ACCESS TO QUALITY SEED IN UGANDA: THE CONTRIBUTION OF FARMERS' LOCAL SEED BUSINESSES TO THE SEED SECTOR

A REPORT

for

Integrated Seed Sector Development (ISSD) Uganda

Prepared by

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LIST OF ACRONYMS

ATT	Average Treatment Effect on the Treated
EGS	Early Generation Seed
FDG	Focus Group Discussion
FS	Foundation Seed
GAP	Good Agricultural Practices
IFDC	International Fertilizer Development Center
ISSD	Integrated Seed Sector Development
KII	Key Informant Interviews
LSB	Local Seed Business
MAAIF	Ministry of Agriculture Animal Industries and Fisheries
NARO	National Agricultural Research Organization
OWC	Operation Wealth Creation
OPV	Open pollinated variety
PSM	Propensity Score Matching
QDS	Quality Declared Seed
SOP	Standard Operation Procedures
UGX	Uganda Shillings
Wageningen UR	Wageningen University & Research
WCDI	Wageningen Centre for Development Innovation, Wageningen University & Research

EXECUTIVE SUMMARY

Seed is a foundation in crop production and therefore a significant component in transforming smallholder agriculture for the development of agricultural economies. The Integrated Seed Sector Development (ISSD) program in Africa that has over the years played a key role in improving availability of and access to quality seed for the rural farm households. One component of ISSD is the ISSD Plus project in Uganda, implemented by Wageningen UR Uganda (WUU) in collaboration with National Agricultural Research Organization (NARO) and the private sector.

The ISSD Plus project aims to strengthen the development of a vibrant, pluralistic and market-oriented seed sector that is able to address key challenges that hamper the seed sector development in Uganda. The project introduced Quality Declared Seed (QDS) of mainly non-hybrid crops to be produced at community level by trained farmer groups. It empowers skilled and market-oriented farmer groups through a Local Seed Business (LSB) approach, and has since 2012 supported over 264 LSBs in 59 districts across Uganda.

To assess the contribution of the LSBs to the seed sector in Uganda, this study was commissioned focussing on assessing availability, accessibility, affordability and quality of QDS of seven priority crops; beans, groundnuts, potato, rice, soybean, sesame and cassava in six regions of Uganda over the last four years (2016-2020). The regions are Kigezi, Ankole, Rwenzori, Eastern, West Nile and Northern region.

The study used mixed methods including literature and document review, focus group discussions, key informant interviews, case studies, household survey and a local market survey which involved LSBs and agro-input dealers in the study area. The household survey involved farmer beneficiaries of the ISSD Plus project (farmers in sub counties where LSBs were established and supported), and a control group (farmers from other sub counties which did not directly participate in the ISSD Plus project and where there were no LSBs).

Using a mixture of purposive, stratified and random sampling methods, respondents for the seven crops supported (LSBs farmers and target beneficiaries), farmers from sub counties without LSBs (control), and other seed actors (formal and informal) were selected and interviewed. From each region, two districts were selected with the guidance of ISSD technical staff. In each district 140 farmer beneficiaries and 160 non-beneficiaries (control) were selected making a total sample of 1,800 farm households. In addition, in

each district four FGDs (two for beneficiaries and two for control), 12 key informant interviews and one case study were conducted.

The data collected were processed using MS Excel, SPSS (version 25), and STATA 13 computer software, and analysed using descriptive and regression analysis. In the analysis, QDS availability was defined as seed supply or the physical quantity of QDS available to farmers from LSBs and any other sources. QDS access was defined as effective demand for the seed, given the prevailing intrinsic and extrinsic factors, while QDS affordability was defined as farmers' ability to access and use QDS in required quantities, quality and time. QDS quality was assessed using qualitative methods based on farmers' perceptions, attitude and knowledge of seed quality attributes.

Study findings on quality seed availability show that in the last three years the supply of QDS by LSBs for all the seven crops has generally been increasing, with the decline in 2018 attributed to the prolonged dry season that affected planting. From 2016 to 2019, bean seed supply increased by 293%, potato by 1,373%, rice by 1,020%, soybean by 562% and groundnuts by 82%. However, sesame seed declined by 5% due to lack of foundation seed, and cassava cuttings also declined by 37% because of low market demand that discouraged LSBs from expanding production.

Despite increased production of QDS in the past few years, there is a general consensus that QDS is still in small quantities and therefore not readily available. Considering all the crops, only 39.3% of the entire sample said QDS is readily available. Overall, the market share of QDS is small (at 10% for season A of 2019 and 6.4% for season B), with home saved seed and grain from the market taking the bigger share of the total seed planted. Although the majority (64.5%) farmers reported availability of enough crop varieties, quite a big percentage (e.g. 40% in rice, 50% in potato and 64% in beans) reported inadequacy in quantity of QDS produced. About 45% of the farmers buy seed from LSBs (35.2% from individual members of LSB groups and 9.4% from LSB stores). Farmers find it convenient to buy from a neighbouring seed farmer than going to the LSB store. The key factors affecting the supply of QDS by LSBs include limited access to foundation seed (FS), quality of FS, limited land and limited capital.

As regards to QDS accessibility, the study findings across the regions show that smallholder farmers access seed from various sources including LSBs, home saved seed, neighbours/ friends/relatives, local markets, agro-dealers/seed companies, NGOs, and

government. The major sources for a majority of farmers (42.7%) is home saved followed by the local market (25.3%).

Overall, the use of QDS is low, only 35% of sampled farmers had access to and used QDS at least for one season in the last four years. There is a relatively low proportion of beneficiary farmers using home saved (32.8%) and local market seed (24.1%) compared to the control/non-beneficiaries of whom 51.2% used home saved seed and 26.4% accessed seed from local markets. The percentage of beneficiaries (48.6%) using QDS is significantly higher than that for the control group (23.3%), suggesting that LSBs have significantly improved access to quality seed in their communities.

Despite the contribution of LSBs, access to quality seed is still constrained by various factors including limited availability of QDS, low income of smallholder farmers and lack of awareness by smallholder farmers, especially on the difference between QDS and other seeds and where to find the seed. The LSBs are limited to very few sub counties (only one LSB per sub county), making it difficult for the farmers in other sub counties to access QDS. On average farmers cover a distance of 4.4 km (for beneficiaries) and 9.3km (control group) to access QDS, yet they are comfortable with a distance of at most 3km.

On affordability, a majority (54.3%) of the smallholder farmers across the regions reported that QDS is expensive and most farmers cannot afford it. They instead opt for home saved seed or cheaper grain (used as seed) accessed in local markets. However, QDS prices are lower than prices for certified seed suggesting that LSBs have significantly contributed to increased affordability of quality seed. On average, the prices of QDS are relatively low at farm gate where prices are much closer to grain prices compared to the LSB stores. This could be an incentive for farmers to buy QDS if more farmers engage in seed production. However, whilst the price of QDS needs to be as low as possible for farmers to be encouraged to buy this, the price needs to be high enough for LSB members to be able to have a profit. Furthermore, there is need for more communication on the potential benefits of QDS, in terms of increased productivity and income, so that farmers can also see it as an incentive.

During this study, farmers as well as key informants concurred that QDS is of high quality. Based on the key attributes valued by farmers, QDS was rated by farmers and extension officers as the best seed on the market. The study compared farmers' yields before and after using QDS and found significant differences in all the crops. The highest percentage change in yield was in cassava (80.8%) followed by potato (75.8%), soybean

(73%), groundnuts (28.6%), sesame (18.8%), beans (11.8%) and rice (6%). This further suggests that QDS produced by LSBs has significantly contributed to increased availability of quality seed for use by farming communities and correspondingly increased yields. However, the yields are still low compared to expected yield, because there are other factors apart from seed quality that affect crop yields. It is also partly explained by the fact that some farmers do not frequently change their seed stock. However, QDS can be used for up to 3 seasons with the same quality if all other factors that affect yield are favourable.

The study further noted that the LSB approach supported by ISSD Plus project is very relevant as it is consistent with the current national seed policy, contributing to addressing the challenge of low production and productivity caused by limited use of quality seed. The number of LSBs in seed production has been increasing over time; from 104 in the 2017 to 179 in 2018; in 2018 six new LSBs were established by out scaling partners (OSP), and in 2019 other 24 LSBs were established by self-funded OSPs, an indication that the QDS business is growing.

A majority of our respondents believe that some of the LSBs will continue to produce QDS. The fact that the LSB objectives are well aligned with the national priorities by producing seed of national and farmer priority crops provides them a sustainable market. It has also attracted support from various institutions which can help them to sustainably produce for the market.

Based on the study findings, the following conclusions are drawn:

Seed availability: in the last three years the supply of QDS by LSBs has been steadily increasing and QDS is readily available in communities where the LSBs are located. However, QDS is still in small quantities and therefore not readily available to the majority smallholder farmers.

The supply-demand gap is partly widened by the fact that a substantial amount of the QDS of up to about 20% is not reserved and sold as seed but as grain for home consumption. Access to foundation seed is also limited as well as land and capital, which also hinder availability to QDS.

Seed Accessibility: Although home saved seed and local markets are still the main sources of seed planted by the smallholders, LSBs have significantly improved access to quality seed in their neighbourhoods, evidenced by the significantly higher

proportion of beneficiary farmers using seed from LSBs compared to the control group. Access to QDS is, however, constrained by among others limited availability of the seed (distant sources), low income for smallholder farmers which hinders affordability, farmers' lack of awareness about access points, lack of awareness that use of QDS can result into higher yields and incomes, and farmers' belief that their home saved seed is of good quality.

Affordability of QDS: The prices of QDS are lower than prices for certified seed indicating that LSBs have significantly contributed to increased affordability of quality seed. Nonetheless, farmers have a perception that QDS is expensive and unaffordable by the majority smallholder farmers due to lack of knowledge that it gives higher returns in terms of yields and income. Moreover, prices of QDS are relatively low and closer to grain prices at farm gate level.

Seed Quality: The LSB approach is contributing significantly to the seed sector in terms of producing quality seed which farmers rate as the best on the market. The yields farmers get from using the QDS are significantly higher than what they used to get before.

Overall, production and supply levels of QDS are still too low to fulfil the demand attributed partly to the high cost of production, constrained access to (quality) foundation seed, and shortage of land. The number of LSBs is still small and localised in few places limiting seed accessibility, and the prices of QDS are relatively high compared to the locally accessed seed and in relation to farmers' purchasing power (income), limiting affordability.

As such, the following recommendations are suggested in order to increase availability, accessibility and affordability of quality seed among the farming communities:

i. LSBs could partner with trusted local Savings and Credit Cooperatives (SACCOs) and be linked to microfinance support centres so as to access affordable credit to increase their capital investment in QDS production.

ii. The structure and legality of LSBs should be streamlined to allow them to operate as independent entities to manage and execute contracts with other organizations that may increase their leverage for sustainability.

iii. Access to foundation seed (FS) is still a big problem, we recommend decentralized multiplication of FS by identifying and training more LSB farmers to multiply FS.

iv. In addition, there is need for LSBs and Agricultural Research Institutes that can provide foundation seed on time and in desired quantities, to strengthen their linkages and partnerships.

v. Government projects and NGOs that provide seed to farmers could directly contract farmer groups (LSBs) to supply seed instead of contracting businessmen or purchasing from seed companies who actually buy from LSBs at a relatively cheaper price. This would encourage farmers to produce more QDS.

vi. There is need to engage local governments (specifically District Production Departments) to incorporate seed production activities in their budget. This is important for scaling out and sustainability but also for reducing cost of production specifically inspection fee which LSBs feel should be paid by government.

i. Further sensitization with emphasis on demonstration gardens that exhibit the difference between QDS of improved varieties and home saved/market seed can increase awareness and consequently adoption of QDS.

ii. Formation of partnerships at local economy between local governments, NGOs and private sector players to sensitize farmers about the importance of using quality seed.

iii. Reliable markets for grain will encourage farmers to invest in quality seed. There is need to develop the grain value chain by engaging key stakeholders and actors including NGOs, local agro-processing industries and schools that purchase grain with strict quality standards thus creating backward linkage (demand) for quality seed.

iv. Whereas QDS is generally known to be of high quality, some farmers have been discouraged from buying QDS because of the bad experience they have from poor quality certified seed which they sometimes receive from government (e.g. OWC). Clearly specified and well developed seed value chains with registered actors at

each node will greatly contribute to quality of seed on the market and encourage farmers to adopt QDS.

v. Continuous farmer training and sensitisation on how to identify genuine quality seeds should be carried out. At the same time, national level campaigns against fake seed and how they should be eliminated from the seed value chain should be mounted by the Ministry of Agriculture, Animal Industry and Fisheries in partnership with the key stakeholders promoting the seed value chain in the country.

vi. Since LSBs are still very few, continuous seed fairs should be maintained to create more awareness about improved quality seed.

vii. More farmer groups at local government in all regions should be formed, trained and enrolled into LSBs that are certified for QDS production to increase access to quality seed by majority of farmers.

viii. Subsidising QDS production (reduced cost of FS, fertilizer and pesticides, inspection fee) may significantly reduce the costs and ultimately the price of QDS hence enable more farmers to afford.

ix. Provision of low cost agricultural credit with a grace period for farmers may encourage farmers to invest in QDS.

x. Awareness should be created among the farmers about the extra benefits QDS has over the low quality seed. This will clear farmers' perceptions that QDS is expensive and unaffordable which is based on limited knowledge about yield and income benefits of using QDS.

xi. Finally, in order to ensure sustainability and a greater impact on availability, accessibility and affordability of QDS, all the stakeholders in the seed value chain should be coordinated; ISSD and MAAIF could take lead in initiating the necessary coordination.

1.0 INTRODUCTION

1.1 Background

Seed is a foundation in crop production and therefore a significant component in transforming smallholder agriculture for the development of agricultural economies. Central to this transformation is the Integrated Seed Sector Development (ISSD) program in Africa that has over the years played a key role in improving availability of and access to high-quality seed for the rural farm households. One component of ISSD is the ISSD Plus four-year project in Uganda, implemented by Wageningen UR Uganda (WUU) in collaboration with National Agricultural Research Organization (NARO) for public varieties and food crops, and the private sector for vegetable seed. The project is coordinated by Wageningen Centre for Development Innovation (WCDI), Wageningen University & Research and funded by the Embassy of the Kingdom of the Netherlands, Kampala.

