potential. The main actors in the supply chain and the key drivers of production were identified with emphasis on the transactional characteristics and constraints along the value chain. The study identified efficiency constraints, investment and financing opportunities at the different levels, existing unmet demand, thereby enabling to pinpoint the key systemic market interventions in the sector.

Introduction

Potato is a key food and cash crop in Uganda. National production has steadily grown over time through increased cultivated area under potato in response to increasing demand and consumption. Today, approximately 200,000 farmers are growing potato in Uganda. Traditionally grown in the highlands, potato production has recently expanded to lowland areas. Majority of potato farmers in Uganda are smallholder farmers, who typically recycle their own seed or obtain their planting material informally from other farmers or in the open market. Yields have remained low 7-10mt per hectare (Ha) per season but there are conflicting data on production from UBOS and FAO STAT as per production and yield levels. Uganda can increase its annual seed potato and automatically ware potato production and this can be achieved through use of clean seed materials and other associated inputs such as fertilizers, proper post-harvest especially cold storage facilities that manage dormancy coupled with reduction in rotting caused by high storage temperatures.

Current estimates of annual seed potato demand range from 16,000 to 25,000 tons (FAO STAT 2020) with only 5-33% of this demand met. The weak functioning of seed certification during production and quality assurance during marketing exacerbates the exchange of poor-quality seed resulting in the spread of diseases and low yields.

Methodology

Throughout the data collection process, the field survey used Focus Group Discussions (FGDs) and key informant interviews as key methods in addition to a review of existing information. Relevant secondary sources analysed and discussed several reports and derived several interpretations. Primary data collection focused on three (3) regions; South Western, Mid-Western, and Eastern (Elgon). Data collected emphasized production and yield parameters, transactional actors and transacting mechanisms, constraints, investment and financing information.

Summary Of Key Findings

The Seed Potato Value Chain

The analysis identified the following main value chain actors; Research Institutions, Tissue Culture Laboratory Operators, Screen-House Operators, and Seed Multipliers (Pre-Basic, Basic Seed and Certified seed).

Demand Analysis

The organized seed supply occupies by consequence only a small fraction of the market, though it is key to a more productive potato sector. On the other hand, only a minority of smallholders purchase seed potatoes in comparison to other inputs. There is a general lack of awareness amongst potato farmers about the benefits of planting high-quality seed. Secondary data reveals that the majority of potato farmers select their seed from the bulk of potatoes at harvest for planting in the subsequent season.

Other factors limiting the access to and use of quality seed potato are limited information on the source of the seed as well as the difficulty to obtain the grade and quantities wanted because seed multipliers have in general not adopted the practice of labeling and packaging seed in different units. On this moment a proper quality assurance or certification is hindered. It's a costly process and difficult to arrange for a single farmer itself.

Supply Analysis

Seed potato is grown throughout the year but field survey suggested that there are two main seasons (March to June, and August to November) based on the rain seasons. Focus group discussions revealed that yields are influenced by high amount of rainfall though growing environment can be controlled through watering to avail sufficient moisture required during the growing season. Some commercial growers like Namakwaland and Agromax keep irrigating during the dry seasons thus achieving increased yields of up to 300% compared to average yield in the country. The discussions also revealed that what was taken as a common advantage of growing in the highlands where temperatures are cool could be overtaken by good farm management and irrigation during dry seasons.

Profitability Analysis

Analysis revealed that the leading drivers for all the value chain actors are input costs compared to labour costs. For all the actors, the Return on Investment or Cost (ROI) were positive rendering a positive approach to investment with commercial lenders who are considered private investors to offer financial services to support expansion of the seed potato sector.

Investing and financing opportunities

While several investment opportunities within the seed potato value chain have been identified, the selected investments address the critical demand and supply side constraints. Three (3) key investment opportunities are identified to target the critical constraints. These included; Financing of working capital for commercial seed potato farming, establishment of irrigation systems and construction of recommended cold storage and DLS.

Conclusions And Recommendations

Conclusions

- **Seed potato in Uganda is essentially a smallholder enterprise,** with repeated use of disease infested soils and lack of recommended crop rotation. Average area under seed potato is about one (1) Ha. About 1 percent of commercial farmers practice seed production making, it difficult to implement quick technological changes towards increased seed production.

- **Uganda has the potential to increase production and productivity for potatoes.** Currently the biggest challenge is access to clean seed since majority is produced in the South-Western region where land holdings are small. The favourable climatic condition is considered to be the cool highlands but recent research by Agromax show that seed potato can be produced in hot areas like Karamoja. Currently there two varieties that can do well under warm environment (Victoria and NAROPOT4 (Rwangume).

- **Factors affecting clean seed potato technology adoption are availability of clean seeds,** constrained access to credit or finance by smallholders to buy seeds, farmer training, and establishment of demonstration centres to show profitability related to use of clean seed. For producers to move from their current production and management levels, they have to see tangible results from adopting the improved technologies and be constantly sensitized.

- **Interventions at the seed multiplication level** must focus on increasing farm level efficiency, investing in adequate irrigation systems, improving quality of cold storage and providing linkages to markets and financing.

- **Inconsistent markets;** Transactions are still dominated by spot markets, lack of trust, and opportunism, with almost no contracts or long-term business relationships. This situation breeds speculation and opportunism, leading to distortions and loss of interest on the part of the producers thus making marketing another biggest challenge. The recent withdraw of NAADS and OWC from the marketing of seed potato left a big gap on especially when it comes to overcoming the free input supply syndrome created by the government.

- **Strengths, weaknesses, opportunities, and threats of the Ugandan seed potato value chain.** With the available water sources, Uganda's strength is its ability to produce throughout the year. Its major weaknesses include lack of certified seed, lack of economies of scale by small seed multipliers, prevalence of scattered producers, and poor sensitization of people about the benefits of using certified seed. Opportunities exist in the form of growing domestic demand for table and processing volumes and proposed new private sector investments in starch for industrial use. The greatest threats to the value chain include the high costs of production due to the recommended crop rotation cycle of a minimum 3 years to reduce soil disease infections.

- **Majority of the activities in the value chain are profitable with high ROI** that should incentivise commercial lending to support commercial production to meet increasing seed potato demand in the country[1].

- **Most of the seed potato production is located in Southwestern region** making distribution and accessibility to other upcoming growers (majority of them smallholders) a challenge especially when it comes to travelling long distances and availability of seed when required at planting time.

Recommendations

In light of the conclusions about the seed potato market study, the following recommendations are considered relevant:

RESEARCH

- **Research should move faster to produce or release potato varieties with characteristics required by processors** similar to those currently imported from Kenya, South Africa and The Netherlands. Therefore, NARO should collaborate with value chain actors to identify key attributes required for quick commercialization of new varieties

- **The potato platform should be strengthened to improve coordination within the value chain** to enhance variety release and commercialization by research to meet demand of emerging markets (processing).

PRODUCTION AND MARKETING

- **Support Enhanced Extension Services; Value chain actors especially farmers should be supported with best agronomical practices** particularly disease and plant population and enterprise profitability analysis with action-based documents such as bulletins, brochures by both public and private sectors.

- **Strengthening the seed distribution system;** The Seed producers associations or groups in the country should be assisted to strengthen their current distribution systems to enhance seed accessibility throughout the country.

INVESTMENT

- **Support commercial production of certified potato seed:** Investment in properly managed fields with available water for irrigation and investment in proper cold storage and DLS facilities should be supported to increase access to clean seed. To this effect, it is important to promote the establishment of large production farms especially in the new potato growing regions apart from the Southwestern region.

- **Support investment in infrastructure and potato seed distribution network:** Potato seed producers should be supported financially to develop good distribution networks to deliver the seed to farmers at the nearest point of availability. This should involve support for aggregation - potato seed marketing centers such as at farmer cooperatives to realize economies of scale or logistics such as transport (light trucks) and marketing initiatives,

[1] In the cases where ROI is higher than lending (interest) rates

POLICY

- **Capacity building towards institutional professionalism;** Public sector should invest in building the capacity of potato growers associations to achieve a professional status. The investment should target improvement in internal management, operations, sustainability, financial management, production system, markets, external risks and enabling environment.

- **Support Current Potato Stakeholders' Platform:** The national potato platform should bring together major potato stakeholders (public and private) in the industry to discuss how to build business relationship amongst the value chain actors to increase potato seed production, improve quality, marketing, and align the roles and responsibilities of public and private stakeholders and development partners.

- **Support the sector to reform the current seed policy;** Private sector should be supported to participate in the implementation of current inspection and certification protocol to enhance production of clean seed (allow private sector seed certification).



I Introduction

1.0 INTRODUCTION

1.1 Background

Potato is a key food and cash crop in Uganda. National production has steadily grown over time through increased area under potato in response to increasing demand and consumption. Today, approximately 200,000 farmers are growing potato in Uganda. Across the Eastern Africa the average potato yield has stabilized at approximately 8-10 tons/ha in the fields of better performing smallholders despite increasing trend in demand. As such farmers have responded to increasing demand by expanding area under production.

However, recent work has shown that continued increase in demand cannot address further increases in areas under potato cultivation. Evidence have shown that a further increase in area under potato cultivation is not the solution for the future, as it will further shorten rotations which brings high risks of build-up of soil-borne diseases[2] .

Majority of potato farmers in Uganda are smallholder farmers, who typically recycle their own seed or obtain their planting material informally from other farmers or in the open market. Uganda can increase its annual seed potato and automatically ware potato production, and this can be achieved through use of clean seed materials and other improved inputs such as fertiliser, proper post-harvest handling facilities like Diffused Light Stores (DLS) or Cold rooms. This will manage dormancy coupled with reduction in rotting caused by high storage temperatures.

Based on Food and Agricultural Organization statistics (FAO STAT 2020), current estimates of annual seed potato demand range from 16,000 to 25,000 tons (although UBOS 2020 states of 47,000MT which is about double FAO figure). The absence of well-functioning marketing and quality assurance systems for seed potato exacerbates the reliance on planting poor-quality seed resulting in the spread of diseases and low yields.

1.2 Seed potato production and marketing systems in Uganda

Potato is a growing cash crop in Uganda due to a favourable climate and increasing domestic demand. However, the sector's growth is held back by a small and highly fragmented seed potato industry, with only 34% of national demand for seed potato met and potato yields averaging 5 MT per acre (equivalent to 12.5MT/Ha), far below the recognised potential for the country to produce up to 17 MT per acre equivalent to 42.5MT per hectare [3] .

It is widely understood that smallholder farmers in developing countries source seed from both formal and informal seed systems. The formal seed system entails a chain of research and development, plant breeding, seed certification and marketing and distribution through recognized outlets. Well-functioning formal systems are governed by a regulatory environment intended to ensure quality and sanitary standards and to maintain varietal identity.

Due to limited availability and access to commercial seed, most potato farmers recycle their own seed or obtain their planting material from other farmers or in the open market. This seed is often infected with seed-borne pathogens, hence leads to low yields and income. Seed multipliers are based in potato growing communities and use Early Generation Seed (EGS), mainly basic seed, as starter material for onward field multiplication[4].