The ISSD Plus project aims to strengthen the development of a vibrant, pluralistic and market-oriented seed sector that is able to address key challenges that hamper the seed sector development in Uganda. The project that runs from October 2016 to December 2020 has four components: 1) promotion of uptake of quality seed, 2) enhancing the Quality Declared Seed (QDS) system through supporting Local Seed Businesses; 3) addressing bottlenecks in early generation seed (EGS) and creating an enabling environment for the seed sector; and 4) promoting the use of advanced vegetable varieties. The LSB approach was initiated and supported by the ISSD Plus project to produce QDS of priority crops in different regions.

In Uganda, there are two co-existing seed systems through which seed and planting materials are availed to farmers, namely the formal and informal systems. The formal seed system mainly constitutes research institutions including National Agricultural Research organisation (NARO) which is mainly involved in breeding and producing foundation seed and a few registered seed companies. The formal system is regulated by government and contributes about 10-15% (18,000 MT) of the estimated food crop seed requirement of which 70% is maize seed, 12.1% is bean seed and the rest take the remaining 17.9% (MAAIF, 2018; Mabaya et al., 2019). The remaining 85-90% of all crops seed is supplied by the informal system that is unregulated but rather guided by indigenous knowledge and standards. For most crops, a majority of farmers in Uganda mainly rely on farm-saved seed from previous harvest, local markets and farmers' social networks within the community. This has been mainly attributed to various factors including; limited exposure to quality seed demos, limited availability of superior improved varieties, limited access

to high quality seed, high cost of quality seed, and lack of trust of improved seed (Mabaya et al., 2019). Limited access to high-quality seed has greatly contributed to low agricultural productivity, low income, and consequently food and nutrition insecurity in Uganda. To realise a transition from subsistence to market-oriented production, a competitive and sustainable seed sector is key to ensuring timely access to and availability of safe affordable high-quality seeds of appropriate varieties for small holder farmers in Uganda (MAAIF, 2018).

To bridge the gap between formal and informal seed supply systems, the ISSD Plus project introduced Quality Declared Seed (QDS) of mainly non-hybrid crops to be produced at community level by trained farmer groups. QDS requires minimum field inspection and certification standards for variety purity and germination as stipulated in QDS regulations. This meets the needs of smallholder farmers and is a basis for future certified seed market development. Together with MAAIF and NARO, the ISSD Plus Uganda project is empowering skilled and market-oriented farmer groups through a Local Seed Business (LSB) approach to produce and market QDS. Since 2012, the ISSD project (first project from 2012-2016, then ISSD Plus from 2016 – 2020) has supported over 264 LSBs in 59 districts across Uganda. Up to 260,000 households are expected to benefit from the project through increased productivity and income.

The ISSD Plus Theory of Change assumes that there are barriers to quality seed availability, to access to quality seed and to affordability of quality seed to most smallholder farmers. Through LSBs, the ISSD Plus project encouraged farmers to grow QDS which they can sell to other farmers within their zone. The key areas of intervention include; developing local seed businesses, improving availability of early generation seed as an essential input for QDS and promoting quality seed use (Mastenbroek et al., 2016). Consequently, it is expected that local seed business farmers will produce more quality seed for the market and hence increase quality seed availability for farmers. Since the quality declared seed is produced locally by farmers a majority of farmers would be able to access this seed at an affordable price. As a result, there will be increased productivity at household level leading to increased income and food security.

The ISSD LSB approach has exhibited great potential for increasing availability as well as access to quality seed through forming and strengthening specialized seed multiplier groups and/or associations which are trained to create a sustainable business opportunity as QDS producers (Bishaw & Niane, 2013). The LSBs have been recommended as one option that can increase seed availability and access at the community level (Okry et al.,

2011; Bishaw & van Gastel, 2008, David, 2004). The LSBs have worked well in different countries such as Afghanistan, where village-based seed enterprises are reported to operate successfully under the Afghanistan National Seed Organization. The success is attributed to a number of factors including regular seed demand from farmers within the community, reasonable seed price, consistent high quality, farmer ownership, entrepreneurship and crop diversification (Bishaw & Niane, 2013). In Kenya and Tanzania, large cereal farmers also practice crop diversification by engaging in potato QDS production as an additional business and a rotational crop thus addressing the challenge of limited land commonly cited by seed producers (Demo et al., 2015).

The LSBs have also improved availability and access to improved quality seed in the Democratic Republic of Congo. Njingulula et al., (2014) reported an increase of 32% in access to improved bean varieties seed benefiting about 56.3 % of the farmers between 2009 and 2012. Seed quality in terms of purity equally improved by about 25% over the same period. The authors attribute the results to innovation platforms by the value chain actors. Other positive results have been reported in Nepal where smallholder households engaged in contract farming of high yielding varieties; paddy seed registered high yielding gains and significantly high profits (Mishra et al., 2016).

1.2 Objectives of the study

The main purpose of the study is to conduct an end-line evaluation to assess the contribution of LSBs to the seed sector. The study focuses on assessing accessibility, availability, affordability and quality of seed of seven priority crops; beans, groundnuts, potato, rice, soybean, sesame and cassava in six regions of Uganda over the last four years (2016-2020). The regions are Kigezi, Ankole, Rwenzori, Eastern, West Nile and Northern region. In addition, the study provides useful and reliable evidence of the relevance, effectiveness, impact and sustainability of LSBs in the project area, and recommendations to various stakeholders. The findings will be used to inform the end-term evaluation of the project and the lessons learned together with recommendations will guide the transformation of the seed sector in Uganda.

2.0 EVALUATION APPROACH AND METHODODLOGY

2.1 Study design

The study used a mixed methods approach to assess the impact of LSBs on accessibility, availability, affordability and quality of seven quality declared seed crops in the project districts. The different approaches include; literature and document review, focus group discussions, key informant interviews, case studies, household surveys with a quasi-experimental design, and a local market survey. The household survey with a quasi-experimental design mimics an experimental design but does not meet all requirements of randomization in an experiment that controls for all exogenous variables. Since there was no randomization in placement of the LSBs, a quasi-experimental design allows us to use the control group as a counterfactual to estimate the impact of the LSBs on farmers. In this study, the beneficiaries also known as the "treatment group" refers to individual farmers in sub counties where LSBs were established and supported by the ISSD Plus project. The comparison group, also known as the "control group", refers to farmers from other sub counties which did not directly participate in the ISSD Plus project and where there were no LSBs established in those sub counties. Different surveys were conducted to collect relevant data from various sources. These include a household survey where farmers were interviewed both individually and in focus groups, and a local market survey which involved LSBs and agro-input dealers in the study area. The details are presented in the following section, but first, we highlight the foremost important task before the surveys.

2.2 Literature and document review

The research team conducted a review of relevant literature and documents to gain a more informed understanding of ISSD 2 Plus project and specifically the LSB model, the project design, its objectives, expected outcomes and impact. The review was useful in identifying the key variables for which data were collected and methods of collection as well as in guiding data analysis. The main documents reviewed include project reports, the national seed policy, and other relevant research articles (published and unpublished sources).

2.3 The study area

The study was conducted in twelve districts in six regions of Uganda. They are Kisoro and Rubanda in Kigezi region, Isingiro and Mbarara in Ankole region, Kamwengye and Kyenjojo in Rwenzori region all in western Uganda. In Eastern Uganda we considered Buyende and Butaleja districts, in West Nile, Nebi and Arua districts were considered and Dokolo and Lira districts were considered in Northern region. These are some of the areas where the ISSD Plus project has empowered farmer groups through the Local Seed Business (LSB) model to produce and market QDS of priority crops and specifically open pollinated variety crops

(OPV). While most farmers in these regions grow various crops, in each of the regions the selected crops are key for both food and income generation. The priority crops promoted for LSBs include; potato in Kigezi and Eastern regions, beans in Ankole, Rwenzori and Eastern regions, rice and groundnuts in the Eastern and Northern regions, sesame and cassava in West Nile and soybean in Northern Uganda. A majority of the population in these districts depend of agriculture for their livelihoods and most of the households are small holders.

2.4 Sampling

A mixture of purposive, stratified and random sampling methods was used to select representative areas and respondents. Purposive sampling was used to select two major crop producing districts and the respective sub counties in each region where the LSBs were supported. In each of the districts one other sub county among those that did not benefit from the project was purposively selected from which a control group was selected. The selection of districts and sub-counties in each region was guided by production levels of priority crops. Stratified sampling was done to ensure that actors in the priority crop value chains are captured; (i) respondents for the different (seven) crops supported (LSBs farmers and target beneficiaries), (ii) farmers from sub counties without LSBs (control), and (iii) other seed actors (formal and informal). The control group was selected from farmer groups in sub counties which are as similar as possible to those of the beneficiaries in terms of agro-ecological and social economic characteristics. Finally, for each stratum, random sampling was done to ensure representation. These sampling methods were used for both household survey and focus group discussions. Purposive sampling was used to select key informants and case studies. In all the categories the different gender groups were considered. Table 2.1 shows the distribution of the samples in the six regions.

Table 2. 1: Sample distribution by region

Region	Districts	Number of households		FGDs (2 per district)		KIIs (6x 2 districts)	LSBs	Case studies
		Beneficiaries	Control	Beneficiaries	Control			
Kigezi	2	140	160	2	2	12	3	1
Ankole	2	140	160	2	2	12	3	1
Rwenzori	2	140	160	2	2	12	3	1
West Nile	2	140	160	2	2	12	3	1
Eastern	2	140	160	2	2	12	3	1
Northern	2	140	160	2	2	12	3	1
TOTAL	**12**	**840**	**960**	**12**	**12**	**72** (excluding ISSD staff)	**18**	**6**
		1,800		**24**				

2.5 Data collection

In this evaluation we collected and used both primary and secondary data. We conducted face-to-face interviews with selected farmers in sub counties with LSBs (beneficiaries) and farmers in sub counties without LSBs (control group) using digitized (ODK) questionnaires (see Annex 2). The baseline questionnaire was adapted to suit the design and objectives of this study. We ensured data triangulation to avoid biases by augmenting individual households' data with qualitative data from Key Informant Interviews (KIIs) and Focus Group Discussions.

2.6 Type of data collected

The type of data collected from households include socio-economic and household characteristics, distance to source of seed, seed prices, seed demand, seed availability and distribution, frequency of seed renewal, proportion expenditure on seed, production and marketing, concentration of agro-input dealers, access to other inputs, extension services and credit, knowledge and awareness, information and perceptions on QDS.

Data collected from LSB participants and seed agro-input dealers include quantity of seed produced by different sources and volumes sold, distribution and marketing, market share, varieties produced, access to foundation seed, packaging, adequacy of seed inspectors, availability of extension services, production and distribution costs, seed prices, seed revenues, seed demand, linkages with other actors in the seed value chain, information flow, storage, seed quality, constraints and challenges.

2.7 Data processing and analysis

Data were cleaned before processing for analysis, MS Excel, SPSS (version 25), and STATA 13 computer software were used for analysis. Different analytical approaches were used depending on the study parameters of seed availability, seed access, affordability, and seed quality as indicated in the subsequent sections. Descriptive statistics such as percentages, means, chi-square and t-tests were used to assess changes in outcome indicators at farmer level as a result of the project. Regression analysis was done to help us in assessing the driving factors of seed access, availability and affordability and specifically how the LSBs model is correlated with the key indicators of seed access, availability and affordability. Further, descriptive analysis was applied to assess the quality of seed produced by LSBs as well as by other players based on farmers' perceptions, attitude and knowledge of seed quality attributes. The known standard seed quality attributes were used as a benchmark. An in-depth analysis of one LSB in each region was conducted to provide evidence of a success story that can be replicated in scaling out and wide. Qualitative data from FGD and KII were

analysed using content and narrative analysis. From each region we identified common responses and patterns in answering the specific research questions.

Moreover, we used propensity score matching to assess the impact of the LSBs and the attribution to ISSD intervention. This involves a comparison of outcome variables between the project beneficiaries and the control group. We compared the change in specific indicators between project participants/beneficiaries and the non-beneficiaries (control group). The propensity score matching (PSM) approach estimates the average treatment effect (ATT) on the treated (beneficiaries) by comparing the outcome variable of similar households among the control group based on exogenous variables.

2. 8 Empirical strategy

The analysis focused on accessibility, availability, affordability and quality of seven quality declared seed (QDS) crops. The empirical strategy is explained below.

2.8.1 Assessing QDS availability

Seed availability refers to seed supply or the physical quantity of seed available to farmers from different sources both formal and informal. Adequate seed availability exists when there is sufficient seed of preferred varieties to meet the needs of farm households at the right time for planting (FAO, 2016).

We provided answers to the following questions: what are the sources of seed farmers plant? To what extent are the quantities supplied sufficient? What role do LSBs play and what is their market share? What factors influence the supply of QDS by LSBs in adequate amounts as required by the farmers? How satisfied are the farmers in regard to QDS supply (in terms of quantity, quality, timeliness, and aftersales services)? Since we did not collect data from QDS suppliers (individual producers), we were not able to estimate the QDS supply function, instead we used descriptive analysis to assess the factors affecting seed supply.

2.8.2 Assessing QDS accessibility

Seed access is the ability and willingness to acquire enough seed through purchases (cash or loan), barter or through social networks. We defined QDS access as effective demand for the seed, given the prevailing intrinsic and extrinsic factors such as farmer characteristics, socio-economic and ecological factors (Kansiime & Mastenbroek, 2016). Its assessment therefore was done within the framework of demand theory. The study assessed the various indicators such as; sources where farmers commonly get QDS, the adoption levels of promoted varieties, farmer awareness of QDS access points, access to

the nearest source of QDS, number of LSBs in the area and number of farmers accessing seed from LSBs. Moreover, a seed accessibility index was constructed using a set of questions/statements in relation to the access indicators. The access to seed index in this study is a relative ranking, comparing households with each other. We generated the index using scores on seven key indicators including; distance to the LSB(<1 =1; >1=0), awareness of QDS access points (yes =1; no =0), satisfaction of the seed access points (yes =1, no =0), level of availability and accessibility, whether the household has ever used QDS (yes=1; no =0) and number of LSBs known by the respondent (one or more = 1; none = 0).

2.8.3 Assessing QDS affordability

We defined QDS affordability as farmers' ability to access and use QDS in required quantities, quality and time; where ability is also defined as farmers' purchasing power (amount of seed they can buy given their budget allocated to farm inputs). We assessed affordability of QDS based on a criteria system of indicators including QDS price in relation to grain price. Furthermore, we assessed farmers' willingness to pay for QDS. This provides insight on affordability as it measures the consumer demand for the QDS. Willingness to pay is the price that an individual farmer is willing to spend to obtain a given unit of the QDS (Lusk & Hudson 2004). In addition, we estimated "affordability gap" defined as the difference between the selling price of QDS (actual) and what farmers could afford to pay (desired).

2.8.4 Assessing QDS quality

Quality of seed is very important as it affects the productivity of the crop. A good crop comes from high quality seed. A good quality seed is one that is capable of germination under various conditions. It is measured against its cultivar purity, analytical purity (free from weeds, other seeds and inert matter), germination, vigour, free from seed borne pathogens and moisture content.

Seed quality assessment can be done using different traditional methods e.g. in the laboratory or in the field, or is done by using advanced technologies including rapid and non-destructive seed quality detection techniques such as machine vision, spectroscopy (Rahman et al., 2016), dynamic speckle technology (Braga et al., 2003). While these methods objectively measure seed quality characteristics, in practice seed quality acceptability depends on the perception of the farmer. In this evaluation we assessed QDS quality using qualitative methods based on farmers' perceptions, attitude and knowledge of seed quality attributes, and their level of satisfaction with the quality in terms of seed purity and germination rate in comparison to attributes of similar seed from other sources.

2.9 Ethical considerations

The research team ensured strict adherence to human subject research ethics. The research team first sought clearance from the respective Resident District Commissioners. This was in accordance to SOPs for controlling Corona virus pandemic. Moreover, all other SOPs for COVID-19 were followed throughout the study. Participation in the study was voluntary and all the respondents were asked to give their informed consent at the beginning of the interviews. All participants were informed about the purpose of the survey and were assured that confidentiality with regard to their responses would be strictly observed.

3.0 EVALUATION FINDINGS AND DISCUSSION

The findings presented in this section focus on changes since the baseline in terms of what has changed, what can be linked to the ISSD LSB intervention, how the intervention has affected the key outcomes for which subgroup, and the driving factors to registered changes. Further, we considered case studies that depict individual or group pathways that can shed light about how the project has influenced changes in the seed sector in the rural communities in terms of availability, accessibility and affordability of quality seed by the farming community. But first, we give a description of the demographic, and socio-economic characteristics of the farm households from whom information was collected.

3.1 Demographic and socio-economic characteristics of sampled households

Table 3.1 presents descriptive statistics for some of household and farmer characteristics that may influence farmers' access to and adoption of quality seed. Most of the farmers are of middle age with an average age of 42 years implying that they are still very active farmers with experience of about 16year. A majority (82%) of sampled households are male headed and 83.8% of the respondents are married. Both the household head and their spouses have primary level education with an average of six to seven years of education.

Table 3. 1: Demographic and socio-economic characteristics of sampled households

Characteristic		Pooled sample (n = 1806)	Project beneficiaries (n = 839)	Control group (n = 967)
Age of the respondent/farmer (years)		42.3 (14.0	43.0 (13.8)	41.7(14.1)
Sex of household head:	Male	82.2	79.0	85.0
	Female	17.7	20.9	14. 9
Sex of respondent farmer:	Male	48.2	45.1	51.1
	Female	51.7	54.9	48.9
Married=1; otherwise = 0		83.8	82.9	84.7
Level of education of household head (years of schooling)		6.6 (4.0)	6.5 (4.2)	6.6(3.9)
Level of education of spouse (years)		5.0 (3.7)	5.1(3.8)	4.9(3.6
Main occupation; agriculture =1; otherwise =0		96.4	95.8	97.0
Secondary occupation: Non-farm business =1; otherwise =0		29.0	29.6	28.6
Household size		6.6 (3.2)	6.7(3.3)	6.6(3.1)
Land size owned (acres)		3.6 (4.1)	3.4(3.4)	3.9(4.7)
Land used for production (acres)		3.3(3.0)	3.3(2.7)	3.3 (3.2)

Characteristic	Pooled sample (n = 1806)	Project beneficiaries (n = 839)	Control group (n = 967)
Main source of labour for production; hired labour = 1; otherwise =0	39.9	43.5	36.9
Experience in farming (years)	16.9 (12.9)	16.8 (12.9)	17.1(12.9)
Access to extension services =1; otherwise =0	43.6	53.6	34.9
Access to credit =1; otherwise =0	64.6	71.5	58.5
Member of farmers group =1; otherwise =0	30.0	40.0	21.1

Note: Standard deviation in parenthesis

Table 3.2 and Figures 3.1 and 3.2 show who in the household is responsible for buying seed, using seed, allocating land to given crops and marketing the crop. There are variations across the crops with regard to gender responsibilities in accessing and using quality seed. Apart from beans and groundnut, the men are responsible for buying seed with higher percentages for rice, potato and cassava which are more of cash crops. The women seem to have relatively more responsibilities in beans and groundnuts, where, contrary to the other crops, women are more involved than men in land allocation, buying using and marketing seed. Nevertheless, both men and women should be actively engaged by stakeholders that promote the use of quality seed.

Table 3. 2: Responsible gender (%) for acquiring and using seed

Crop	Gender responsible for land allocation			Who is responsible for buying seed			Gender responsible for using seed			Gender responsible for marketing		
	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both
All crops	37.0	25.0	37.9	39.1	30.6	30.2	23.7	34.7	41.4	30.5	27.5	41.8
Beans	35.0	34.5	30.3	38.9	46.2	14.8	17.7	56.3	25.8	33.2	36.8	29.9
Potato	37.1	20.5	42.4	45.3	19.5	35.1	21.8	25.2	52.9	38.7	17.5	43.7
Rice	61.9	12.2	25.8	58.1	12.2	29.6	51.6	14.2	34.2	61.9	11.6	26.5
Soybean	32.2	12.8	54.9	37.4	15.2	47.3	30.9	16.3	52.6	32.2	13.5	54.4
Sesame	36.1	17.6	46.4	31.7	27.5	40.7	25.7	22.7	51.5	19.7	23.6	56.7
Ground nut	15.2	43.5	41.3	16.3	41.8	41.8	8.7	47.8	43.5	14.1	40.7	45.1
Cassava	45.2	16.8	37.8	45.6	21.7	32.6	29.1	20.3	50.5	17.8	28.4	53.6

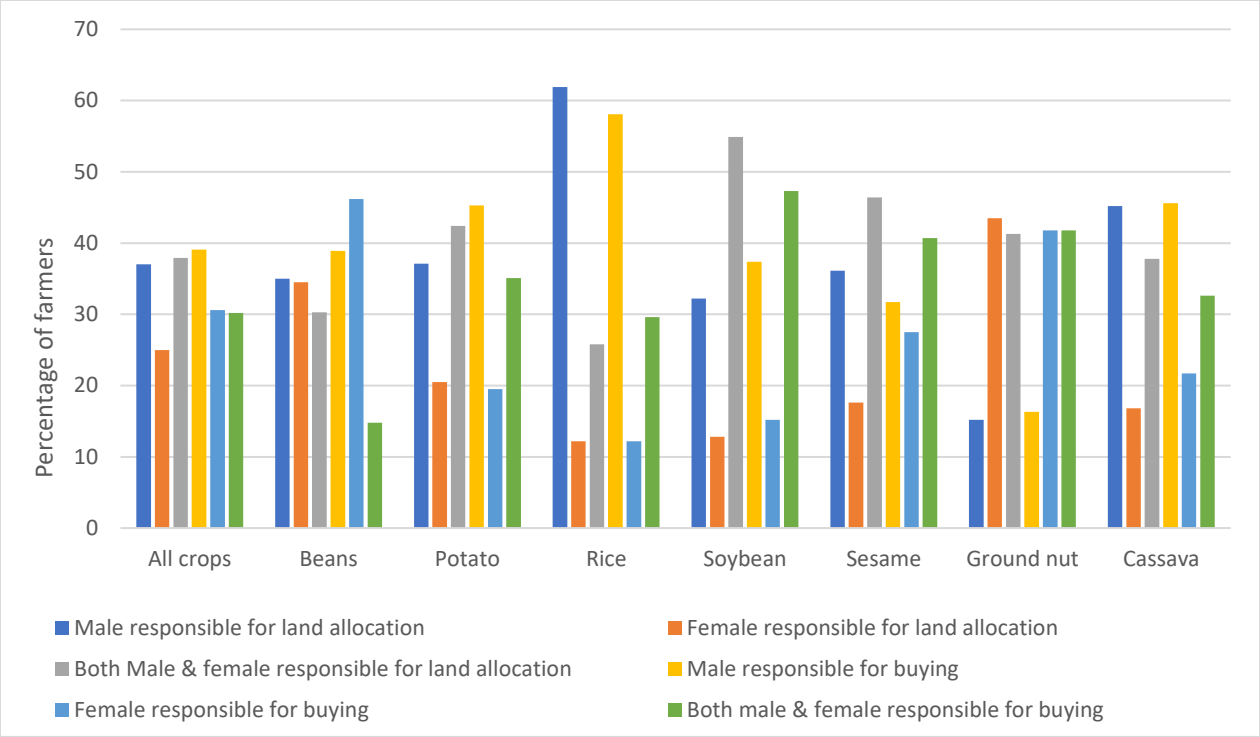


Figure 3. 1: Gender responsible for land allocation and buying seed

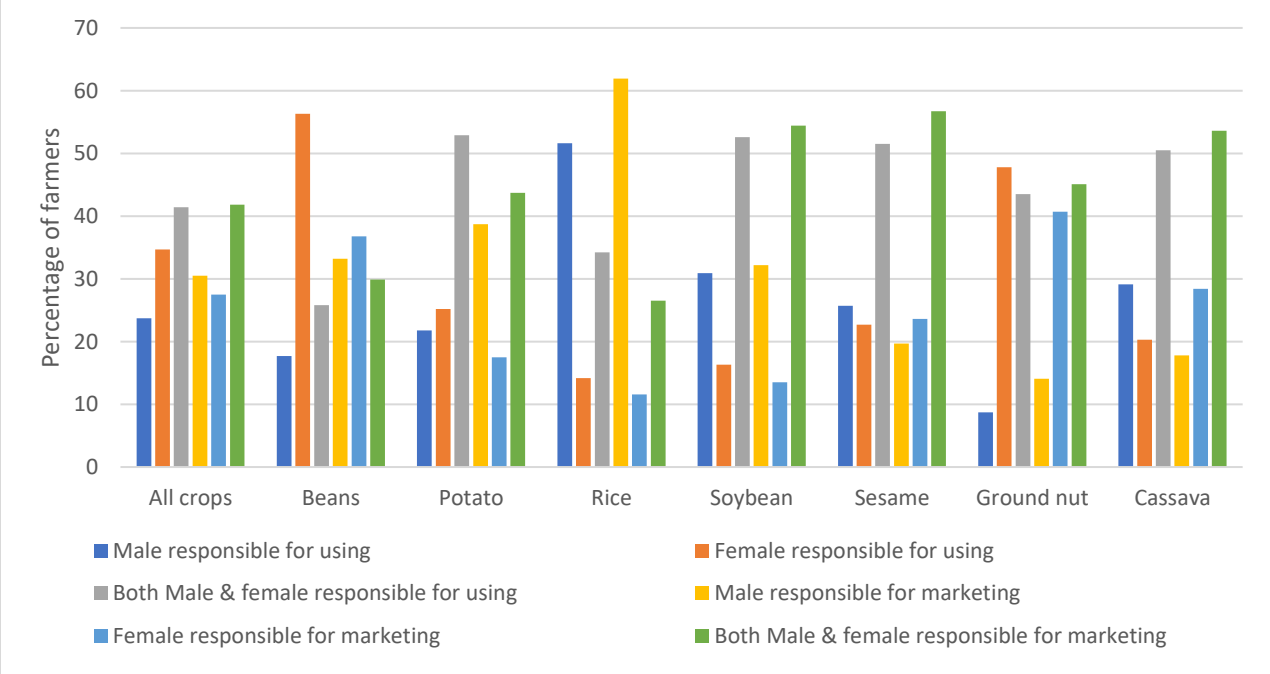
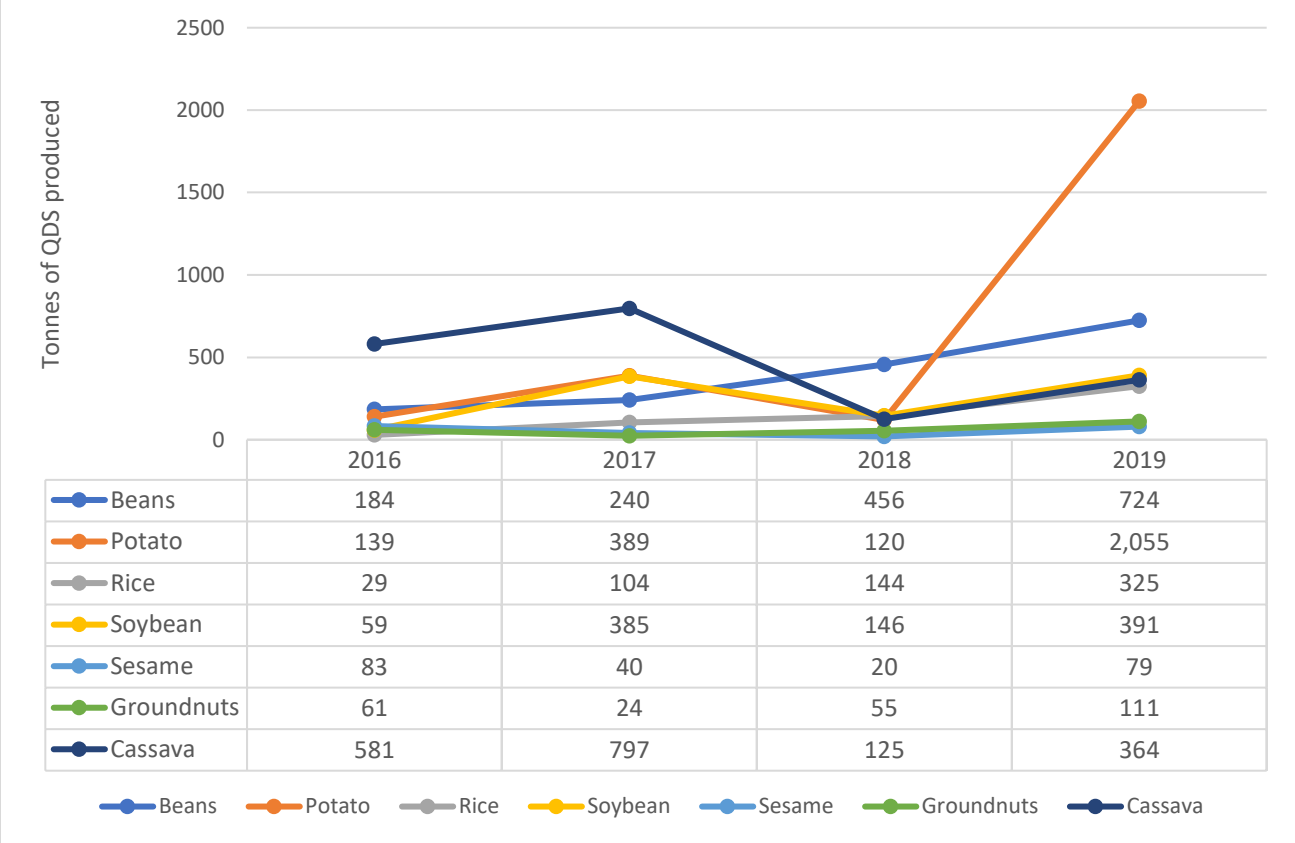