[2] CIP Research Brief, 4; 2021
[3] IFDC 2020
[4] CIP Unpublished Paper; Business cases for various options to produce early generation seed potato in Uganda 2022

1.3 Objectives of the Study

The general objective of the seed potato market study is to provide a national descriptive analysis of seed potato value chain with emphasis on commercialization of certified seed technology in Uganda. The Agricultural Research Activity Project is seeking clear information and knowledge of the opportunities, gaps and challenges in the production, storage and marketing of the seed potato value chain including the interface, relationships, linkages and segments that connect the various players from production through to marketing.

The following are the specific objectives of the market study;

(1) Determine the demand and supply of seed potato in the South, Mid-Western and Elgon regions of Uganda.
(2) Identify the constraints and opportunities along the value chain
(3) Identify investment and finance opportunities to unlock the efficiency constraints in the seed potato value chain.

1.4 Scope of work

(1) Review and document all existing work on seed potato along the entire value chain: research, production, storage and marketing. Note that information disaggregated on District seed potato production level should be provided;
(2) Identify key seed potato market segments;
(3) Identify the major chain actors along the various functions of the seed potato chain and analyse the linkages among them. This should include seed potato producer associations, traders and agro-input suppliers and their organizations;
(4) Develop and present seed potato sub sector mapping;
(5) Establish seed potato research, production, exports and imports volumes and their outlet channels (show the trend since last 5 years);
(6) Estimate returns through gross margin analysis on investment along the different stages of seed potato value chain;
(7) Identify and prioritize areas that require investments by both public and private sector: personnel, equipment, institutional reforms, and associated costs; and
(8) Identify bottlenecks in the value chain that, if resolved, could lead to substantial returns to participants in agribusiness particularly those involved in seed potato multiplication and distribution.



2 Methodology

2.0 METHODOLOGY

2.1 Technical approach

This study employed the value chain analysis approach to achieve its objectives. A value chain is a business model that describes the full range of activities needed to create a product or service. The value chain approach uses both the functional and economic analysis (at market prices) of an identified value chain (FAO, 2005). The functional analysis was used to define the actors in the value chain and their transactional mechanisms while the financial analysis was used to analyze the marginal returns of the different actors that should help to inform both the assessment of credit worthiness of the actors, and the capacity to incentivize (new or additional) investment by the actors.

2.2 Study population and sampling

(i) Study population

The study population was composed of selected key seed potato production and marketing districts covered in the three main regions of the country i.e South -Western, Eastern (Elgon), and Mid-Western (Kabalore and Mubende) districts as shown in Table 1.

Table 1: Market study population

Framework Level	Category	Stakeholders
Micro-	Agro-input dealers	• UNADA members
	Seed producers	• Uganda National Seed Potato Producers Association • Kween Seed Potato Producers Association • Kapchorwa Seed Potato Producers Association • Local Seed Businesses • Individual farmers
	Seed marketers	• Uganda National Seed Potato Producers Association • Kween Seed Potato Producers Association • Kapchorwa Seed Potato Producers Association • Individual farmers • Individual farmers • Local Seed Businesses
	Seed buyers	• Individual farmers
Meso-	Agricultural Research and Development Institutes	• Kachwekano Zonal Agricultural Research and Development Institute • Buginyanya Zonal Agricultural Research and Development Institute • Rwebitaba Zonal Agricultural Research and Development Institute

Source: Survey data 2022

Table 1: Market study population

Framework Level	Category	Stakeholders
	Agricultural training and extension	• Kabale District Local Government • Uganda National Seed potato Producers Association • Kween Seed potato Producers Association • Kapchorwa Seed potato Producers Association
	Agricultural finance	• SACCOs
Macro-	Policy and regulation	• MAAIF (Roots and Tubers) • NARO
	Development partners/ projects	• IAM • ISSA • SIA • CIP • UAA/Uganda Potato Platform

Source: Survey data 2022

(ii) Sampling

The production and marketing of seed potato is widespread throughout the country, statistically the consultants employed a sampling methodology that is representative of all the potato production characteristics in the country. The team clustered the country into three regions (South-Western, Mid-Western and Elgon) based on their geographic differences, production estimates and marketing potential.

The study sample was obtained using the purposive sampling technique to select participants on the basis of their expertise and/or knowledge of the seed potato value chain in the targeted sample geographies. The sample list was created with a view to get a diverse set of representatives, this diversity provided a broad range of perspectives.

In each of the proposed regions, key informant interviews (KII) of the identified traders (buyers), representatives of trade associations, projects, NGOs and government institutions within the district were conducted. At least one FGD per region for producer representatives were conducted and individual traders (buyers) of seed potato were interviewed. The aim of the interviews was to record the estimated volumes and value in addition to trade flows of seed potato within these markets. The consultants identified bottlenecks that hinder demand and supply growth.

2.3 Data collection methods

The consultants used a multiplicity of methods to collect data:

(i) Review of documents

The consultants reviewed existing secondary data especially reports on production and marketing to supplement data obtained from primary methods. Data was obtained from UBOS, MAAIF, FAO reports, and district reports where the survey took place. The information is covered in the discussions of findings in Chapter three while large data tables are in the annexes.

(ii) Individual interviews or key informants

Individual interviews were conducted to solicit for information among actors and other key informants who were both direct actors and enablers of the value chain. The individual interviews targeted researchers, commercial producers, policy makers and regulators. It was critical that these individual interviews were conducted to identify linkages that existed along the seed potato value chain as well as the issues being addressed by the non-actors or stakeholders. Key informants also aided the consulting team undertake a mapping exercise that determined the roles as well as the inter-relationships among the various actors. In addition, production, demand, cost and profitability information were solicited.

(iii) Focus Group Discussions

FGDs were conducted to generate both quantitative and qualitative information that served to identify the descriptive roles and interrelationships among the different actors in the value chain. The qualitative information identified key issues in terms of constraints and opportunities that exist at different levels of the chain as well as points of intervention among the actors. Other policy and gender-related issues that affected the actors along the value chains were also uncovered. In order to generate precise and accurate information, the members of the focus group discussions were purposively and carefully selected to include those respondents who were knowledgeable and also endeavoured to include both men and women, a total of two (2) interviewees were conducted per district. FGDs were moderated by the consultant and notes were taken during interviews. Since some actors did not understand English, the consultant used interpreters to gather information.

(iv) Personal Observations

Personal observations were used to collect data on production room/sites, agronomic practices/ performance of seed potato, storage facilities, packaging, intervention/investment areas and where appropriate photographs were taken.

2. 4 Data collection tools

The tools included check lists that were used during the key informant interviews, they were flexible leaving room for new ideas and expression of sentiments by the respondents. In addition, the consultant used FGD guides that were instructed purposely to allow the respondents to discuss as much as possible during the meetings. Observation template designed to capture all issues seen during the survey were also used.

Data analysis

Quantitative data were analyzed and summarized using tables and graphs to enhance presentations of key study findings.

Recordings from FGD, KII and observations were transcribed and analyzed through a process of data reduction and content approaches to enhance categorization of emerging themes and relationships. The qualitative data was analyzed to bring out the key study findings and lessons in light of the stipulated aspects of the study objectives.



3 Study Findings

3.0 STUDY FINDINGS

The chapter discusses demand and supply dynamics with emphasis on commercialization of certified seed potato technology i.e affordability, availability, accessibility and profitability of seed potato. The study further discusses information on value chain characterization, profitability analysis, challenges and opportunities. The report also highlights the need for development partners like USAID to identify intervention areas to support a viable commercial seed potato sector, which can not only produce high quality seed in sufficient quantity to satisfy farmer needs but also operate efficient, self-sustained commercial enterprises to ensure sustainability for seed potato marketing.

3.1 Demand Analysis

The organized seed supply occupies by consequence only a small fraction of the market, though it is key to a more productive potato sector. Government institutions are the major buyers of seed potato with a program of distributing it to small holder farmers on the other hand, only a small proportion of smallholders purchase seed potato in comparison to other inputs. There is a general lack of awareness amongst potato farmers about the benefits of planting high- quality seed.

Secondary data reveals that majority of potato farmers select their seed from the bulk of potatoes at harvest for planting in the subsequent season. Other factors limiting the access to and use of quality seed potato are limited information on the source of the seed as well as the difficulty to obtain the grade and quantities wanted because seed multipliers have in general not adopted the practice of labelling and packaging seed in different units. On this moment a proper quality assurance or certification is hindered. It's a costly process and difficult to arrange for a single farmer itself[5].

The current price of seed potato (average of UGX 2,000 per kilo) is affordable to most farmers in all the growing regions but the issue of accessibility still remains a challenge.

This was attributed to the fact that most Early Generation Seed (EGS) come from the Soth Western region which is far from the remaining growing and upcoming production areas. The seed is also not available when required for planting since currently rain fed seed production cycles avail seed towards the end of the planting season thus impacting negatively on the demand.

Uganda is currently realizing commercial or large field production that require large volumes of good quality seed which is currently unavailable, this has forced new entrants like Namakwaland farm to start its own seed production to sustain its planting programs. Exports to regional seed buyers like the neighboring Rwanda is also interested in larger volumes and this impacts positively to the demand in this sector.

[5] Netherlands Enterprise Agency; 2021

3.1.1 National Demand Estimation

Table 2 shows the derived seed demand from a computation based on Food and Agriculture Organization Statistics (FAO STAT) 2021.

Seed requirement is based on a rate of two metric tons per hectare (2MT/Ha) but is not always followed by farmers who keep replanting up to a cycle of four (4) times before requesting for new seed. This therefore takes the assumption that farmers actual seed demand is only 25% of the seed requirements.

Table 2: Derived National Annual Potato Seed Demand (2015-2020)

Year	Ware potato production area (Ha)	Derived seed requirement * (MT)	Seed demand ** MT	UNSPPA Annual Seed Supply (MT)	National Annual Seed Supply ***(MT)	Difference in demand (MT)	% Annual Seed Supply
2015	39,339	78,678	19,669.50	0	0.0	19,669.50	-
2016	31,975	63,950	15,987.50	236	314.7	15,672.83	2.01
2017	39,300	78,600	19,650.00	386	514.7	19,135.33	2.69
2018	47,584	95,168	23,792.00	666	888.0	22,904.00	3.88
2019	55,192	110,384	27,596.00	765	1020.0	26,576.00	3.84
2020	50,559	101,118	25,279.50	880	1173.3	24,106.17	4.87

Source: FAO STAT 2021

* On average, it requires an average of 2MT of potato seed per Ha

** Using a four-cycle seasonal renewal period by farmers i.e. only 25% of the seed requirement is attributed as actual seed demand

*** UNSPPA represent 75% of the national annual seed supply

Ware potato for home consumption (food security), chips and crisps consumption are the major drivers of demand for seed potato in Uganda. This is known as "*derived*" demand where seed potato multipliers don't experience direct demand, but instead ware potato farmers experience farm-level demand which is directly related to the demand for potatoes for household consumption, chips and crisps processors.

3.1.2 Characteristics and requirements of the seed buyers

Volumes generated by seed potato multipliers tend to be sold in small quantities to ware potato farmers at the village level usually making the cost of distribution low. This is common in the South-Western region where most of the potatoes are produced but with expanded production into other regions, distribution costs have increased. Most seed farmers sort or grade at this level to meet customer needs but leave behind reasonable volumes which are later sold as ware potato.

The variability in quality between farmers also increases downstream when it comes to farmers buying seed from fellow farmers or from the market. There is a quality standard currently in place by the UNBS which is a regional standard though not much used thus making trust building remaining a key issue in this business.

3.1.3 Marketing

Most of the produced certified seed grown and supplied by UNSPPA is aligned to farmers within the same region and the balance is bought through UNSPPA by government institutions (NAADS and OWC) and NGOS to reach individual farmers. There are very small percentages (about 3%) that is marketed by seed farmers through middle-men. This small percentage may go to individual farmers but majority goes for export to neighbouring countries especially Rwanda[6].

[6] Netherlands Enterprise Agency; 2021

In the South Western region (Kabale, Kanungu and Kisoro) districts, the cost of certified seed potato ranges between UGX 1700 and 2000 per Kg equivalent to UGX 170,000 and UGX 200,000 per 100kg Bag. This price is not very different from that of ware potato which consequently impacts on the attractiveness to produce seed.

In the Mid-western region, seed potato is sold at farm gate by the farmers who are involved in production, this may be attributed to the fact that volumes are still small and far less than volumes demanded.

The traders in eastern region reported challenges that affect the smooth trading in the seed potato business, which included:

- Competitors who sell "fake" seed potato at lower price i.e. ware potato
- Lack of special packaging bags to increase farmer confidence and to keep off impersonators who sell fake seed potato
- Lack of capital to invest in recommended store construction within the growing areas in order to stock big quantities of seed at discounted rates.
- Poor linkages with farmers especially at seed production level

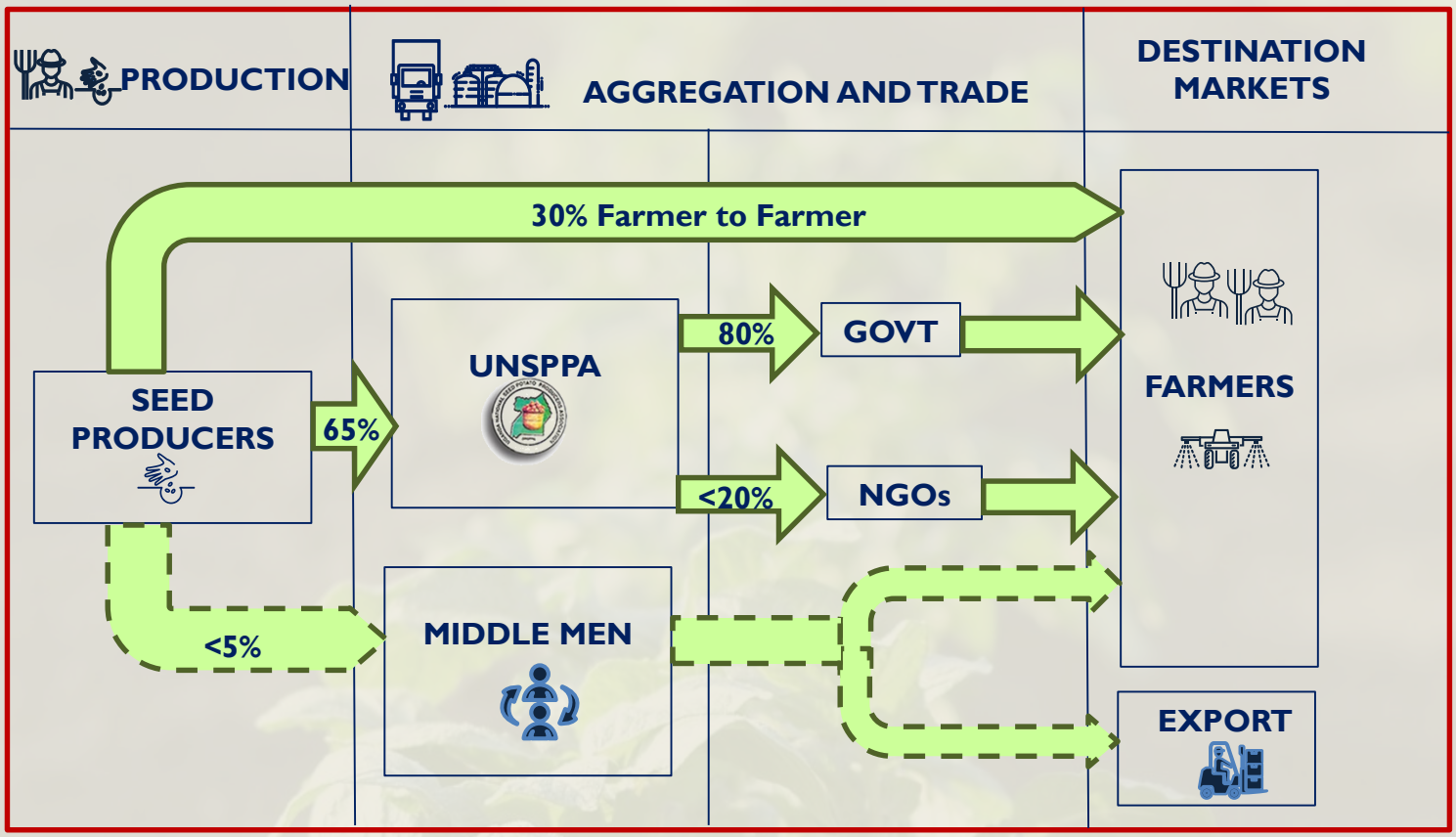
3.1.4 Distribution channels

The flow of seed from the seed multipliers (farmer groups) up to the final buyer (ware potato farmers) through the different channels is summarized by Figure 1. In the south-western region, the farmers and/or public institutions (NAADS and OWC) are the major buyers of seed potato. Focus group discussions with UNSPPA show that 30% of the seed potato was supplied directly to farmers while 65% was bought by public and civil society organisations during the year 2021 but this creates a market sustainability challenge.

This is not very different from the Elgon (Eastern) and Mid-Western (Mubende -Kabarole) where majority of seed is also bought by government from the multipliers in the production zone. Lack of recommended seed potato cold storage facilities, unstructured market system and the informality of most farmer operations in addition to the perishability of seed leave almost no room for a formal system to work.

In addition, seed multipliers also require cash at the earliest opportunity to solve domestic and business requirements since there are few if any financial service providers presently offering credit services. The second distribution channel is either the local seed businesses or UNSPPA acting as an intermediary to the market. This is very common when new entrants in ware potato production require seed for planting but with minimal information about the location of the seed multipliers.

Figure 1: Potato seed distribution channels



Source: Survey data, 2022

The study concluded that:

- Demand for seed potato is far beyond the current supply leaving a bigger proportion of the market to look for alternative seed for planting. This makes availability of seed constrained during the planting time and consequently leaving suppliers to sell seed during off season.

- There is a poor distribution system of the seed in the country since most of seed is produced in the South Western region. This makes accessibility to quality seed poor since potato growers from other regions have to travel long distance to get Early generation Seed (EGS). Even when distribution is improved, other logistical issues associated with storage and packaging subsist.

3.2 Seed Potato supply analysis and growth potential

3.2.1 Production trends and projections

Seed potato is grown throughout the year but field survey suggested that there are two main seasons (March to June, and August to November) based on the rain seasons. Focus group discussions revealed that yields are influenced by high amount of rainfall though growing environment can be controlled through watering to avail sufficient moisture required during the growing season. Some commercial growers like Namakwaland and Agromax keep irrigation during the dry seasons thus achieving increased yields of up to 300% compared to average yield in the country. The discussions also revealed that what was taken as an advantage like growing in the highlands where temperatures are cool could be overtaken by good farm management and irrigation during dry seasons.

Uganda National Seed Potato Producers Association (UNSPPA) and Kachwekano Zonal Agricultural Research and Development Institute (KAZARDI) have remained the major suppliers of disease-free seed in the country.

KAZARDI has spearheaded the country's seed potato production using in vitro derived plantlets for multiplication through to the basic seed level. Private sector seed companies with laboratories for tissue culture production have gained interest in seed multiplication and at the moment five (5) are operational and have tried TC on potatoes.

Based on primary data and secondary data, it was revealed seed potato production has steadily increased in the last five (5) years of 2015-2020 as shown in Figure 2. The increased production recorded over the years was attributed to increased number of seed growers especially the "new" screen houses established with assistance from Development Partners (DPs) like Embassy of the Kingdom of the Netherlands through REACH project.

Figure 2: Derived Annual Potato Seed Supply (2015-2020)



Source: Survey data 2022

In the Eastern region, current seed potato production is carried out by predominantly small-scale seed multipliers either organized under groups or as individual oriented farmers but estimation of the number of farmers has been difficult due to lack of reliable data. UNSSPA, Kween Seed Potato Producers Association (KWESPPA), Mengya Integrated Farmers Association (MIFA), Kapchorwa Seed Potato Producers Association (KASPPA), Wanale Seed Potato Producers Association (WASPPA) remained key sources of data for available farmer groups in the region. Typical small-scale growing fields of 1-2Ha with almost no land for rotation is characteristic of most seed growers.

The study concluded that:

- Seed potato production is still predominantly a smallholder enterprise, with Kabale, Kanungu and Kisoro from South Western region represented by UNSPPA as the leading producers of seed potato and suppliers at the national level but with limited land for expansion.

- Productivity is quite low at 4.5MT compared to 12MT per acre documented yield potential; with increased use of non-seed inputs like fertilizers, pesticides and good agricultural practices especially application of a 3-year field rotation cycle to reduce the burden of high soil bacterial infections, productivity could be significantly increased to 8MT per acre.

3.2.2 Key drivers of seed potato production

Climatic and environmental conditions

The south-western agro-ecological zone presents favourable agro-climatic conditions for potato production. They include altitude, rainfall and temperature and potato production is also predominantly rainfed in Uganda, with a bimodal rainfall pattern. The amount of rainfall ranges from 1,000 to 1,500 mm per annum. Therefore, potatoes are largely grown in two distinct rainy seasons in a year: in the short (March to June) and long (August to November). Sometimes, farmers near swamps especially in the South Western region have a third season where potato is planted in swamps though not recommended.

Potato production systems

Potatoes are mainly grown by smallholder farmers for food and income security. The area of an average smallholder farm is estimated to be one (1) hectare equivalent to 2.5 acres. The potato crop is also occasionally grown in rotation with other crops such as beans, maize, sorghum and peas. The most common source of planting material used in the region is farm-saved seed, usually either from the previous harvest or other farmers. To a limited extent farmers used seed from KAZARDI or seed multipliers. The small farms and considerable shortage of land for potato production present a challenge to keep the seed potato crop healthy where the seed and ware potato crops are planted closely leading to cross infection and disease build-up. This in turn leads to seed potato degeneration and reduced yield.

Technologies

The use of technologies such as improved varieties, good agronomic practices and use of improved and/or diffused light store (DLS) cold storage methods enhance the production of good quality seed potato. NARO has released up to 29 improved varieties of potato to date with a potential yield ranging from 20mt/ha to 35mt/ha.