Figure 3. 2: Gender responsible for using seed and marketing produce

3.2 QDS availability

3.2.1 Production of QDS and market share

Timely availability of QDS is critical to improving access and use of quality seed for smallholder farmers. Our findings indicate that in the last three years the supply of QDS by LSBs has generally been increasing (Figure 3.3). The decline observed in 2018 is attributed to the prolonged dry season that affected planting.



	2016	2017	2018	2019
Beans	184	240	456	724
Potato	139	389	120	2,055
Rice	29	104	144	325
Soybean	59	385	146	391
Sesame	83	40	20	79
Groundnuts	61	24	55	111
Cassava	581	797	125	364

Figure 3. 3: Amount of QDS produced and marketed by LSBs, 2016-2019

Results in Table 3.3b show the quantity of seed planted by the sampled farmers in 2019, and the market share of the QDS for the respective crops.

Beans; in the last four years QDS for beans increased from 184 tonnes in 2016 to 724 tonnes in 2019, an increase of 293%. While there is a positive growth annually, the market share of LSBs is small. Based on our household survey, the market share for QDS was 6.4% and 6.8% for seasons A and B 2019, respectively.

Potato; potato increased from 139 tonnes in 2016 to 389 tonnes in 2017 but dropped to 120 tonnes in 2018. It picked up again to 2,055 tonnes in 2019 registering the highest increase of 1,373% in the four years. The LSBs had a higher market share of 10.5% for season 2019A compared to season 2019 B with 6.4%. The LSBs mainly produce and supply *Rwangume*, a variety farmers prefer to plant in season A; partly explaining why the LSB market share was higher in that season.

Table 3. 3: Market share of QDS

Crop	Season A 2019			Season B 2019		
	Quantity planted (kg)	QDS (kg)	Market share (%)	Quantity planted (kg)	QDS (kg)	Market share (%)
All crops*	156,377	15,744	10.0	115,434	7,424	6.4
Beans	19,718	1,279	6.4	13,975	597	6.8
Potato	120,066	12,660	10.5	91,981	5,890	6.4
Rice	5,974	560	9.3	5,197	495	9.5
Soybean	5,210	587	11.2	888	86	9.7
Sesame	683	57	8.4	1,968	157	7.9
Groundnuts	4,726	601	12.7	1,425	199	13.9
Cassava (bags)	2,569	408	15.8	385	19	4.9

*Note; All crops exclude cassava which is not measured in kg.
Source: Household survey data

Rice; rice QDS equally registered a high increase of about 1020% from 29 tonnes in 2016 to 325 tonnes in 2019. The LSB market share in 2019 was almost the same for the two seasons at 9.3% and 9.5% for seasons 2019 A and B, respectively.

Soybean; production of soybean QDS significantly increased from 29 tonnes in 2016 to 385 tonnes in 2017 but dropped to 146 tons in 2018 picking up again in 2019. In the last four years production has increased by 562% from 59 tonnes in 2016 to 391 tonnes in 2019. The market share for LSBs was 11.2% and 9.7% for seasons 2019 A and B respectively.

Sesame; unlike other crops, sesame QDS production decreased from 83 tonnes in 2016 to 20 tonnes in 2018 picking up to 79 tonnes in 2019, a general reduction of 4.8% between 2016 and 2019. This is partly attributed to lack of foundation seed (Oyee et al., 2020). Like all the other crops the LSB market share is small, respectively, taking only 8.4% and 7.9% of seasons A and B of 2019.

Groundnuts; production of QDS dropped from 61 tonnes in 2016 to 24 tonnes in 2017 after which the trend reversed for the last three years with an increase of 81.9%. The market share for LSBs is similarly small providing only 11.2% and 13.9% for all seeds planted in

seasons 2019 A and B, respectively. Although the market share for season B is higher than that for season A, the volumes planted in season A are higher compared to season B because a majority of farmers plant groundnuts in season A.

Cassava; similar to sesame, production of QDS declined by 37.3%. It fluctuated in the last four year. While it increased from 581 tonnes in 2016 to 797 tonnes in 2017, it dropped in 2018 to 125 tonnes and rose again in 2019. This is explained by low market demand which discourages LSB farmers from expanding seed production. As reported by Oyee et al. (2020), there was low demand for cassava planting material from local governments which were the main buyers. In addition, cassava has a long maturity period (about 1 year) compared to the other crops and the planting material is not consumed so it is easier for farmers to share and replant the planting material from the previous crop.

Apart from beans and rice which had a steady increase in production, there were annual fluctuations in other crops. The changes in volumes of QDS produced over time are explained by changes in the number of LSBs, acreage, yield as well as market demand. The number of LSBs increased from 109 in 2016 to 214 in 2019 (Oyee et al., 2020; Mastenbroek et al., 2017) implying increased participation in the seed business hence increased volumes. Regarding acreage and yield, our findings revealed that some of the farmers do not consistently produce seed every season due to limited resources or delayed onset of rains hence causing annual volume fluctuation. For example, the LSB producing soybean in Northern Uganda reported that they missed three seasons (2017A, 2018A and 2019A) because they were not able to prepare their gardens on time and could not raise the money for seed. Moreover, farmers reported that they sometimes experienced adverse weather conditions such as drought, which affected yields.

Overall, the market share of QDS is small at 10% for season 2019 A and 6.4% for season 2019 B. Home saved seed and grain from the market take the bigger share of the total seed planted. This is further discussed under the section on source of seed. The seasonal differences in the market share of QDS is because for most annual crops, there is a major and minor season mainly defined by weather conditions, and farmers tend to grow more of the crop in the major season. Thus, the share of QDS for a given crop is low in the minor season compared to the major season. For example, a NARO scientist from Ngeta ZARDI informed us that they always have challenges in supplying FS for season B due to delayed rains.

3.2.2 Farmers' perceptions on QDS availability

Despite increased production of QDS in the past few years, there is a general consensus that QDS is still in small quantities and therefore not readily available (Figure 3.4). Our respondents were asked to describe the availability of QDS using a Likert scale. Their responses are summarized in Table 3.4. Considering all the crops, 39.3% of the entire sample said QDS is readily available.

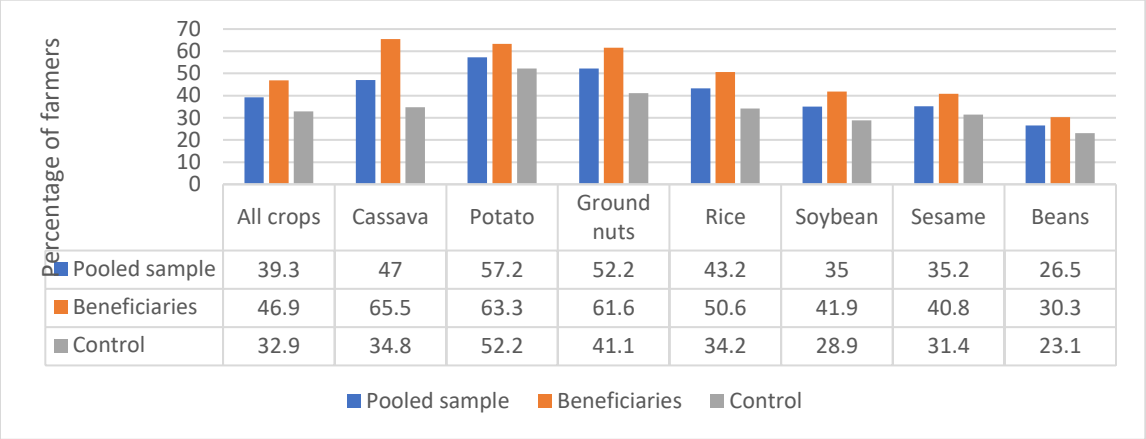


Figure 3. 4: Percentage of farmers reporting QDS is readily available

Table 3. 4: Farmers' responses on QDS availability

Crop	Availability of QDS	Percentage of farmers responding		
		Pooled sample	Beneficiaries	Control
All crops	Not readily available	25.2	17.6	31.7
	Fairly available	35.3	35.3	35.3
	Readily available	39.3	46.9	32.9
Beans	Not readily available	37.6	29.3	44.5
	Fairly available	35.2	40.4	32.1
	Readily available	26.5	30.3	23.1
Potato	Not readily available	13.9	9.4	17.8
	Fairly available	28.8	27.3	30.1
	Readily available	57.2	63.3	52.2
Rice	Not readily available	24.5	18.8	31.4
	Fairly available	32.1	30.5	34.3
	Readily available	43.2	50.6	34.2
Soybean	Not readily available	16.9	9.8	23.3
	Fairly available	47.9	48.2	47.7
	Readily available	35.0	41.9	28.9
Sesame	Not readily available	24.8	15.0	31.4
	Fairly available	39.9	44.1	37.1

Crop	Availability of QDS	Percentage of farmers responding		
		Pooled sample	Beneficiaries	Control
	Readily available	35.2	40.8	31.4
Ground nuts	Not readily available	24.4	13.1	37.6
	Fairly available	23.3	25.2	21.1
	Readily available	52.2	61.6	41.1
Cassava	Not readily available	14.0	7.0	18.6
	Fairly available	38.9	27.4	46.5
	Readily available	47.0	65.5	34.8

In terms of QDS being readily available, the percentage for the beneficiaries (46.9%) is much higher than that for the control group (32.9%), for all crops. Over 37% reported that bean QDS is not readily available; the percentage is higher for the control group compared to the beneficiaries but percentages are higher for beneficiaries compared to control group in terms of QDS being fairly or readily available. In contrast, potato QDS is more readily available as reported by 57.2% of the farmers, both beneficiaries (63.3%) and the control group (52.2%). Similarly, 43.2% of the farmers reported that rice QDS is readily available. The percentage for the beneficiaries (50.6%) is significantly higher than that for the control group (34.2%). For soybean and sesame, 47.9% and 39.9%, respectively, reported that QDS is fairly available, whilst for some 35% these are readily available. For both soybean and sesame, a higher percentage of the beneficiaries reported availability compared to the control group (Table 3.5). In the case of groundnut and cassava, over 60% of the beneficiaries reported that QDS is readily available. The percentages for the control group are significantly smaller.

Table 3.5 shows the percentage of farmers responding to availability levels of QDS. A majority (64.4%) reported availability of enough crop varieties. The percentage is much higher for soybean (83.0%) and potato (73.2%) while the rest are between 50 to 57%. In the case of potato, in addition to Kachwekano ZARDI, other private farmers have been trained to produce and multiply FS. This explains the higher percentage. There is very high demand for QDS especially groundnut and potato as reported by 80% and 75% of farmers, respectively.