Enabling environment

The enabling environment comprises policies, institutions and support services that form the general setting under which the seed potato sector operates. Components of the enabling environment include: research and development institutions that support technology development and transfer; provision of business development services such as training and extension to seed potato growers; and laws and regulations regarding the seed potato sector, including seed potato standard.

3.2.3 Transactional characteristics

SEED POTATO marketing transactions are mainly between ware potato growers and the seed potato farmers at farm gate level. The transactions are mainly cash and this makes it difficult for farmers without cash to buy seed. Commercial growers, government institutions like NAADS, OWC and NGOs that buy large volumes usually transact on credit during marketing but this constrains seed suppliers when payments come late. The fact that NAADS and OWC stopped buying seed has affected the commercialization of seed in the country.

There is need for financial service providers to support seed multipliers but current business operations without business plans and proper record keeping have constrained the development of a formal financial support system. Though the study has shown that there is a gap between seed demand and supply, discussions with seed multipliers reveal that farmers keep recycling seed up to eight (8) times compared to the recommended 4 cycles by research institutions.

3.2.4 Supply constraints and threats

(i) Production and Productivity Constraints and Threats

FGDs revealed that lack of knowledge, technology gap, scale of production and poor distribution channels were major constraints.

- **Knowledge:** Smallholder and even medium-scale seed multipliers cannot or do not apply adequate knowledge to optimize their yields. There is both poor field rotation and low application of non-seed inputs like fertilizers and pesticides. Utilization of already infected soils or fields is common in most areas of the south western region where land is limited though not accepted since the soils keep infecting the new clean seed from screen houses.

- **Scale of production**: Seed multipliers in Uganda tend to be small and it is estimated that 60-75 percent of seed multipliers cultivate an average of 3-5Ha of land. The majority of farmers do not have enough land for rotation based on a recommended three (3) year cycle which results in low yields attributed to use of soils with high disease build-up. This level of production by itself impedes farmers' capacity to scale up because returns do not enable savings and reinvestment.

- **Lack of irrigation systems;** Most seed production is rain-fed leaving smallholder farmers without irrigation facilities with no alternative during the dry season or changing weather patterns due to climate change.
- **Constrained access to finance;** Most seed multipliers are smallholders with no direct collateral required by most financial service providers. This has kept the seed producers with inadequate resources that are required for increased production of seed potato to meet increasing demand.

- **Poorly coordinated certification process;** Currently the certification process is managed by MAAIF but the ministry does not have enough human resource to carry out the supervision as more entrants keep joining seed potato production. This causes delays and, in the process, leads to circulation of uncertified seed on the market.

Productivity constraints can be broadly classified as technology gaps. These gaps reflect the difference in the quality and volume of seed and the organization of the distribution channels at any point of time.

- **Technology Gap:** Producing seed potato is a complex process comprising multiple steps and requires specific equipment, infrastructure, expertise and land. The entire seed multiplication process takes around 28 months from start to finish. It begins with plantlets grown in controlled conditions in screen houses. The plantlets then mature into mini-tubers which are planted in an open field to produce pre-basic seed. Pre-basic seed is multiplied to produce basic seed, which is multiplied to produce seed for ware potato farmers to grow.

(ii) Climate Variability and Change

During focus group discussions, farmers revealed that production is low during dry season spells. Since Uganda's seed potato production is rainfed, it is highly vulnerable to climate variability and change.

Additionally, some areas in higher elevations like Kabale are also becoming hot compared to ten years ago. The study established that in the Elgon region during the year 2021 production season B, seed multipliers failed to sell over five (5MT) of seed due to prolonged dry season.

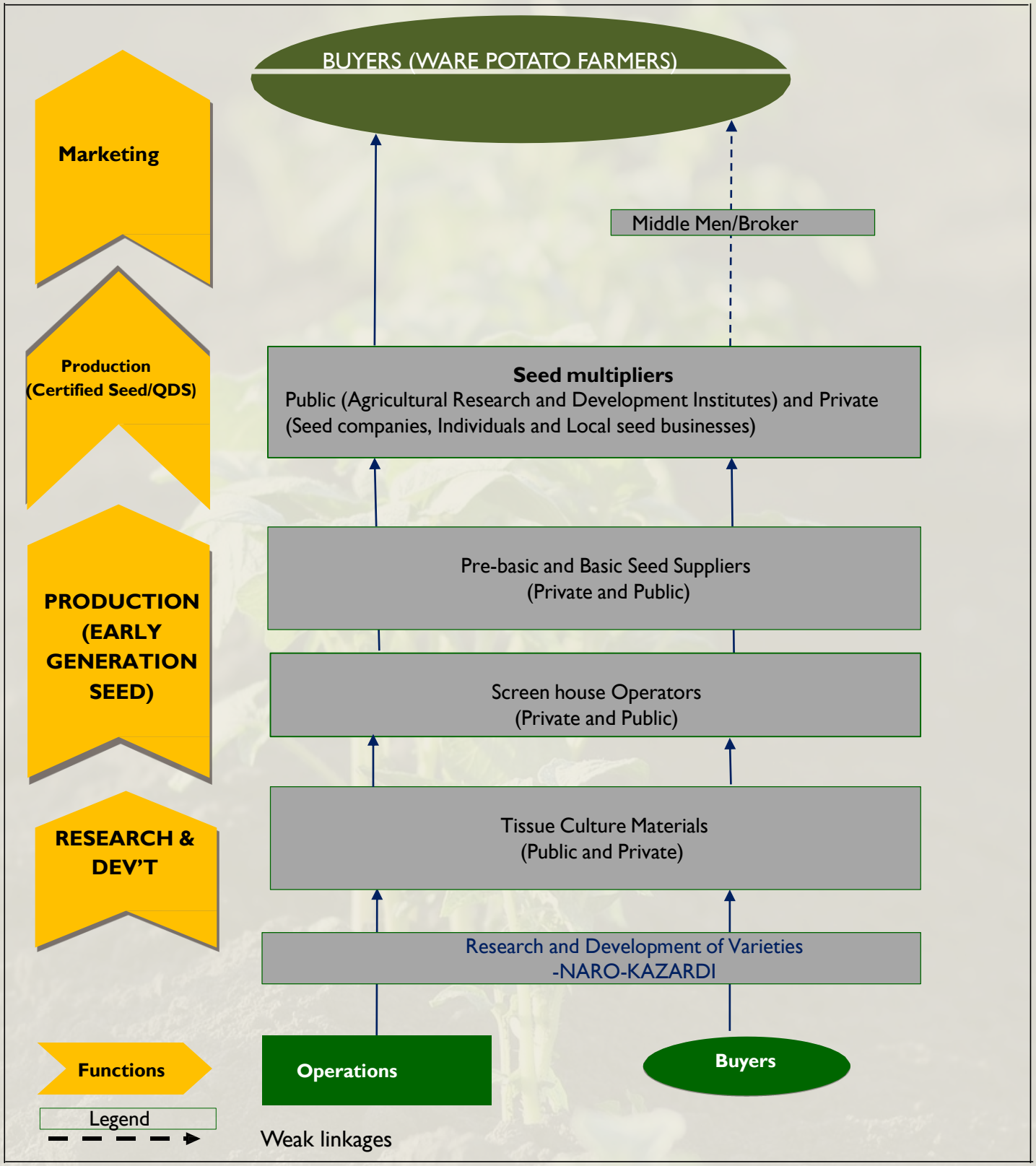
(iii) Postharvest Handling Constraints

Postharvest handling constraints especially lack of recommended storage facilities like cold room or their alternatives like diffused light houses (DLS) reduce the total volume of seed reaching the market (ware potato farmers) due to rotting. Lack of DLS lead to production of elongated sprouts that are less robust hence reduced growth vigor which automatically lead to poor yield.

3.3 Seed Potato Value Chain

The seed potato value chain map for Uganda is presented in Figure 3. It starts with research that deals with development of varieties and policy to inputs through production, trading up to final buyers (ware potato farmers). The chain map shows different layers of processes through which seed moves up to final buyers.

Figure 3: Potato Seed Value Chain Map



Source: Survey data

The value chain map represents the actors, describes what they do within the chain and the links between and their supportive roles actors within the chain.

The value chain map represents the actors, describes what they do within the chain and the links between and their supportive roles actors within the chain. The actors in the seed potato value chain identified during the study were classified into two categories; the main actors that actually handle the product and the supporters of these actors.

The main actors included the following; Research institutions, screen house operators, seed multipliers and the buyers of seed (ware potato farmers) while the chain supporters included government institutions, NGOs, BDS and financial services providers like financial institutions.

3.3.1 Research and Development Institutions

These are public institutions mandated to carry out research and development of varieties that meet policy instructions with emphasis on food security. Currently KAZARDI is the lead institution which carries out research though other like BugiZardi and RwebitabaZardi are still under development to pursue a similar direction. The location for these institutions is always biased to cooler climates known for supporting potato production in the country.

3.3.2 Tissue Culture Laboratories (G0 suppliers)

Production of tissue culture materials has been predominantly done by research institutions especially KAZARDI (with an annual capacity to produce one million plantlet) but of recent commercial seed suppliers like AGT, BioCrops, Afrokai and others have invested in tissue culture laboratories. The research institutions supply over 90% of plantlets to screen house operators though some of them go an extra stage to produce mini-tubers which is still a mandate of research. Presently Uganda has a weak network of public and private potato research with limited national research budgets allocated for potato though supplemented by development partners (Donors);

- *BugZARDI funded by the Government and donors is* responsible for research and development in the Eastern or Elgon region.
- *RwebitabaZARDI in Kabarole* coordinates research and development in the Mid-Western region though its tissue culture laboratory is in its infancy stage.
- *Local universities, primarily Makerere University* have invested in tissue culture laboratories specifically for training purpose.

Since there are few active seed potato related research institutions in the country, technology transfer to smallholders has been slow, particularly in the customization, promotion, and adoption of commercial seed potato varieties available for different ecological conditions.

3.3.3 Mini-tuber Producers (G1 Suppliers)

Production of mini-tubers is done in screen houses and Uganda currently has about 20 with an average size of 7m by 14m. Supply of quality mini-tubers remains the biggest challenge since there are few screen houses to supply certified materials. Currently the introduction of rooted apical cuttings (RACs) has provided a quick process of developing mini-tubers compared to use of tissue culture plantlets.

Mini-tuber suppliers range from research institutions to screenhouse operators and seed companies. Most of the small-scale seed businesses multiply their G1 seed twice, a few even three times but quality will be undermined if multiplication goes beyond three times. Challenges faced by the screenhouse owners include, timely access to TC material in the right quantities and of the right varieties, access to clean water for irrigation and fertigation as well as access to other non- seed inputs.

3.3.4 Pre-Basic (G2) and Basic Seed (G3) Suppliers

The production of pre-basic and basic seed is carried out by screenhouse operators. The main challenge, however, the small-scale seed businesses encounter to obtain the maximum return on their investment due to limited access to enough suitable land for seed multiplication. Research has revealed that a total area of approximately 23 ha is required to sustain a complete cycle of their business of concurrent G1 seed production (37,939 tubers annually) and its further field multiplication into G2 and G3 seed during two cycles per year while using fully the installed capacity of one screenhouse and respecting a 3-year field crop rotation cycle. This is much more than the average area of cropland of 7 ha owned by most screenhouse owners in the country. As a result, their overall G2 and G3 tuber production is 47 and 63%, respectively lower than anticipated[7].

3.3.5 Seed Multipliers (G4 Suppliers)

Majority of the farmers interviewed can be regarded as small with growing fields of 1-2Ha but can hire as much land as they can afford though not easy in the South Western region were land holding on average is 1Ha. On average most seed suppliers cannot observe the recommended rotation of 3 years to keep land under fallow or growing other crops not related to potato. FGDs with seed growers revealed that farmers always start with 1 Ha fields but continue to rent more land due to demand of quality seed.

3.3.6 Seed Buyers (Ware Potato Farmers)

Majority of the farmers are smallholders especially when it comes to the South Western region where majority of ware potato is grown though commercial large farmers are emerging in the Mid-Western region (Kabarole, Kyenjojo and Mubende districts). Farmers experience low yields due to lack of land for crop rotation and use of home saved seed. Low application of non-seed inputs like fertilizers, pesticides and irrigation also impact on their production.

There is great potential for farmers to achieve high yields and improve profitability when farmers learn the value associated with application of recommended agronomic practices. The unstructured market for ware potato is another challenge for farmers since they are price takers rather than price makers during potato marketing.

3.3.7 Support Actors

(a) Financial Service Providers

Throughout the field survey, financial institutions did not appear to be strong players in the seed potato value chain. SACCOs were more common financiers of farmer activities but at a small level compared to the requirement of seed production business. Microfinance institutions have traditionally penetrated the smallholder agriculture sector and have designed some appropriate financial products for producers. Financial institutions are usually reluctant to lend to agriculture in general, since they perceive them to be risky and to small farmers in particular due to lack of collateral and the high cost of servicing small loan amounts.

Commercial bank lending to agriculture is nearly exclusively to large-scale farmers. Smallholders' access to financial services is affected by a number of factors; some farmers find the loan application process tedious, while others fear the consequences of defaulting. Since most smallholder farmers are advised to form strong groups in order to access loans, defaulting has consequences for all group members.

[7] CIP Unpublished Paper; Business cases for various options to produce early generation seed potato in Uganda 2022

(b) Regulatory and policy makers

(i) Policy

The key policy maker for the potato sub-sector is MAAIF under the Roots and Tubers department and potato is a priority commodity in the Agricultural Sector Development Plan 2020/21-2024/25 (ASDP) that is translated into the Agricultural Sector Strategic Plan (ASSP) under National Development Plan 2020/21-2024/25 (NDP III). MAAIF supports the production and marketing of potato and one of its staff under roots and tubers department is a member to the Uganda Potato Platform.

Policy is a major factor for seed potato production, given the fact that priority for Government is to support food security therefore it has a reason to justify intervention in production and marketing of ware potato in Uganda. This can be in the form of extensive sensitization of the population on the nutritional importance of potatoes, strict ban on non-certified seed or varieties and inclusion of potato a priority commodity for national planning.

(ii) Grades and Standards

Currently the grades and standards by UNBS of local seed potato materials tackle the most challenging issue of seed potato production. The available standard or guidelines available in the market are rarely adhered to especially when it comes to fallowing of land for a minimum of 3-5 years. Quality does not seem to be a major concern for the retail market and farmers cannot easily differentiate between seed potato and ware potato leading to poor adoption of the technology. In addition, MAAIF with assistance from CIP developed a Seed potato Inspection and Certification Protocol that guides seed multiplication in Uganda.

(c) Development Partners

Several NGOs have supported the production and marketing of potato in the country. IFC and ISSD supported by The Embassy of the Kingdom of Netherlands (EKN) assisted farmers in the establishment of screen houses and development of the local seed businesses respectively that produce Quality Declared Seed (QDS). GIZ from Germany through Promotion of Nutrition Sensitive Potato Value chain (PNSP) project assisted the potato sub-sector in developing a seed multiplication process country-wide working with farmer groups or associations and organized them in targeted regions to help shape the seed industry.

(d) Business Development Services Providers

Both public and private business development service (BDS) providers are available in the potato sector but public services in form of agricultural extension and farmer group strengthening services remain the majority. The BDS target mainly improvement of market linkages and support to achieve improved marketing.

3.4 Profitability Analysis

3.4.1 Tissue Culture Suppliers (G0 Suppliers)

The leading drivers of tissue culture plantlet production costs are majorly the laboratory establishment cost which is a capital investment, equipment, accessories and the human resource. The cost of cleaning of potato tubers of all diseases takes a long time and this could not be easily established.

Table 3: Profitability Analysis for Tissue Culture Plantlet Production

Item	Total Cost (UGX)
Infrastructure -Buildings (annual depreciation for a period of 20 years)	19,000,000
Equipment (depreciated of a period of 5 years)	235,000,000
Accessories (annual cost)	97,012,800
Human resource (annual cost)	117,000,000
Total cost	**468,012,800**
Revenue	
Yield (plantlets)	1,000,000
Average Price (UGX)	1,000
Total revenue	**1,000,000,000**
Gross Margin	531,987,200
ROI	113.7%

Source: Field survey 2022

A tissue culture laboratory with a basic investment of UGX 360m could produce about one (1) million plantlets per year according to KARZADI technical staff in the South Western region. The challenge remains whether all the plantlets could be taken over by the current number of screen houses in the country. Based on the estimated lifespan of about 20 years, the return on investment (ROI) was 113.6% making it favorable for a business decision to invest. The ROI is over four (4) times the average interest rates (25% including supervision) charged by commercial banks. This means that tissue culture production is very profitable and can pay for its own costs including making margin for the entrepreneur, even when financing by lenders is factored in.

3.4.2 Mini-tuber suppliers

Table 4: Profitability Analysis for Mini-tuber production (Elgon region); 7mx14m screen house

Item	Quantity	Unit Cost (UGX)	Total Cost (UGX)
Input costs			4,547,000
Labour cost			5,217,000
Total cost			**9,764,000**
Revenue			
Yield (Kg)	440		
Price/Kg (UGX)		150,000	
Total revenue			**66,000,000**
Gross Margin			**60,783,000**
Return on Investment (ROI)			2,330%

* N.B Screen house costs was co-financed at 50% to the tune of 52 million

Source: Field survey 2022

3.4.3 Pre-Basic and Basic Seed Suppliers (G2 and G3 Suppliers)

Table 5: Profitability Analysis for Pre-Basic and Basic Seed (1 acre)

Item	South-Western	Mid-Western	Elgon (Eastern)
Input Costs	4,760,000		
Labour Costs	3,608,000		
Total Costs	**8,368,000**		
Revenue			
Yield	6,720		
Price	2,500		
Total Revenue	**16,800,000**		
Gross Margin	8,432,000		
Return On Investment (ROI)	201.50%		

Source: Field survey 2022

3.4.6 Certified Seed Multipliers (G4 suppliers)

Table 6: Profitability Analysis for Certified Seed Multipliers (1acre)

Item	South-Western	Mid-Western	Elgon (Eastern)
Input Costs (UGX)	4,268,500	2,370,000	3,988,000
Labour Costs (UGX)	1,864,000	1,620,000	1,300,000
Total Costs (UGX)	**6,132,000**	**3,990,000**	**5,288,000**
Revenue			
Yield (Kg)	4,480	5,000	7,500
Price (UGX)	2,000	2,000	1,500
Total Revenue	**8,960,000**	**10,000,000**	**11,250,000**
Gross Margin	2,828,000	6,010,000	5,962,000
Return On Investment (ROI)	92.20%	301.30%	225.50%

Source: Field survey 2022

3.4.7 Ware Potato Suppliers

Table 7: Profitability Analysis for Ware Potato Suppliers

Item	South-Western	Mid-Western	Elgon (Eastern)
Input Costs	1,433,500	1,552,000	2,670,000
Labour Costs	647,600	1,450,000	1,124,000
Total Costs	**2,081,100**	**3,002,000**	**3,794,000**
Revenue			
Yield (Kg/Bag)	4,645	60	100
Price	1,059	120,000	60,000
Total Revenue	**4,918,235**	**7,200,000**	**6,000,000**
Gross Margin	2,837,135	4,198,000	2,206,000
Return On Investment (ROI)	272.70%	279.70%	116.30%

Source: Field survey 2022

The study concluded that:

- The leading drivers for all the value chain actors are input costs compared to labour costs, this is common when business requires high investment in inputs to perform the production function.
- For all the value chain actors, the Return on Investment (ROI) were positive giving a positive approach to investment with commercial banks more than willing to offer financial services to support this sector.

3.5 Business Enabling Environment

3.5.1 Supporting organizations and institutional actors

Uganda has key leading public institutions handling agriculture-related issues, including Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) and National Agricultural Research Organization (NARO).

Table 8: Interventions by Development Partners in the potato sector; Rwenzori region

Organization	Activity/ Type of support	Coverage in the Rwenzori region	Project Start Date	Project End Date
CIP	Field evaluation of genetically modified potatoes for resistance to potato blight disease caused by *Phytophthora infestans* at Rwebitaba Zonal Agricultural Research and Development Institute. (Rwebitaba ZARDI)	Confined field Trial On station at Rwebitaba ZARDI in Kabarole	2017	2020
	1. Evaluation of agronomic performance of Dutch potato varieties	Field Trial at Rwebitaba ZARDI On station in Kabarole	2015	2020
IFDC	3. Infrastructure development on irrigation and storage for 3 seed companies and 1 farmers' group	Kabarole, Bunyangabu, and Kyenjojo	2020	2021
	4. Establishment and operationalization of the Rwenzori regional potato platform	Bunyangabu, Kamwenge, Kyenjojo, Kyegegwa, Kabarole	2017	Ongoing
	5. Market linkages for Dutch ware potato producers to a potato processing company	Bunyangabu, Kabarole	2021	2021

Organization	Activity/ Type of support	Coverage in the Rwenzori region	Project Start Date	Project End Date
FICA Seeds	Multiplication of seed for Dutch potato varieties for supply to ware potato producers	Kabarole	2020	Ongoing
KOPIA	Increasing potato productivity and farmers' income through supplying of quality seed potatoes	Kabarole, Bunyangabu, Kamwenge Kyenjojo, Kyegegwa	2017	On going

Public regulatory institutions are regarded as weak because of limited resources and low credibility. Their ability to regulate and enforce quality standards is limited. The regulatory institutions responsible for national seed certification system are weak thus making it possible for fake seed to reach the market. This has also hindered the adoption of certified seed technology since farmers cannot differentiate seed potato from ware potato that can easily be bought from local markets.

Research, Extension and Information Institutions; Uganda has a good network of public and private potato institutions that can offer information on potato especially NARO with branches in most regions of the country. Development partners have also been instrumental in supporting in research in this area though commercialization of most technologies remain weak.