Table 3. 5: Percentage of farmers responding to QDS availability levels

Indicator	All crops	Beans	Potato	Rice	Soybean	sesame	G/nuts	Cassava
Enough varieties available	64.4	53.3	73.2	53.5	83.0	54.3	57.6	49.8
Demand for QDS								
Very high	55.1	42.8	75.0	40.0	60.0	66.6	80.0	50.0
High	14.2	21.4	12.5	20.0	20.0	0	0	25.0
Medium	14.2	14.2	12.5	20.0	20.0	33.3	0	25.0
Low	6.1	7.1	0	20.0	0	0	20.0	0
Very Low	6.1	14.2	0	20.0	0	0	0	0
Adequacy of quantity produced								
Sufficient	36.7	14.2	25.0	20.0	40.0	50.0	40.0	50
Somewhat sufficient	10.2	7.1	12.5	20.0	40.0	16.6	20.0	0
Insufficient	36.7	64.3	50.0	20.0	20.0	16.6	40.0	50
Very insufficient	12.2	14.2	12.5	40.0	0	16.6	0	0
How farmers acquire QDS								
Book in advance	16.6	11.1	22.5	14.8	26.8	17.8	6.6	50.2
Buy from LSB store	9.4	4.5	14.9	15.6	15.7	13.6	18.3	8.5
Buy from members of LSB groups	35.2	52.6	41.9	2.8	23.1	13.6	15.8	13.7
Buy from agro-dealers	3.8	2.1	8.5	0.6	18.5	2.1	1.6	
others	44.4	27.8	12.1	63.1	15.7	2.1	56.6	24.8
Farmers who always receive quantities booked in advance	96.7	99.1	94.4	95.7	100	100	95.0	97.3
Seed available on time	85.5	89.4	88.3	92.9	96.3	96.8	97.8	88.9
When is QDS available								
A season earlier	35.5	43.0	22.8	41.9	24.0	22.8	51.1	27.2
At the start of the planting season	56.5	44.3	75.3	32.0	75.9	77.2	39.2	72.0
others	7.8	12.6	1.8	25.9	0	0	9.09	0
Farmers' preferred time to acquire the seed								

Indicator	All crops	Beans	Potato	Rice	Soybean	sesame	G/nuts	Cassava
Before/start of the planting season	38.3	40.0	34.4	30.0	25.0	0	25.0	29.4
Mid season	41.6	48.5	58.6	20.0	0	66.6	50.0	41.2
others	20.0	11.3	6.9	50.0	0	0	25.0	11,7
Farmers who order in advance	27.0	16.7	36.2	17.7	62.9	50.5	13.8	68.6
Extent to which orders are met								
Always	82.1	82.8	78.8	72.0	88.2	93.7	88.0	90.4
sometimes	17.3	17.1	21.1	24.0	11.7	6.2	12.0	9.5
never	0.5	0	0	4.0	0	0	0	0

Much as most of the farmers report availability of enough crop varieties, quite a big percentage reported inadequacy in quantity of QDS produced. This is more pronounced in rice where 40% of the farmers reported very insufficient production followed by sesame and beans with 16.6% and 14.2%, respectively, reporting very insufficiency levels. About 45% of the farmers buy seed from LSBs (35.2% from individual members of LSB groups and 9.4% from LSB stores). Farmers find it convenient to buy from a neighbouring seed farmer than going to the LSB store. This could mean that there is more QDS produced than what is recorded by the LSBs. Over 94% of farmers who book QDS in advance get the quantities they want and over 85% who use QDS reported getting the seed on time, that is, at the start of the planting season or a season earlier. A majority of farmers who plant cassava (68.6%), soybean (62.9%) and sesame (50.5%) order for seed in advance and over 88% always get their orders met.

Our findings point to the fact that QDS is relatively more available to farmers who are in areas where LSBs operate. This is expected since LSBs are still few and their production is still low. Our interaction with groups engaged in local seed businesses also revealed that while much more seed is produced especially for beans and potato, a substantial amount of the seed is not available for the farmers because it is sold as grain for consumption a few weeks after harvest to enable the producers raise money for their needs. For instance, it was reported by most groups that members retain at least 20% of their produce for consumption and/or sale not as seed but as grain since it is sold much earlier before the planting season. However, even what is bulked is sometimes sold to seed companies and/or traders and not farmers. This implies that QDS may be available on the national market or even regional market and yet not locally where it is produced. In the case of potato, it was reported that over 80% of the seed was sold (not as seed) to traders from Rwanda as they offered a good price. Moreover, some farmers said they are not able to

wait for 3-4 months for the potato to sprout and be sold as seed since they have other needs, hence they sell the seed as ware potato.

3.2.3 Factors affecting supply of quality seed by LSBs

The key factors affecting the supply of quality seed by LSBs include limited access to foundation seed (FS), quality of FS, limited land and limited capital.

Limited access to FS; The major source of foundation seed for all the crops seed grown by LSBs is NARO. However, all the groups cited limited access to foundation seed as a key constraint in seed production. Farmers claim that the cost of foundation seed including transport is high and most farmers cannot afford it. Sometimes the FS is received late and in insufficient quantities. As a result, a few farmers are involved in seed production, sometimes they miss a season and this negatively affects quantity and quality seed supply. Farmers' assertions corroborate with information from NARO scientists who admit that they have not been able to supply all the FS required by LSBs. They attribute the challenge to two major factors; limited funding for production of FS; and failure by the LSBs to pre-book at least a season before to enable NARO to plan for FS production. Surprisingly we found 2 tonnes of FS for beans at one of the ZARDIs yet, farmers are not informed. There seems to be a weak relationship between the LSBs and NARO, the main source of FS. Some of the research institutes do not reach out to the LSBs and the impression one gets from farmers is that NARO should subsidise FS.

This is not unique to Uganda, similar results were reported by Altaye & Mohammed (2013) in Ethiopia where seed producer cooperatives had weak linkages with the research organizations thus affecting access to FS and ultimately availability of QDS.

Poor quality FS: Farmers complained about poor quality FS which resulted in many off-types to about 11.6 – 25% for beans. This was mainly reported on beans in Ankole and Rwenzori regions and it significantly affected QDS availability. First, farmers made losses by roguing out the off-types and second, by sorting the seed after harvesting where farmers said they lost about 15 - 20% of the QDS. Moreover, LSB farmers reported that often times when the seed is rejected at the LSB store because of off-types, they sell the seed as grain, at a lower price, to avoid the sorting that was reportedly laborious and time wasting.

Limited land: local farmers are constrained by small land holdings with exhausted soils and majority do not meet the requirements such as virgin isolated land necessary for seed production. Most farmers engaged in seed production especially in western region rely on hired land which is not readily available. Farmers pay an average rent of UGX 250,000 per acre per season which they reported increases cost of production hence limiting acreage under seed production. It also limits the number of farmers engaged in seed production. This is consistent with ISSD records which show that only 14.5% of all the LSBs satisfy the 20 acres minimum criteria per season.

Lack of capital; LSB farmers are constrained by low financial capital and low management skills in the seed business. For instance, LSB farmers reported that they were not able to pre-book FS due to lack of funds. They also revealed that not all the QDS is bulked at the store; at least 20% is sold earlier as grain to take care of financial needs, and another portion is reserved for home consumption. When asked why they consume seed, farmers said they were not able to produce seed and grain for home consumption at the same time due to limited resources especially land and labour. Seed potato farmers intimated that some farmers cannot wait for 3 – 4 months to sell seed because they have other financial needs. This challenge has been persistent following reports by previous studies (e.g. Mayabala, 2016).

3.3 Seed accessibility

The QDS is an alternative way to improve access to valuable genetic resources for smallholder farmers who do not have access to certified seed for crop production. To understand the contribution of LSBs to access to quality seed, we assessed the various indicators of seed access, the different sources of seed and which improved varieties have been accessed and adopted from the LSBs as the suppliers.

3.3.1 Farmers' sources of seed

Our findings across the regions show that smallholder farmers access seed from various sources including LSBs, home saved seed, neighbours/friends/relatives, local markets, agro-dealers/seed companies, NGOs, and the government. Results (Figure 3. 5) show that the major sources of seed for a majority of farmers is home saved (42.7%) followed by the local market (25.3%).

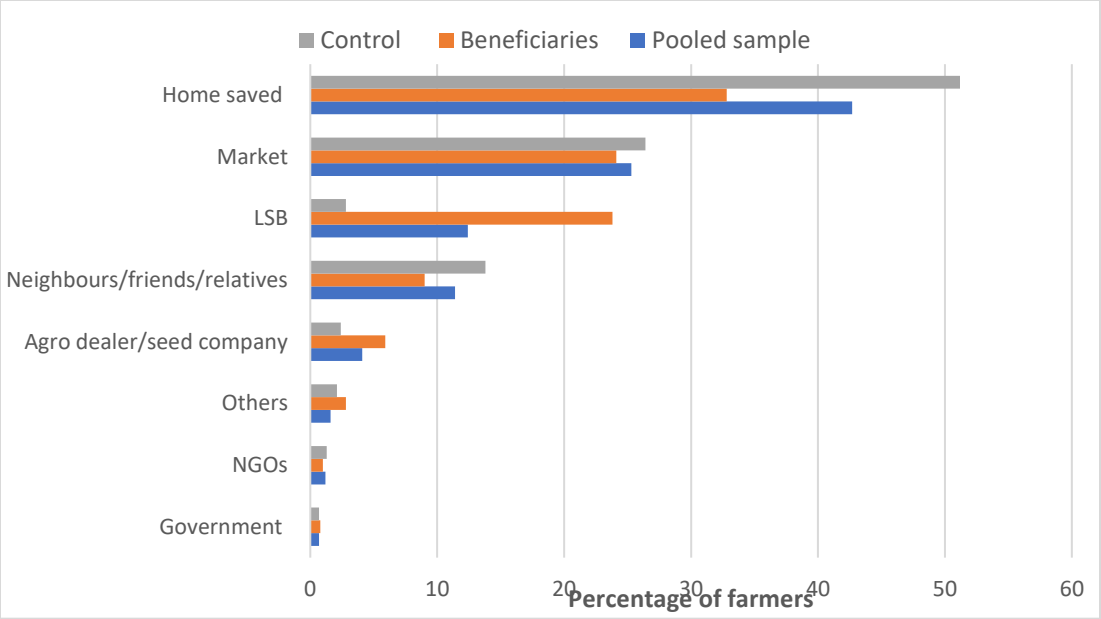


Figure 3. 5: Sources of seed reported by farmers

Figure 3.6 shows the percentage of farmers reporting that QDS is readily accessible, while Tables 3.6 - 3.13 show the proportion of farmers who access seed for each of the crops from the different sources.

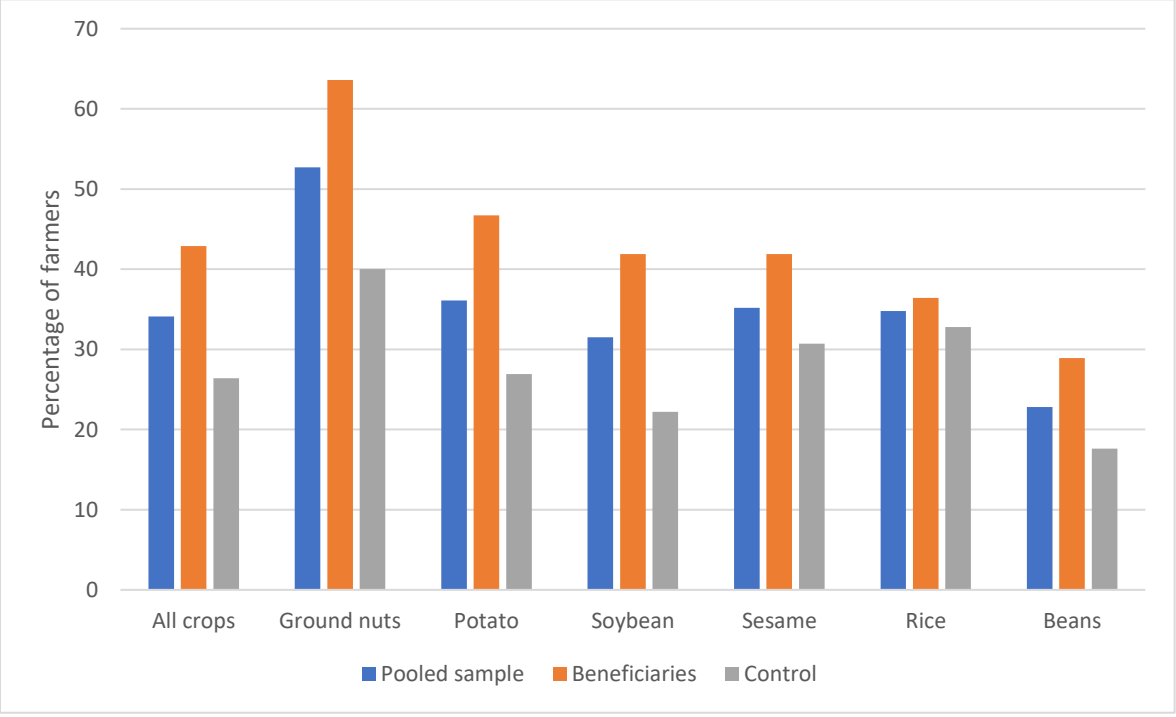


Figure 3. 6: Percentage of farmers reporting QDS is readily accessible

Table 3. 6: Farmers' main source of seed

Seed source	Percentage of farmers using the source		
	Pooled sample	Beneficiaries	Control
LSB	12.4	23.8	2.8
Home saved	42.7	32.8	51.2
Neighbours/friends/relatives	11.4	9.0	13.8
Local market	25.3	24.1	26.4
Agro-dealer/seed company	4.1	5.9	2.4
NGOs	1.2	1.0	1.3
Government	0.7	0.8	0.7
Others	1.6	2.8	2.1

Beans; The major source of bean seed for majority of farmers (47.4%) is home saved followed by local market (34.6%) and LSBs (8.3%). The percentage of farmers accessing seed from LSBs is significantly higher (15.9%) in sub counties where LSBs are located compared to 1.6% for the control group. There is a relatively low percentage of farmers using home saved seed (39.4%) among the beneficiaries compared to the control group with 54.2%.

Table 3. 7: Farmers' main source of bean seed

Seed source	Percentage of farmers using the source		
	Pooled sample	Beneficiaries	Control
LSB	8.3	15.9	1.6
Home saved	47.4	39.4	54.2
Neighbours/friends/relatives	4.3	3.2	5.3
Local market	34.6	35.5	33.8
Agro-dealer/seed company	3.0	4.5	1.6
NGOs	0.7	0.9	0.5
Government	0.1	0	0.2

Potato; The major source of potato seed for smallholder farmers is the local market (by 35.7% of the farmers) followed by home saved (24.5%) and neighbours/friends (20.5%). Only 9.3% of our sample accessed seed from the LSBs. However, the proportion is significantly higher among the beneficiaries (17.2%) compared to the control group (2.5%).

Table 3. 8: Farmers' main source of potato seed

Seed source	Percentage of farmers using the source		
	Pooled sample	Beneficiaries	Control
LSB	9.3	17.2	2.5
Home saved	24.5	23.0	25.7
Neighbours/friends/relatives	20.5	15.8	24,5
Local market	35.7	33.1	38.0
Agro-dealer/seed company	9.3	10.7	7.9
Government	0.6	0	1.2

Rice; Over 61.3% of farmers use home saved seed but the proportion for beneficiaries (42.3%) is lower than that for the control group with 84.2%. Compared to other crops, a significantly higher proportion (40.1%) of beneficiaries use seed from LSBs with only 1.4% for the control group.

Table 3. 9: Farmers' main source of rice seed

Seed source	Percentage of farmers using the source		
	Pooled sample	Beneficiaries	Control
LSB	22.5	40.0	1.4
Home saved	61.3	42.3	84.2
Neighbours/friends/relatives	12.9	14.1	11.4
Local market	1.9	1.2	2.8
Agro-dealer/seed company	0	0	0
NGOs	0	0	0
Government	0.6	1.2	0
Others	0.6	1.2	0

Soybean; A majority of farmers access seed through the local market followed by home saved and agro-dealers. The LSBs is the fourth source accessed by 11.7%; mainly by farmers from LSB sub counties (19.7%) compared to the control group (only 4.4%).

Table 3. 10: Farmers' main source of soybean seed

Seed source	Percentage of farmers using the source		
	Pooled sample	Beneficiaries	Control
LSB	11.7	19.7	4.4
Home saved	26.3	22.2	30.0
Neighbours/friends/relatives	6.4	4.9	7.7
Local market	33.3	25.9	40.0
Agro-dealer/seed company	14.6	20.9	8.9
NGOs	5.2	1.2	8.9
Government	0.5	1.1	0
Others	1.7	3.7	0

Sesame; The local market is the main source of seed for a majority (40.3%) of farmers followed by home saved seed (35.2%) and LSBs for 11.2%. About 19.3% of beneficiaries compared to 5.7% of control group use LSBs as their major source of seed.

Table 3. 11: Farmers' main source of sesame seed

Seed source	Percentage of farmers using the source		
	Pooled sample	Beneficiaries	Control
LSB	11.2	19.3	5.7
Home saved	35.2	27.9	40.0
Neighbours/friends/relatives	4.7	5.4	4.3
Local market	40.3	30.1	47.1
Agro-dealer/seed company	2.5	6.5	0
Project/NGOs	2.5	3.2	2.1
Others	3.0	6.4	0.7

Groundnuts; The major source of seed is home saved (by 57.6% of the farmers) followed by LSBs (21.2%) and the local market (11.4%). The use of home saved seed among the beneficiaries is significantly lower (by over 50%) compared to the control group. Compared to other crops, we do not find any farmer among the control group who considers LSBs as their major source of seed.

Table 3. 12: Farmers' main source of groundnut seed

Seed source	Percentage of farmers using the source		
	Pooled sample	Beneficiaries	Control
LSB	21.2	39.3	0
Home saved	57.6	35.3	83.9
Neighbours/friends/relatives	3.3	2.0	4.7
Local market	11.4	14.1	8.2
Agro-dealer/seed company	2.2	3.0	1.2
Others	3.8	6.1	1.2

Cassava; Farmers mainly use home saved seed (by 43.5%) followed by neighbours/ friends/relatives (30.2%) and the LSBs (16.5%). There is a significantly higher proportion (35.4%) of beneficiaries using seed from LSBs compared to that of home saved (28.3%).

Table 3. 13: Farmers' main source of cassava planting material (cuttings)

Seed source	Percentage of farmers using the source		
	Pooled sample	Beneficiaries	Control
LSB	16.5	35.4	4.1
Home saved	43.5	28.3	53.5
Neighbours/friends/relatives	30.2	22.1	35.4
Local market	2.5	4.4	1.1
Agro-dealer/seed company	0.7	1.7	0
NGOs	1.7	2.6	1.2
Government	3.2	4.4	2.3
Others	1.7	0.8	2.3

Across the crops there is a relatively low proportion of farmers using home saved and local market seed, and a significantly higher proportion of farmers using seed from LSBs among the beneficiaries compared to the control group suggesting that LSBs have significantly improved access to quality seed in their neighbourhoods. There are various reasons why farmers get seed from the different sources. A majority of farmers still believe that their home saved seed is of good quality. We also noted that affordability is a key factor. This was confirmed by key informants that about 50 to 70% of the farmers appreciate the value of QDS but cannot afford it (further discussion under affordability section). The other key factor is availability of (quality) seed especially for rice, soybean and groundnuts.

3.3.2 Commonly grown crop varieties

We assessed the commonly grown varieties for the various crops as one key indicator of access to quality seed. Tables 3.14 – 3.20 present the percentage of farmers who have adopted varieties of the different crops through LSBs. Consistent with the source of seed, a majority of farmers grow local varieties. Nevertheless, the LSBs have to some extent increased adoption of improved varieties as evidenced by the proportion of beneficiaries who have adopted the different varieties compared to the control group.

Beans; this crop has the highest number of improved varieties (Table 3.14). Over ten varieties are grown by the communities in Ankole and Rwenzori regions. The improved varieties mainly grown include NABE20 by 8.3% of the farmers followed by NAROBEAN2 and 3 (6.9% and 4.6%), NABE16 (4.2%) and NABE15 (4.1%). Since these are the same varieties that are grown and promoted by the LSBs, it is logical to believe that LSBs have increased access and adoption of seed of improved varieties. Nevertheless, it should be noted that there is always a high rate of diffusion of good varieties among farmers through exchange and purchase of seed. It is therefore not

surprising that famers among the control group have equally adopted the same varieties. As discussed earlier, since the seed is sold on open market the varieties have also been adopted by the control group hence, achieving the ISSD objective.

Table 3. 14: Percentage of farmers growing improved bean varieties

Crop varieties	Frequency	Percentage of farmers growing variety		
		Pooled sample	Beneficiaries	Control
*Mixed local varieties**	274	37.2	37.4	36.4
*Other local varieties (sorted)**	141	19.9	18	21.6
NABE20	59	8.3	10.8	5.8
NAROBEAN2	49	6.9	6.0	7.7
NAROBEAN3	33	4.7	3.4	5.8
NABE16	30	4.2	3.7	4.7
NABE15	29	4.1	4.5	3.6
K132	25	3.5	2.5	4.4
NABE17	24	3.4	3.1	3.6
NABE19	16	2.3	3.4	1.1
NAROBEAN4C	16	2.3	2.5	1.9
NAROBEAN1	10	1.4	1.4	1.3
Other improved varieties	14	2.0	3.3	2.1

**"Mixed local" varieties are different varieties of local seed but assorted. "Other local varieties" are sorted; only one variety in a seed basket.*

Beans in the field and QDS branded by ORUPEA LSB in Rwanyamahembe Mbarara District

Potato; The LSBs mainly produce *Rwangume* and *Kinigi* which are the most commonly grown varieties by 58.6% and 33.9%, respectively, of the sampled farmers in Kigezi region. *Rwangume* is relatively highly grown by beneficiaries (61.8%) compared to the control group (55.6%). On the contrary, a relatively lower proportion of beneficiaries (29.8%) compared to the control group (37.7%) grow *Kinigi*.

Table 3. 15: Percentage of farmers growing improved potato varieties promoted by ISSD

Crop varieties	Frequency	Percentage of farmers growing variety		
		Pooled sample	Beneficiaries	Control
Rwangume	173	58.6	61.8	55.6
Kinigi	100	33.9	29.8	37.7
Rwashaki (local)	15	5.08	6.9	3.3
Victoria	7	2.37	1.3	3.3

Rwangume potatoes in the field in Chahi Sub county, Kisoro district

Potato QDS in Rutare farmers group, Kisoro District

Rice; While up to 13 improved varieties were introduced to farmers by ISSD Plus, apart from other mixed varieties, the most common grown is *Wita*9 by 20.8% of the sampled farmers (25.3% beneficiaries and 16.1% control group). This is the same variety promoted by LSBs implying that LSBs have significantly contributed to its adoption. Other improved varieties are grown by a very small proportion (1.1%).

Table 3. 16: Percentage of farmers growing rice varieties

Crop varieties	Frequency	Percentage of farmers growing variety		
		Pooled sample	Beneficiaries	Control
Wita 9	40	20.8	25.3	16.1
Local variety	15	7.9	6.6	8.1
SUPERICA2	2	1.1	1.1	2.3
Upland rice	1	0.6	1.1	0
AR 1189	1	0.6	1.1	0
NERICA 6	1	0.6	0	1.2
Other varieties	129	67.9	64.8	73.5

WITA 9 in the field at Nyamunasa farmers group, Butaleja district

WITA 9 QDS ready for sale

Soybean; Out of the three improved varieties promoted by LSBs, Maksoy 4N is the most grown by 9.3% followed by Maksoy 3N by 7.1%. The Maksoy 4N is almost equally grown by both the beneficiaries and the control group while a higher proportion of the control group (8%) compared to beneficiaries (6.3%) grew Maksoy 3N. The adoption rate associated with LSBs is very small compared to other crops. This could be due to limited availability of QDS of the improved varieties. The LSB farmers we interacted with in Lira district reported that they started seed production in 2017 but have so far missed three seasons because they could not raise money for FS. The LSB farmers decry high costs involved in acquiring FS from Makerere University. In 2019B the LSB harvested 600 kg of QDS but sold 300Kg as grain because it was not of good quality as it had been affected by heavy rains at the time of harvest.

Table 3. 17: Percentage of farmers growing soybean varieties

Crop varieties	Frequency	Percentage of farmers growing variety		
		Pooled sample	Beneficiaries	Control
Maksoy 4N	17	9.3	9.5	9.2
Maksoy 3N	13	7.1	6.3	8.0
Maksoy 5N	2	1.1	0	2.3
Other varieties	156	82.5	0	

Soybeans; Maksoy 3N in the field in Agweng subcounty Lira District

Farmer cleaning QDS of Maksoy 4N in Lira

Garden of Sesame 2 grown by a farmer in Rhino Camp Sub county in West Nile

Sesame; The local varieties are the most grown by 72.5%, with a slightly higher proportion of the control group (73.5%) compared to the beneficiaries (70.6%). The improved variety most grown is Sesame 2 adopted by 17.2% of beneficiaries and 18.8% of the control group. Since it is the variety promoted by the LSB in the study area, one would have expected higher adoption among the beneficiaries compared to the control group. Instead we find a significantly higher adoption of Sesame 3 among the beneficiaries (10.3%) compared to the control group (2.6%). The cause of variation in adoption of improved varieties among the beneficiaries and the control group is not clear from available data. The general low adoption rates can be attributed to lack of affordability. Our discussion with LSB farmers revealed that most (70%) of the QDS is sold to seed companies and NGOs and farmers buy only 30%. Farmers claim UGX 10,000 per kg of QDS is expensive and many farmers cannot afford.

Table 3. 18 : Percentage of farmers growing Sesame varieties

Crop varieties	Frequency	Percentage of farmers growing variety		
		Pooled sample	Beneficiaries	Control
Local varieties	127	72.5	70.6	73.5
Sesame 2	32	18.3	17.2	18.8
Sesame 3	9	5.1	10.3	2.6
Sesame 1	7	4	1.7	5.1

Groundnuts; The LSBs have been promoting the *Serenut* series of improved varieties, however, not many are grown by the local farmers. Among the improved varieties, *Serenut* 3R is the most grown by only 16.4% of the farmers. Adoption of *Serenut* 3R is slightly higher among the beneficiaries (17.5 %) compared to the control group (15.2%).

Table 3. 19: Percentage of farmers growing groundnut varieties

Crop varieties	Frequency	Percentage of farmers growing variety		
		Pooled sample	Beneficiaries	Control
Serenut 3R	38	16.4	17.5	15.2
Red beauty (local variety)	12	5.2	6.1	4.2
Serenut 5R	5	2.2	3.5	0.8
Other varieties	59	76.4	72.5	86.3

Serenut 8 in the field in Bata Sub county Dokolo district

Shelled Serenut 8

Cassava; compared to other crops, cassava improved varieties have been relatively highly grown by both the beneficiaries and the control group. The most grown is NASE14 (by 22.7%), followed by NAROCAS 1 (21.8%) and NASE19 (18.5%). The LSBs mainly grow NASE19 and NAROCAS1. This explains why NASE19 is grown by a significantly

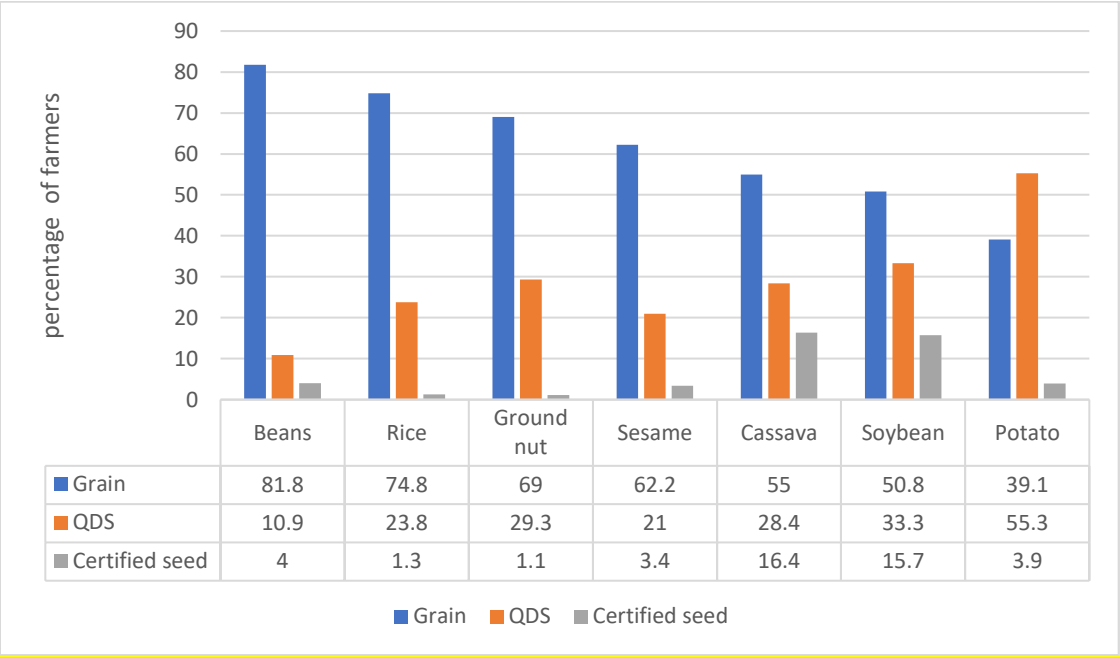
higher percentage of beneficiaries (23.1%) compared to the control group (15.7%). NAROCAS1 also promoted by LSB is relatively highly grown by the control group compared to beneficiaries, explained by the fact that there are other sources other than the LSBs where farmers in the region access the planting material of this variety. Being a food security crop, NGOs and local governments have put effort in ensuring farmers have access to quality planting materials. This is evidenced by the fact that the biggest customers for LSBs in cassava production are the institutional buyers. Nonetheless, the percentage of beneficiaries growing local varieties is slightly lower than that for the control group.