4 INVESTMENT

4.0 INVESTMENT AND FINANCING OPPORTUNITIES

4.1 Constraints and Opportunity Analysis

The market analysis of the seed potato value chain led to the identification of efficiency constraints or what constrains the efficiency of the certified seed to reach the market. If the actors were to participate in the value chain, they MUST address the efficiency since it affects marketing and adoption of the technology amongst the ware potato farmers

Table 9: Summary of constraints in supply and marketing of seed potato

RESEARCH AND DEVELOPMENT	SUPPLY SIDE	DEMAND SIDE
Low varietal technical development capacity (Speed of varietal release is slow compared to industry demand in the last 10 years)	Inadequate quantities of seed potato produced for the market leaving farmers with no alternative but to use uncertified seed	Distorted markets (key buyers e.g Government organs like NAADS and OWC keep pulling out of the market rendering pre-produced seed unmarketable)
Unreliable flow of resources from Government to support research and development	Limited access to appropriate financing to support production of seed potato	Limited access to appropriate financial products by seed potato buyers (ware potato farmers)
Weak coordination within the value chain which constrains variety commercialization to meet market demand	High disease pressure in soils due constrained access to adequate land for crop rotation	No structured marketing i.e seed potato marketing is mainly informal (no marketing contracts)
	Long seed production cycle of 3 years coupled with high initial investment before returns	Proper distribution system for seed potato by seed multipliers i.e there is almost no investment in the distribution and logistics of seed potato rendering the interested growers to move long distances to access the seed.
	Lack of proper seed storage facilities at seed multiplication level	
	Lack of irrigation infrastructure for both screen-house and field production	
	Poor seed certification supervision leading to mixed seed quality	

Source: Stakeholder Consultation 2022

4.2 Critical Constraints' Analysis

The market analysis of the seed potato value chain led to the identification and validation of constraints within the market system. Supply side limitations were identified as the main source of the market constraints while the demand side also presented constraints especially those related to structuring of the market through signing of formal contracts between producers and buyers and constrained access to appropriate financial products for small holder ware potato growers. The identified constraints were ranked based on national impact, ability to provide market and improve income and inclusiveness.

Table 10: Ranking of Demand and Supply Constraints

Constraints	Ranking 1-5; (1 low, 5 High)			
	National impact	Market/Income	Inclusiveness	Ranking
Demand Side				
Unreliable buyers (key buyers e.g Government organs like NAADS and OWC keep pulling out of the market rendering pre-produced seed unmarketable	3	4	4	11
Limited access to appropriate financial products by seed potato buyers (ware potato farmers)	3	4	4	11
No structured marketing i.e seed potato marketing is mainly informal (no marketing contracts)	4	4	4	12
Proper distribution system for seed potato by seed multipliers i.e there is almost limited investment in the distribution and logistics of seed potato warranting interested growers to move long distances to access seed.	2	3	2	7
Supply side				
Inadequate quantities of seed potato produced for the market leaving farmers with no alternative but to use home saved seed	3	3	4	10
Limited access to appropriate financing to support production of seed potato	5	4	4	13
High disease pressure in soils due constrained availability of land for crop rotation	3	4	3	10
Long seed production cycle of 3 years coupled with high initial investment before returns	3	4	2	9
Lack of proper seed storage facilities at seed multiplication level	4	4	4	12
Lack of irrigation infrastructure for both screen-house and field production	4	4	4	12
Inadequate seed certification supervision leading to mixed seed quality	3	2	2	7

Research and Development				
Low varietal technical development capacity (no new varieties released by NARO in the last 10 years)	3	2	3	8
Limited resources from Government to support research and development	2	2	2	6
Regional imbalance in location of research and development institutions	2	2	2	6
Poor variety commercialization strategies to meet market demand	3	2	4	9

Source: Survey data 2022

Constraint 1

Limited access to appropriate financing to support seed potato production; presents the largest constraint within the seed potato value chain. The current demand for seed potato is higher than the supply leaving no alternative but to use home-saved seed for planting. Further discussions with the actors revealed that even the timing of seed availability is poor. When farmers need seed, there are limited volumes of seeds available in the market thus leading to delays in planting and sometimes missing key rains since majority of ware potato production is rain-fed.

Constraint 2

Lack of irrigation infrastructure; Most seed multipliers do not have access to irrigation facilities that could provide quality water required to supplement moisture requirements during dry seasons. In addition, screen houses also need constant water supply to sustain the moisture requirements during key production stages of development plantlets which are very sensitive to low moisture conditions.

Constraint 3

Lack of proper storage facilities (cold rooms or DLS); most seed producers lack recommended cold storage facilities to maintain quality during the dormancy period thus suffering high temperatures predisposing seed to degradation. In addition, high temperatures promote rotting during storage and other storage pests like bacterial build up. Seed multipliers without proper storage are forced to sell seed potato as ware potato if they fail to get buyers in time thus making losses.

4.3 Investment Opportunities

While there exists several investment opportunities within the seed potato value chain, the selected investments must address the critical demand and supply side constraints. There are both private and public investments considered for the seed potato chain.

4.3.1 Private Investment

There are three (3) key investment opportunities identified to target the critical constraints as outlined below;

Constraint 1

Limited access to finance by seed potato multipliers; Majority of the actors right from the seed multipliers, traders, buyers (ware potato farmers (80%) revealed that lack of certified seed was the biggest constraint since the current germplasm has been recycled over time. The challenge was that seed suppliers cannot produce enough seed and this was contributed to limited access to finance since it requires a reasonably large investment per acre. In agronomy, quality seed production requires a crop rotation cycle of three years and this automatically calls for acquiring large pieces of land for seed production.

Opportunity 1

Financing of working capital for commercial farming; There exists an opportunity for financing of commercial seed multipliers that require good money to invest in quality seed production. At the moment, research has revealed that more than 80% of the farmers use home saved seeds. If certified seed is available on the market, crop yields will improve leading to increased production to meet market demand. Majority of the seed potato multipliers are smallholders organized under producer organizations that require capacity building in governance, developing market linkages and preparing financing proposals/business plans to reduce collateral demand by most financing institutions that consider small-holder production risky.

Financing of Working Capital Business Opportunity

Based on the current annual seed potato demand difference of 25,000 MT and an average cost of US$ 300 to produce one (1) ton of certified seed, seed potato multipliers need about an annual working capital of US$ 7,500,000 through a combination of equity, commercial loans and grants.

Constraint 2

Lack of proper storage facilities (cold room or DLS); Currently over 90% of Ugandan small holder seed multipliers do not have recommended storage facilities (cold rooms or diffused light stores) as recommended for breaking dormancy for a minimum period of two months. This usually results into quick selling of seed potato as ware potato and as a result lead to losses for most seed multipliers. In addition, seed multipliers suffer rotting of seed during storage due to high temperatures thus reducing volumes for marketing.

Opportunity 2

Support construction of recommended storage facilities (cold rooms or diffused light stores (DLS)

There is an opportunity to invest in cold room infrastructure to give the Ugandan potato seed a competitive edge in the market most especially if potato seed multipliers were to avail seed to farmers at the appropriate planting time. In addition, if Uganda is to expand its current export marketing business especially to Rwanda and Democratic Republic of Congo (DRC), commercial seed multipliers or seed companies need proper storage facilities. The issue of marketing seed which cannot be differentiated with ware potato has exacerbated the poor adoption of using certified quality seed by farmers

Storage facility (Cold Room or DLS) Infrastructure Business Opportunity

160,000 m^3 Total Cold Room
Area 1 m^3 =US$ 400

Total investment US$ 64,000,000
40% Private sector investment US$ 25,600,000
60% Debt financing US$ 38,400,000

Constraint 3

Lack of irrigation facilities; Most seed multipliers do not have access to irrigation facilities that could provide quality water required to supplement moisture requirements during the dry seasons. In addition, screen houses also need constant water supply to sustain the moisture requirements during development of tissue culture plantlets. Most screen house operators and seed multipliers have failed to achieve the recommended yield due to lack of adequate water supplement during the dry seasons making seed unavailable during key cropping calendar. Unreliable rains have kept distorting the supply plans of seed producers which contribute to the failure of commercial farmers to meet market demand especially when it comes to meeting contractual obligations exercised by the processing industry and the unconventional markets like Café Javas and KFC.

Opportunity 3

Financing of Irrigation facilities for Seed Multiplication

There is an opportunity to invest in irrigation infrastructure to give the Ugandan potato seed multipliers an opportunity to increase their average yield by more than 30%. Current production area required to meet seed demand deficit is about 1,500Ha most especially if we are to avail ware potato farmers with seed when required at the time of planting. In addition, if Uganda is to expand its current marketing towards export markets, seed multipliers need water throughout the growth period.

Irrigation Infrastructure Business Opportunity

Current production area required to meet demand deficit is 1,500Ha
1Ha= US $ 20,000

Total investment US$ 30,000,000; 40% Private sector investment US$ 12,000,000
60% Debt financing US$ 18,000,000.

4.3.2 Public Investment

There are three (3) key investment opportunities identified to target the critical constraints as outlined below;

(i) **Advocacy and lobbying**

Research should be assisted to develop varieties that respond to the needs of the emerging markets especially for processing of crisps and French fries

(ii) **Infrastructure (cold room and or DLS)**

Seed multipliers should be assisted with proper logistical investment like communal storage facilities or centers across the growing areas to facilitate accessibility of seed by the growers

(iii) **Extension**

Public sector should invest in dissemination of knowledge and skills to farmers in the areas of good agronomic practices with emphasis on pests and diseases, post-harvest handling and management.



5 Conclusion

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This market study has revealed a number of issues regarding the seed potato value chain in Uganda. The main conclusions based on field assessment carried out were:

- *Seed Potato in Uganda is essentially a smallholder enterprise*, with repeated use of disease infested soils and lack of recommended crop rotation. Average area under seed potato is about one (1) Ha. About 1 percent of commercial farmers practice seed production, making it difficult to implement quick technological changes towards increased seed production.

- *Uganda has the potential to increase production and productivity.* Currently the biggest challenge is access to clean seed since majority is produced in the South-Western region where land holdings are small. The favourable climatic condition is considered to be the cool highlands but recent research by Agromax show that seed potato can be produced in hot areas like Karamoja.

- *Factors affecting clean seed potato technology adoption* are availability of clean seeds, constrained access to credit or finance by small holders to buy seeds, farmer training, and establishment of demonstration centres to show profitability related to use of clean seed. For producers to move from their current production and management levels, they have to see tangible results in terms of increased yield and profit levels and be constantly sensitized.

- *Interventions at the seed multiplication level* must focus on increasing farm level efficiency, investing in adequate irrigation systems, increasing and improving quality of cold storage infrastructure, and providing linkages to markets and financing.

- *Inconsistent markets;* Transactions are still dominated by spot markets, lack of trust, and opportunism, with almost no contracts or long-term business relationships. This situation breeds speculation and opportunism, leading to distortions and loss of interest on the part of the producers thus making marketing another biggest challenge.

The recent withdraw of NAADS and OWC from the marketing of seed potato left a big gap on especially when it comes to overcoming the free input supply syndrome enabled by the government interventions.