Table 3. 20: Percentage of farmers growing cassava varieties

Crop varieties	Frequency	Percentage of farmers growing variety		
		Pooled sample	Beneficiaries	Control
Local varieties	119	36.6	35.5	37.2
NASE14	74	22.7	21.4	23.5
NAROCAS1	71	21.8	19.0	23.5
NASE19	60	18.46	23.1	15.7
Other varieties	2	0.31	0.8	0

Cassava garden of variety Nase19 in Nebbi Subcounty, Nebbi District

Aware of the fact that farmers can acquire QDS from different sources (individual seed producers, market fair, etc.), we asked farmers to categorise the type of seed they usually plant. The results are displayed in Figure 3.7. The results consistently show that a majority of farmers are using grain except for potato where a majority (55.3%) said they plant QDS.



	Beans	Rice	Ground nut	Sesame	Cassava	Soybean	Potato
Grain	81.8	74.8	69	62.2	55	50.8	39.1
QDS	10.9	23.8	29.3	21	28.4	33.3	55.3
Certified seed	4	1.3	1.1	3.4	16.4	15.7	3.9

Figure 3. 7: Percentage of farmers using the different seed categories

Whereas there are other institutions such as NARO which have promoted improved seed among the communities, for most of the crops the proportion of beneficiaries who are growing the improved varieties is higher than that for the control group suggesting that part of the adoption is attributed to LSBs supported by the ISSD project.

Overall, the use of QDS is low, only 35% of our respondents have used QDS at least for one season in the last four years. The percentage of beneficiaries (48.6%) is higher compared to that of the control group (23.3%). The low use of improved varieties is partly due to limited access to quality seed. The accessibility index is low at 39.9% for the entire sample although it is relatively high for the beneficiaries (49.1%) compared to the control group (32.0%). Across all the crops, only 34.9% reportedly have ready access to QDS. The percentage of beneficiaries (42.9%) is significantly higher than that for the control group (26.4%). For specific crops, save for cassava and groundnuts, QDS is readily accessible to less than 50% of the farmers (Table 3.21). As expected, QDS is more readily accessible for the beneficiaries than the control group for all the crops. Cultural perceptions also explain why most farmers use home saved seed. In most cultures any responsible woman is expected to save seed. Farmers claim that home saved seed is most secure (nobody uses it for any other purposes), and it is reliably available when needed for planting.

Table 3. 21: Seed accessibility index and percentage of farmers responding to accessibility of QDS

Crop	Accessibility of QDS	Percentage of farmers		
		Pooled sample	Beneficiaries	Control
All crops	Accessibility Index	39.9	49.1	32.0
All crops	Not readily accessible	28.6	21.0	35.1
	fairly accessible	37.2	36.0	35.1
	Readily accessible	34.1	42.9	26.4
Beans	Not readily accessible	43.9	35.5	51.1
	fairly accessible	33.2	35.5	31.2
	Readily accessible	22.8	28.9	17.6
Potato	Not readily accessible	21.8	12.2	30.0
	fairly accessible	42.0	41.0	42.9
	Readily accessible	36.1	46.7	26.9
Rice	Not readily accessible	32.2	24.7	41.4
	fairly accessible	32.2	38.8	25.7
	Readily accessible	34.8	36.4	32.8
Soybean	Not readily accessible	14.0	8.6	18.8
	fairly accessible	54.3	49.4	58.9
	Readily accessible	31.5	41.9	22.2
Sesame	Not readily accessible	24.8	17.2	30.0
	fairly accessible	39.9	40.8	39.2
	Readily accessible	35.2	41.9	30.7
Ground nuts	Not readily accessible	24.5	13.1	37.6
	fairly accessible	22.8	23.2	22.3
	Readily accessible	52.7	63.6	40.0
Cassava	Not readily accessible	12.6	7.9	15.7
	fairly accessible	41.0	27.4	50.0
	Readily accessible	46.3	64.6	34.3

We tested whether the difference in accessibility is attributed to LSB by estimating the Average treatment effect on the treated (ATT) using Propensity Score matching (PSM). The results presented in Table 3.22 show that accessibility index for the beneficiaries is significantly higher than that of the control group by 14.5-14.8%. The results are consistent using different matching methods. This affirms the contribution of LSBs to improved access to quality seed.

Table 3. 22 : Average treatment effects of LSBs on seed access index

Outcome indicator	Matching algorithm	No. of beneficiaries on support	No. of control on support	Mean Index beneficiaries	ATT (SE)	t- value
Accessibility Index	Kernel matching (band width =0.2)	689	819	49.8	14.8 (1.36)	10.88***
	Radius matching (caliper =0.02)	691	819	49.8	14.5 (1.27)	11.37***

3.3.3 Factors affecting accessibility of QDS

Despite the contribution of LSBs, access to quality seed is still constrained by various factors including limited availability of QDS, low income for smallholder farmers and lack of awareness by smallholder farmers. As discussed above, the LSBs are limited to very few sub counties (on average only one LSB per sub county), making it difficult for the farmers in other sub counties to access QDS. Results in Table 3.23 show that on average farmers have to cover a distance of 4.4 km (for beneficiaries) and 9.3km (control group) to access QDS, yet they are comfortable with a distance of at most 3km (Table 3.24). The selling points are limited to LSB stores and seed fairs only hence farmers have to move long distances to access the seed. For example, the average distance to the nearest LSB is 6.6 km which is 3.6km farther than where they can purchase grain. For specific crops the distance ranges between 2km for rice to 11 km for potato. Moreover, over 90% of the farmers buy seed individually, thus becoming more costly.

Table 3. 23: Indicators of access to quality seed

Indicator	Pooled sample (n = 1,806)	Project beneficiaries (n = 839)	Control group (n = 967)
Farmers who have used QDS in the last four years	35.1	48.6	23.3
Distance to the nearest source of QDS/planting material (km)	6.6 (12.1)	4.4 (10.4)	9.3 (13.1)
Distance to the nearest source of certified seed /planting material (km)	11.7 (19.7)	7.8 (15.3)	15.1 (22.4)
Distance to the nearest source of grain /planting material (km)	3.0 (6.5)	2.1 (4.1)	3.7 (7.9)
Distance to the nearest source of seed/planting material where the farmer always buys (km)	3.7 (9.3)	3.2 (8.7)	4.2 (9.8)
Amount of money spent on transport to the commonly used seed source (UGX)	2,212 (4,591)	1,897 (3,816)	2,492 (5,170)

Indicator	Pooled sample (n = 1,806)	Project beneficiaries (n = 839)	Control group (n = 967)
Means of transport; 1=walking; 0=otherwise (%)	53.8	54.2	53.5
Means of procuring seed: Individually (%)	95.2	91.2	98.3
As a group (%)	4.5	7.9	1.5
With friends (%)	0.2	0.3	0.1
Number of agro-dealers known in the sub county (n=585)	2 (1.7)	2(1.3)	2(2.3)
Number of LSBs known in the sub county (n=689)	1(0.6)	1(0.6)	1(0.8)

Moreover, there is competition for QDS between seed companies, businessmen and farmers. We find that LSBs producing beans, potato and soybean mainly sell to seed companies and businessmen. By the time farmers look for seed at the beginning of the planting season it is not available. The LSB farmers reported that these customers buy all the seed in bulk and sell it in other areas far away from the localities of the LSBs.

Low income for farmers is one other factor affecting access to QDS both from the supply and demand side. As discussed above some of the seed is sold as grain before the planting season as LSB farmers are trying to raise money for other needs. From the demand side, seed access is constrained by lack of money by smallholder farmers to purchase seed. Findings show that over 50% of the smallholder farmers cannot afford QDS.

Table 3. 24: Distance to the nearest LSBs for the various crops

Crop	Distance to the nearest LSB (km)			Most suitable distance (km)		
	Pooled sample	Beneficiaries	Control	Pooled sample	Beneficiaries	Control
Beans	3 (3.4)	2.1 (1.8)	4.1 (4.5)	1.0 (1.4)	1.0 (0.8)	1.0 (1.8)
Potato	11.5 (17)	6.8 (13.5)	15.6 18.8)	1.0 (3.1)	1.4 (4.3)	1.0 (1.4)
Rice	2 (1)	2.0 (1.6)	3.0 (3.2)	1.0 (1)	1.0 (0.7)	1.0 (1.1)
Soybean	3.3 (3.9)	2.3 (3.1)	4.3 (4.4)	3.0 (4.6)	2.4 (3.4)	3.6 (5.3)
Sesame	4.8 (6.7)	3.8 (4.2)	5.8 (8.2)	1.8 (3.2)	2.0 (3.3)	1.8 (3.2)
Groundnut	2 (4.0)	2.0 (4.1)	1.1 (3.6)	1.4 (2.4)	1.5 (2.9)	1.0 (1.6)
Cassava	5 (6.6)	2.8 (3.3)	7.0 (8.2)	1.0 (1,7)	1.0 (1.1)	1.0 (2.1)

Note: Standard deviation in parenthesis

Limited access to QDS is also explained by lack of awareness. We found that in control sub counties most farmers did not know the difference between QDS and other seeds; they believed QDS was expensive and not accessible. Some of the farmers are not informed of where to find QDS (see Table 3.25). Save soybean, less than 50% of the sample farmers know seed access points. A majority of farmers learn about new varieties through informal conversations by word of mouth (74.3%); mainly from fellow farmers as reported by 79.2% of the farmers). Others get information from Radio/TV (by 34.1%) and LSB associations (13.6%) (Figure 3.8). Seventeen radio stations have been used to disseminate information on QDS. However, only five stations were mentioned by more than 10% of the farmers; Unity FM (by 27.8%), Voice of Kamwengye (by 20.9%), Radio Pacis (12.6%), Radio West (10.5%) and Radio Paidha (10.2%).

Table 3. 25 : Farmers' awareness and satisfaction of seed access points

Crop	Farmers who are aware of seed access points			Farmers who are satisfied with seed access points		
	Pooled sample	Beneficiaries	Control	Pooled sample	Beneficiaries	Control
All Crops	26.5	32.6	22.8	79.2	78.7	79.8
Beans	29.3	35.1	24.3	70.7	65.7	77.0
Potato	20.2	19.4	20.8	49.2	48.2	50.0
Rice	14.2	25.8	0	72.7	72.7	0
Soybean	65.5	69.1	62.2	94.6	91.0	98.2
Sesame	38.6	48.3	32.1	87.7	93.3	82.2
Groundnut	24.5	40.4	5.8	95.5	97.5	80.0
Cassava	6.3	6.2	6.4	94.4	100	91.0

Note: Standard deviation in parenthesis

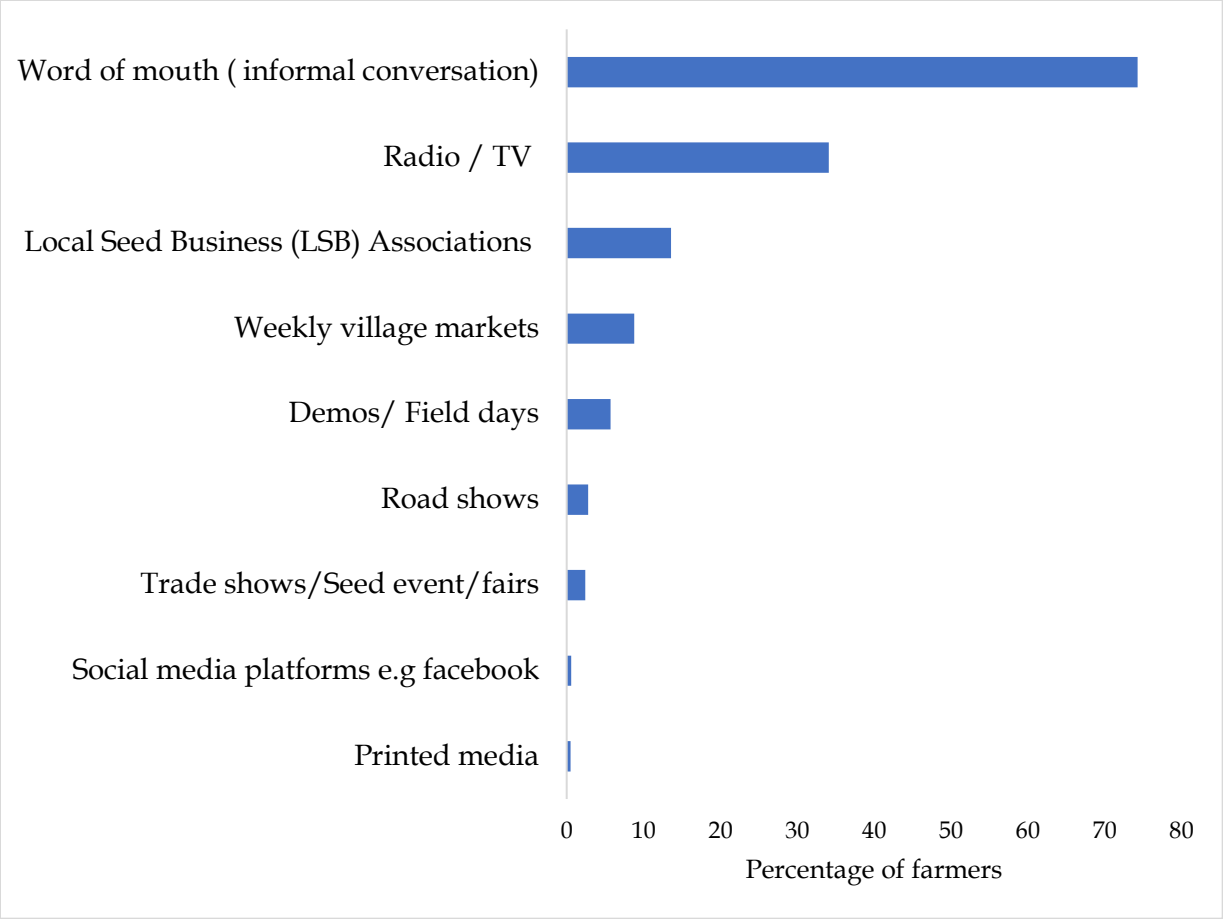


Figure 3. 8: Channels through which farmers get information about new varieties

3.4 Affordability of QDS

3.4.1 Farmers' affordability of seed

Affordability is one factor that drives farmers' decision to use QDS. The disparity between the cost of quality seed relative to income of farmers can affect adoption of QDS. Seeking opinion of farmers on affordability of QDS gave responses summarised in Table 3.26, with those reporting that QDS is affordable to most people presented in Figure 3.9.