- *Strengths, weaknesses, opportunities, and threats of the Ugandan seed potato value chain.* With the available water sources, Uganda's strength is its ability to produce throughout the year. Its major weaknesses include lack of certified seed, lack of economies of scale by small seed multipliers, prevalence of scattered producers, and inadequate sensitization of ware potato growers about the benefits of using certified seed. Opportunities exist in the form of growing domestic demand for table and processing volumes and proposed new private sector investments in starch for industrial use. The greatest threats to the value chain include the high costs of production due to the recommended crop rotation cycle of a minimum 3 years to reduce soil disease infections.

- *Majority of the activities in the value chain* are profitable with high ROI that can attract commercial lending to support commercial production to meet increasing seed potato demand in the country.

- *Most of the seed potato production* is located in Southwestern region making distribution and accessibility to other upcoming growers a challenge especially when it comes to travelling long distances and availability of seed when required at planting time.

5.2 Recommendations

In light of the conclusions about the potato seed market study, the following recommendations were made:

RESEARCH

- *Research should move faster to produce or release potato varieties with characteristics required by processors* similar to those currently imported from Kenya, South Africa and The Netherlands. Therefore, NARO should collaborate with value chain actors to identify key attributes required for quick commercialization of new varieties

- *The potato platform should be strengthened to improve coordination within the value chain* to enhance variety release and commercialization by research to meet demand of emerging markets (processing).

PRODUCTION AND MARKETING

- *Support Enhanced Extension Services; Value chain actors especially farmers should be supported with best agronomical practices* particularly disease and plant population and enterprise profitability analysis with action-based documents such as bulletins, brochures by both public and private sectors.

- *Strengthening the seed distribution system*; The Seed producers associations or groups in the country should be assisted to strengthen their current distribution systems to enhance seed accessibility throughout the country.

INVESTMENT

- *Support commercial production of certified potato seed:* Investment in properly managed fields with available water for irrigation and investment in proper cold storage and DLS facilities should be supported to increase access to clean seed. To this effect, it is important to promote the establishment of large production farms especially in the new potato growing regions apart from the Southwestern region.

- *Support investment in infrastructure and potato seed distribution network*: Potato seed producers should be supported financially to develop good distribution networks to deliver the seed to farmers at the nearest point of availability. This should involve support for aggregation - potato seed marketing centers such as at farmer cooperatives to realize economies of scale or logistics such as transport (light trucks) and marketing initiatives.

POLICY

- *Capacity building towards institutional professionalism;* Public sector should invest in building the capacity of potato growers associations to achieve a professional status. The investment should target improvement in internal management, operations, sustainability, financial management, production system, markets, external risks and enabling environment.

- *Support Current Potato Stakeholders' Platform:* The national potato platform should bring together major potato stakeholders (public and private) in the industry to discuss how to build business relationship amongst the value chain actors to increase potato seed production, improve quality, marketing, and align the roles and responsibilities of public and private stakeholders and development partners.

- *Support the sector to reform the current seed policy;* Private sector should be supported to participate in the implementation of current inspection and certification protocol to enhance production of clean seed (allow private sector seed certification).



6 Annex

Annex 1: List of references

- ***A.R. Aheisibwe, A. Barekye, P. Namugga and A. A. Byarugaba;*** Challenges and opportunities for quality seed potato availability and production in Uganda, 2015
- **IFDC, 2020;** Business Innovation for Resilient and Efficient Farming
- **NARO and KOPIA:** Seed potato Production Manual 2020
- **CIP and CGIAR, June:** Research Brief 04: The potato value chain in Uganda, its actors and the status of their business linkages 2021
- **CIP, 2011:** Roadmap for Investment in seed potato value chain in Eastern African.
- **Kingdom of Netherlands, IFDC and Cardno, MIFA -REACH, Uganda:** Establishing a Seed potato Value Chain in Eastern Uganda.
- **Pieter Wauters;** Value Chain Mapping and Stakeholder Analysis of te Potato Sector in Uganda, a Literature Review 2017
- **Pieter Wauters and Monica L, Parker;** Business Cases for Various Options to Produce Early Generation Seed Potato in Uganda 2022
- **Swaibu Mbowa and Francis Mwesigye 2016;** Investment Opportunities in the Irish Potato Value Chain in Uganda
- **IFDC-REACH Project 2020**; Establishing a Seed Potato Industry in Eastern Uganda

Annex 2: Profitability tables

(I) Elgon Region

Table 11: Gross Margin Analysis for Mini-tuber production (7mX14m screen house)

Activity	Quantity	Unit cost UGX	Total cost UGX
Buy plantlets	2000	1000	2,000,000
Fumigation of screen house	1	4000	4,000
Clean & sterilize buckets	664	50	33,200
Purchase composite manure	4 trucks	50,000	200,000
Collect virgin soil from forest	4 trucks	16,000	64,000
Purchase firewood	4 trucks	80,000	320,000
Purchase sterilizing drum	1	134,000	134,000
Sterilize soils + manure	8 trucks	20,000	160,000
Laying and putting soil in buckets	664	50	33,200
Planting TC in buckets	664	100	66,400
Spraying chemicals	1	2000	2,000
Watering under drip irrigation	1	100,000	100,000
Weeding and hilling the pots	664	100	66,400
Spraying fungicides	1	2000	2,000
Earthing up	664	100	66,400
Spraying & earthing up cont	664	100	66,400
Dehaulming	2	10,000	20,000
Harvesting & counting	5	10,000	50,000
Sorting & grading	5	10,000	50,000
Weighing & bagging	5	10,000	50,000
Total costs			3,488,000
Yields			441.28kgs
Sales	441.28	600,000	**264,768,000**
N.B Screen house costs was co-financed at 50% to the tune of 52 million			
To last up to 15 years			

Table 12: GM analysis for potato seed production-KWSPPA (1 acre)

Activity	Quantity	Unit Cost	Total Cost
Land hire	1	500,000	500,000
Land clearing	1	30,000	30,000
1st Ploughing	1	80,000	80,000
Purchase of seed	800KG	2,750	2,200,000
Purchase of fertilizers DAP	2 @ 50kg	5,000	500,000
Purchase of fertilizer NPK	2 @50 Kg	4,400	440,000
Purchase of pesticides	1 liter	40,000	40,000
Purchase of fungicide	5 kg	14,000	70,000
2nd ploughing	1	60,000	60,000
Making furrows	1	50,000	50,000
Transportation of seed potato	8 bags	5,000	40,000
Planting	10	5000	50,000
Fertiliser application	2	4000	8,000
spraying labor	2	30000	60,000
weeding	30	2000	60,000
Planting returns to DAO	1	30,000	30,000
1st Inspection	1	50,000	50,000
Earthing up	30 Katara	3000	90,000
Hand picking of weeds	4	3000	12,000
Dehalaming	2	5000	10,000
Harvesting of potato seed-80 Bags	30	5300	159,000
Buy sacks	80	1200	96,000
Transport from garden 80 bags	80	2000	160,000
Sorting & grading	80	1000	80,000
Storing 80 bags	80	1000	80,000
Dusting with acetellic	1 kg	10,000	10,000
3rd Inspection	1	100,000	100,000
Put seed into trays -DLS	80	200	16,000
Marketing information	1	30,000	30,000
Purchase new bags	80	1,200	96,000
Putting seed into bags	75	1,000	75,000
Sisal roll	1	6,000	6,000
Total costs			**5,288,000**
Sales (75 x100kg)	**7500**	**1,500**	**11,250,000**
GROSS MARGIN			5,962,000

Table 13: Gross Margin Analysis for seed production-WASPPA (1 acre)

Activity	Quantity	Unit cost	Total cost
Land hire	1	500,000	500,000
Land clearing	1	100,000	100,000
1st Ploughing	1	80,000	80,000
Purchase of seed	8@80 kg	180,000	1,440,000
Purchase of fertilizers	2 @50kg	220,000	440,000
Purchase of pesticides	1 litre	17,000	17,000
Ridomil-systemic fungicide	1	70,000	70,000
Purchase of fungicide	3 kg	15,000	45,000
2nd ploughing	1	40,000	40,000
Making ridges	1	30,000	30,000
Transportation of seed potato	8 bags	5,000	40,000
Planting	10	4000	40,000
Fertiliser application	2	4000	8,000
Covering with soil	4	4000	16,000
1st spraying	4	5000	20,000
2nd spraying	4	5000	20,000
1st weeding	20	4000	80,000
Planting returns to DAO	1	30,000	30,000
1st Inspection	1	50,000	50,000
Earthing up	10	4000	40,000
Hand picking of weeds	4	3000	12,000
Harvesting OF POTATO SEED-80 BAGS	20	3000	60,000
Buy sacks	80	1200	96,000
Transport from garden 80 bags	80	6000	480,000
2nd Inspection	1	50,000	50,000
Sorting & grading	80	300	24,000
Dusting with acetellic	1 kg	10,000	10,000
3rd Inspection	1	100,000	100,000
Put seed into trays -DLS	80	500	40,000
Marketing information	1	15,000	15,000
Buy new bags	80	1,200	96,000
Putting seed into bags	80	200	16,000
Sisal roll	1	6,000	6,000
Total costs			**4,111,000**
Sales (80 x100kg)	8000	1,500	**12,000,000**
Gross Margin			**7,889,000**

Table 14: GM Analysis for ware potato production -Kapchorwa farmers (1 acre)

Activity	Quantity	Unit cost, UGX	Total cost, UGX
Land hire	1	300,000	300,000
Land clearing	1	50,000	50,000
1st Ploughing	1	80,000	80,000
Purchase of seed (Kla)	5 bags	230,000	1,150,000
Purchase of fertilizers-DAP	2 @ 50kg	220,000	440,000
Purchase of pesticides	1 liter	40,000	40,000
Purchase of fungicide	10 kg	25,000	250,000
Buy systemic fungicide-ridomill	1	30,000	30,000
2nd ploughing	1	60,000	60,000
Making ridges	1	30,000	30,000
Transportation of seed from kla	5 bags	10,000	50,000
Transport seed + fertiliser to garden	9	2,000	18,000
Planting	20	5000	100,000
Fertiliser application +soil covering	2	5000	10,000
1st spraying	16	2000	32,000
1st weeding	35	2000	70,000
Fungicide application	56	2000	112,000
Top dressing with UREA	2	230,000	460,000
Labor for top dressing	2	5000	10,000
Earthing up	35	2000	70,000
Hand picking of weeds	4	3000	12,000
Harvesting	100 bags	3000	300,000
Buy sacks	100	1200	120,000
Total costs			3,794,000
Sales	**100**	**60,000**	**6,000,000**
Gross Margin			**2,206,000**

Table 15: GM for ware potato production -Kween farmers (1 acre)

Activity	Quantity	Unit Cost, Ugx	Total Cost, Ugx
Land hire	1	250,000	250,000
Land clearing	1	50,000	50,000
1st Ploughing	1	80,000	80,000
Purchase of seed	4@ 150 kg	220,000	880,000
Purchase of fertilizers	2 x@50kg	220,000	440,000
Purchase of pesticides	1 liter	25,000	25,000
Purchase of fungicide	6 kg	17,000	102,000
2nd ploughing	1	60,000	60,000
Making ridges	1	50,000	50,000
Transportation of seed potato	6 bags	3000	18,000
Planting	6	4000	24,000
Fertiliser application	2	4000	8,000
Covering with soil	4	4000	16,000
1st spraying	55	2500	137,500
1st weeding	25	2000	50,000
Fungicide application	55	2500	137,500
Top dressing with UREA	2	230,000	460,000
Labor for top dressing	2	5000	10,000
Earthing up	25	2500	62,500
Hand picking of weeds	4	3000	12,000
Harvesting	70 bags	2000	140,000
Buy sacks	70 bags	1200	84,000
all costs			3,096,500
Sales	**70**	**60,000**	**4,200,000**
Gross Margin			**1,103,500**

N.B Inputs especially fertilizers have lately eaten into the GM

Mid-Western Region

Table 16: Seed Potato Production costs (High Input) – 1 acre

Input	Investment / acre		
	Quantity	Unit Price (Ush)	Total Cost (Ush)
Input Costs			
Land cultivated acre (rent)	1	300,000	300,000
Seed (100kg)	8	250,000	2,000,000
Fertilizer – NPK (50kg bag)	2	250,000	500,000
Fungicides – Systemic	5	50,000	250,000
Fungicides – Contact	5	25,000	125,000
Pesticides (Liters)	6	50,000	300,000
Total Costs			**3,475,000**
Labor Costs			
Land preparation	1	800,000	800,000
Planting	1	200,000	200,000
First Weeding	1	250,000	250,000
Earthing up	1	250,000	250,000
Foliar Fertilizer (twice)	6	15,000	90,000
Spraying each knapsack	6	8,000	48,000
Harvesting	1	350,000	350,000
Transporting from garden to home / stores	100	5,000	500,000
Storage Costs (Malathion Dust)			35,000
Total Labour Costs			**2,523,000**
Total Costs			**5,998,000**
Output and revenue			
Yield (100kg bags)	100	300,000	30,000,000
Net profit per acre			**24,002,000**

Table 17: Seed potato Production costs (Medium Input) 1 acre

Input	Investment / acre		
	Quantity	Unit Price (Ush)	Total Cost (Ush)
Input Costs			
Land cultivated acres (rent)	1	200,000	200,000
Seed (80kg)	8	200,000	1,600,000
Fertilizer (50kg bag)	1	220,000	220,000
Fungicides (Systemic and			100,000
Contact)			
Pesticides (Litres)			50,000
Carrier bags	50	1,000	50,000
Packing Bags (for 50 kgs)	50	3,000	150,000
Total Costs			**2,370,000**
Labour Costs			
Land clearing	1	100,000	100,000
First ploughing	1	100,000	100,000
Second ploughing	1	100,000	100,000
Planting	1	150,000	150,000
First Weeding	1	100,000	100,000
Second weeding	1	100,000	100,000
Dehaulming	1	80,000	80,000
Spraying			300,000
Harvesting			300,000
Transporting from garden to home	50	5,000	250,000
Sorting and grading			40,000
Total Labour Costs			**1,620,000**
Total Costs			**3,990,000**
Output and revenue			
Yield (100kg bags)	50	200,000	10,000,000
Net profit per acre			**6,010,000**

Table 18: Cost benefit analysis of potato production of a farmer using proper agronomic practices in Kyegegwa district Kasule Sub County (1 acre)

Description	Stage	Sub stage	item	Item type	Qnty per acre	Freq per season	Unit cost	Total cost
A farmer will spend a total of Ush.1.552000 million per acre on inputs in Kyegegwa district	Production Expenses	Inputs	Land hire	Land	1	1	200.000	200.000
			Seed	Seed (80kg)	5	1	150,000	750,000
			Fertilizer NPK (50kg)	Fertilizer NPK 17:17:17	2 Bag of 50kg	1	220,000	440,000
			Fungicides(mancozeb)	kg	2	1	25000	50,000
			Pesticides	Litres	2	1	20,000	40,000
			Bags	Bags	60	1	1200	72000
			Sub total					**1,552,000**
	Labour		Land preparation				400,000	400,000
A farmer will spend Ush 1050,000 on labour per acre in Kyegegwa district			Planting				200,000	200,000
			Fertilizer and pesticide application				250,000	250,000
			Weeding			2	100,000	200,000
Post-harvest handling			**Sub total**					**1,050,000**
			Harvesting and collection	Man days	20		10,000	200,000
			Grading, packing and loading	Man days	20		10,000	200,000
			Sub total					**400,000**
			Total Expenses					**3,002,000**
A farmer using good agronomic practices is earning **4,198,000** million per harvest per acre			Potatoes Revenue		60		120,000	7,200,000
			Profitability per acre					**4,198,000**

Table 19: Cost benefit analysis of potato production of a farmer using traditional practices in Kyegegwa district Kasule Sub County (1 acre)

Description	Stage	Sub stage	item	Item type	Qnty per acre	Freq per season	Unit cost	Total cost
A farmer will spend a total of Ush.854,000 per acre on inputs in Kyegegwa district	Production expenses	Inputs	Land hire	Land	1	1	200.000	200.000
			Liquid manure (organic)	Litres	3		10,000	30,000
			Seed	Seed (80kg)	5	1	120,000	600,000
			Bags	Bags	20	1	1200	24,000
			Sub total					854000
	Labour		Land preparation				400,000	400,000
A farmer will spend Ush 860,000 on labour per acre in Kyegegwa district			Planting				200,000	200,000
			manure application	Liquid manure	20 knaps	20	3000	60,000
			Weeding			2	100,000	200,000
Post-harvest handling			**Sub total**					**860,000**
			Harvesting and collection	Man days	10		10,000	100,000
			Grading, packing and loading	Man days	10		10,000	100,000
			Sub total					**200,000**
			Total Expenses					**1914,000**
a farmer using traditional practices is earning Ush **486,000** per harvest per acre in Kyegegwa			Potatoes Revenue		20 Bags		120000	2400,000
			Profitability per acre					486,000

Note; most of these farmers they use family labour and they never cost family labour therefore also think they are in business.

Annex 3: LIST OF RESPODENTS

(a) Table 20: CENTRAL

Key Informants			
S/No.	**Name**	**Institution**	**Contact**
1	Nsubuga Erastus	AGT Nursery	0772585211
2	Gilbert Mbalinda	Agromax	0773132339
3	Arinaitwe Geoffrey	BioCrops	0786290279
4	Mukasa S. B	SENAI	0782670041
5	Fredrick Kibira	USAID-IAM	0788509430
6	Anthony Nyungu	USAID-ISSA	0772769646
7	Robert Anyang	USAID-SIA	0776666018
8	Narcis Tushabe	Royal Plant Nurseries	0772980233
9	Brian Kisembo	KFC	0702168869
10	Pieter Wauters	CIP	0706582190
11	Samuel Muloma	MAAIF	0772640005
12	Komayombi Bulegeya	Uganda Potato Platform	

(b) Table 22: SOUTH-WESTERN

Name	**Institution**	**Sub County**	**District**	**Contact**	
Dr. Alex Barekye	KAZARDI, Director	Bubare	Rubanda		
Dr. Prossy Namugga	KAZARDI, Program Leader	Bubare	Rubanda		
Mr. Steven Tindimubona	UNSPPA, Executive Officer	Kabale Municipality	Kabale		
Mr. Puis Nyabigweki	UNSPAA, Agronomist	Kabale Municipality	Kabale	0778 552 827	
Mr. Deus Baguma	Kabale DLG, DAO	Kabale Municipality	Kabale	0782 568 560	
Mr. Erasmas Natumanya	Kabale DLG, DCO	Kabale Municipality	Kabale	0773 218 268	
Mr. Ambrose Akankwasa	Nyabyumba Farmers' SACCO, Manager	Kamuganguzi	Kabale		
Mr. Charles Byarugaba	Private Screenhouse Owner	Kamuganguzi	Kabale	0772 984 619	
Mr. John Karugaba	Kigezi Farmers' Resource Centre (Private Screenhouse Owner	Hamurwa	Rubanda	0772 663 666	
Mr. John Mugisha	Namakwaland Farm, Resident Director	Bukakata	Masaka	0777 682 532	
Mr. Hussein Kiyemba	Namakwaland Farm, General Manager	Bukakata	Masaka	0875 234 208	
Mr. Willy Asiimwe	Private seed Grower	Kamuganguzi	Kabale		
Name of Group	**Institution**			**Attendance**	
				M	F
Nyabyumba FFS LSB		Kamuganguzi	Kabale	09	01
Murugyesi LSB		Hamurwa	Rubanda	03	06
Mukatooma LSB			Kashasha	09	12

(c) Table 23: ELGON (EASTERN)

Name	Designation/Organization	Contact Address
Kenneth Walimbwa	Crop Technician, BugZARDI	0775673872
George Shiodo	WASPPA	0758631705
Ivan Kitima	WASPPA	0740073350
Rose	DAO Mbale	0772673789
Nelson Apil	DAO Kapchorwa	0772646875
Moses Kiptala	MIFA	0789117972
Leonard Kulany Bomet	DAO Kween	0782493224
George Chapkurui	Chairperson Potato Seed Traders	0779468610
Patrick Bomutai	Potato Seed Trader	0798287555
Alfred Chapjur	Potato Seed Trader	0781931299
Sam Waninde	WASPPA	0782557440
Jackson Mwanga	Field Assistant Potato Program, BugZARDI	0777232461
Juliet Sawani	KSPPA	0779530286

(d) Table 24: MID-WESTERN

(RWENZORI) List of Key Informants

N.o	Name	Designation	Contact
1	George Sebugwawo	Agricultural Officer - Mubende District	0772 - 392474
2	Joseph Kiyingi	Secretary for District Production Officer - Mubende District	0772 - 897353
3	Brian Manzi	Agricultural Officer, Kiruuma Sub county - Mubende District	0772 - 013818
4	Fred Okello	Chairperson LC1, Bugomba Village, Makukulu Parish, Kiruuma Sub county - Mubende District	0779 - 428035
5	Stephen Ahimbisibwe	Chairperson LC3, Kiruuma Sub county - Mubende District	0777 - 449499
6	Moses Kagambagye	District Councilor - Kiruuma Sub County and Secretary for Production, Mubende District	0784 - 351344
7	Arthur Mbalire	District Agricultural Officer - Kyegegwa District	0775 - 255128
8	Devunary Tumuhereze	Sub County Agricultural Officer – Kasule Sub County, Kyegegwa District	0787 - 826229
9	Gertrude Tumushabe	Chairperson, Bugogo Women Irish Potato Project, Kasule Sub County, Kyegegwa District	0773 - 644925
10	Moses Karuhanga	Secretary, Bugogo Women Irish Potato Project, Kasule Sub County, Kyegegwa District	0779 - 812662
11	Dr. Robooni Tumuhimbise	Director of Research, RwebitabaZARDI, Kabarole District	0778 - 455710
12	Faith Aharinta	Agronomy Technician, RwebitabaZARDI, Kabarole District	0772 375327
13	Fred Baker Isingoma	Senior District Agricultural Officer - Kabarole District	0772 - 799760
14	Frank Niwagaba	Chairman Rwenzori Potato Platform and Seed Potato Producer, Kabarole District	0772 - 956889
15	Vincent Murungi	Seed Potato Producer, South Ward, Nyakigimba Town Council, Bunyangabu District	0772 - 553950





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