Table 3. 26: Percentage of farmers responding on affordability of QDS

Crop	Affordability of QDS	Percentage of farmers responding		
		Pooled sample	Beneficiaries	Control
All crops	Affordable to most people in the community	45.5	46.5	44.8
	Expensive, few people can afford it	30.7	31.5	30.1
	Very expensive: Very few people in the community can afford	23.6	22.1	24.9
Beans	Affordable to most people in the community	27.5	23.7	30.7
	Expensive, few people can afford it	41.9	43.9	40.2
	Very expensive: Very few people in the community can afford	30.5	32.2	29.1
Potato	Affordable to most people in the community	29.5	39.5	20.8
	Expensive, few people can afford it	34.1	26.6	40.5
	Very expensive: Very few people in the community can afford	36.4	33.8	38.6
Rice	Affordable to most people in the community	79.3	78.8	80.0
	Expensive, few people can afford it	15.4	15.3	15.7
	Very expensive: Very few people in the community can afford	5.1	5.8	4.3
Soybean	Affordable to most people in the community	66.1	65.4	66.6
	Expensive, few people can afford it	14.6	20.9	8.9
	Very expensive: Very few people in the community can afford	19.3	13.5	24.4
Sesame	Affordable to most people in the community	57.9	56.9	58.5
	Expensive, few people can afford it	21.9	23.6	20.7
	Very expensive: Very few people in the community can afford	20.1	19.3	20.7
Ground nuts	Affordable to most people in the community	57.6	65.6	48.2
	Expensive, few people can afford it	27.7	23.2	32.9
	Very expensive: Very few people in the community can afford	14.6	11.1	18.8
Cassava	Affordable to most people in the community	53.6	50.4	55.8
	Expensive, few people can afford it	29.8	38.1	24.4
	Very expensive: Very few people in the community can afford	16.5	11.5	19.7

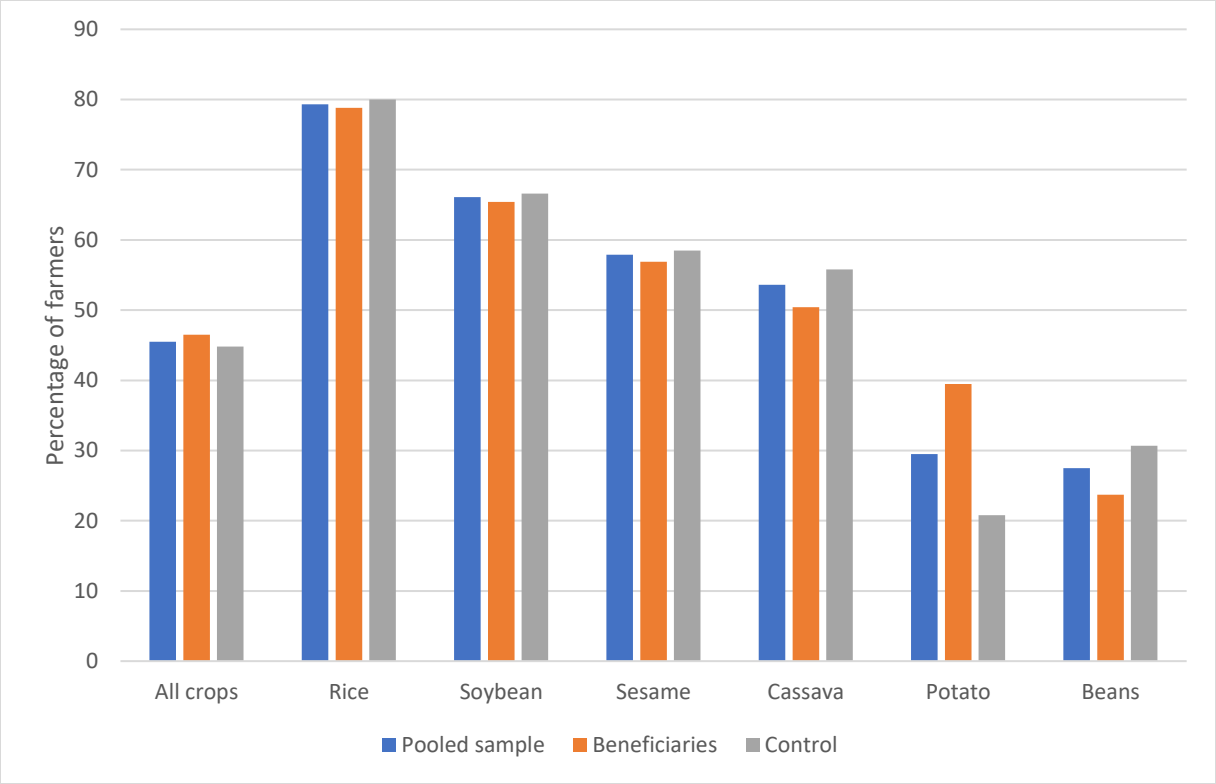


Figure 3. 9: Percentage of farmers reporting QDS is affordable

The findings reveal that a majority (54.3%) of farmers across the regions said QDS is expensive or very expensive for most farmers cannot afford to buy it. The percentage for beneficiaries (53.6%) is slightly lower than that of the control group (55%). The details on the specific crops are elaborated below.

Beans; over 70% of farmers interviewed claim that QDS is expensive /very expensive and few can afford it. This is largely explained by a relatively big difference (approx. UGX 1300 per kg) between grain and QDS prices (Table 3.14). Beans recorded the lowest percentage of farmers who said that QDS is affordable to most farmers in the community. Contrary to what we expected, results show a relatively higher percentage of the control group (30.7%) compared to the beneficiaries (23.7%) reporting that QDS is affordable. A majority of farmers prefer to buy the 5 kg and 10kg packages.

Potato; similar to beans a majority (70%) of potato farmers said QDS is expensive or very expensive. However, a relatively higher proportion of beneficiaries (39.5%) compared to the control group (20.8%) think QDS is affordable to most farmers. The mean price difference between QDS and ware potato is about UGX 700 per kg. This translates to about UGX 210,000 per acre at a seed rate of about 300kg used by most farmers. Most farmers

buy seed in bags of 130kg and 100kg. This partly explains why farmers prefer to buy seed from local market a 130 - 150kg bag costs UGX 300,000 (UGX 2000/kg) yet, a bag of QDS has 80kg and at UGX 200,000 (UGX 2500/kg).

Rice; rice QDS is the most affordable to a majority of the sampled farmers. About 79% of the farmers reported that QDS is affordable to most farmers in the community. This applies to both beneficiaries and the control group. This could be explained by the small difference in prices of about UGX 500 per kg between QDS (approx. 2,500 UGX) and grain (approx. UGX 2,000). Most farmers prefer to buy the 10kg pack.

Soybean; soybean QDS is the second most affordable with over 60% of the farmers reporting that QDS is affordable to most farmers in the community. One kg of QDS costs about UGX 1,300 higher than the grain. For farmers who appreciate the value of quality seed QDS is much more affordable compared to certified seed whose price is more than double that of grain. Most farmers prefer to buy the 2kg and 5kg packs.

Sesame; sesame seed is relatively affordable to most farmers as reported by about 50% of the farmers. The mean price difference between QDS (UGX 5,700/kg) and grain (UGX 3,569/kg) is about UGX 2,200. Important to note is that farmers use a very low seed rate (6-10kg/acre) compared to other crops. Most farmers (50.5%) prefer to buy 2kg pack, and 5kg pack by 49.4%.

Groundnuts; a relatively high proportion of beneficiaries (65.6%) compared to the control group (48.2%) reported that QDS is affordable to most people in the community (on average 56.7%). This is explained by close proximity of the beneficiaries to LSBs. We also found that the price of QDS (UGX 5,000 per kg) is almost the same as that of grain (UGX 4,600); a difference of only UGX 400/kg, which increases the likelihood to buy the QDS. Most farmers prefer to buy 5kg pack. About 35.1% buy QDS after 4 seasons.

Cassava; the QDS is fairy affordable according to over 50% of the farmers. There is no big variation between the opinion of beneficiaries and that of the control group. However, a higher percentage of the control group (19.7%) compared to the beneficiaries (11.5%) believe that QDS is very expensive and very few people can afford it. Most farmers prefer to buy in bags. A majority (54.8%) buy seed after 2 seasons.

Overall, prices of QDS are relatively low at farm gate level compared to the LSB stores. The farm gate prices are much closer to grain prices. This could be an incentive for farmers to buy QDS if more farmers engage in seed production. However, it could also be a disincentive for farmers who are producing QDS. This needs further investigation. Further, we note that QDS prices are lower than prices for certified seed suggesting that LSBs have significantly contributed to increased affordability of quality seed. A majority of farmers prefer to buy the 5 kg and 10kg packs of QDS. Comparing the prices of QDS and home saved grain, with increased sensitization on the benefits of QDS more farmers are likely to invest in QDS.

Table 3. 27: Average market prices (UGX/kg) for the different types of seed

Crop	Price of QDS/planting material (from LSBs)	Price of grain/ planting material	Price of certified/ planting material	Price of seed/ planting material from farmers who planted QDS	Preferred package size (kg)
Beans	4,185 (1221)	2,843 (648)	4,853 (1,205)	3,080 (828)	5 & 10
Potato	2,500 (967)	1,896 (588)	3,041 (1,108)	2,100 (611)	130 &100
Rice	2,589 (542)	1,922 (320)	3,200 (1,228)	2,167 (364)	10
Soybean	3,784 (2162)	2,388 (1,353)	4,820 (2,950)	2,684 (1,654)	2 & 5
Sesame	5700 (1249)	3,569 (2,145)	7,901 (6,798)	3,976 (1,797)	2 & 5
Groundnut	5000 (1346)	4,600 (1,538)	6,502 (5,314)	4,036 (11,34)	5
Cassava*	24,089 (9062)	11,676 (6,348)	25577 (12,844)	21,531 (8,474)	a bag

**Price of cassava is in UGX/bag*

3.4.2 Farmers' willingness to pay for QDS

Farmers' responses on the prices they were willing to pay for QDS, and the minimum prices seed producers were willing to supply the QDS are summarized in Table 3.15. The results show a very high difference between the supply price and what farmers are willing to pay. The affordability gap for grains ranges between UGX 900 per kg for rice and UGX 1,600 per kg for beans. The highest gap is in cassava estimated at UGX 10,000 per bag of cuttings. The importance of seed price varies depending on the type of seed and the crop. For non-hybrid seed which the farmer can save for the next season, price sensitivity becomes high. While seed producers set the price based on the costs involved in production, short term and long term marketing objectives need to be considered for sustainability of LSBs. As to who will cover the affordability gap is a question for debate. It is important to note that for other crops apart from soybean and groundnut, farmers in the beneficiary locations have a relatively higher average willingness to pay for QDS as

compared to those in the control locations. This difference could be attributed to efforts put into awareness creation in the beneficiary locations.

Table 3. 28: Average prices seed producers and farmers are willing to transact for QDS

Crop	Minimum supply price (UGX)	Average price farmers are willing to pay/kg/bag (cassava) (UGX)			Affordability gap (for pooled sample) (UGX)	t- value
		Pooled sample	Beneficiaries	Control		
Beans	4,000	2,410 (736)	2,584 (797)	2,244 (632)	1,600	-46.3***
Potato	2,500	1,512 (434)	1,524 (507)	1,504 (385)	1,000	10.39***
Rice	2,500	1,659 (475)	1,916 (353)	1,328 (408)	900	9.99***
Soybean	3,500	2,367 (894)	2,288 (550)	2,456 (1,176)	1,200	8.89***
Sesame	4,500	3,952 (3,350)	4,362 (3,760)	3,658 (3,025)	1,000	1.60**
Ground nuts	4,000	3,121 (747)	2,961 (733)	3,245 (743)	1,000	10.37***
Cassava	24,000	14,522 (5,372)	16,892 (4,614)	12,776 (5,244)	10,000	20.26***

Note: the willingness to pay for the pooled sample was rounded off to calculate the affordability gap (the difference between minimum supply price and willingness to pay for pooled sample)

3.4.3 Factors affecting affordability

The key factors that influence affordability of QDS are mainly farmers' income and market prices. We found that most farmers depend on farming as their only source of income. It follows that their income is seasonal and usually crop sales are done at or shortly after harvest due to high demand for other needs. Therefore, at the time of planting most farmers cannot afford QDS, the reason they use home saved or the cheaper grain from the local market. Surprisingly even some farmers who produce seed prefer to plant home saved seed for home consumption crop.

The relative price of QDS (in relation to grain price) also determines affordability. As mentioned above smallholder farmers opt for the cheaper grain for use as seed. Others argue that they cannot afford to buy seed at a higher price yet they sell their produce (grain) at the same low prices as those who planted (the more expensive) QDS. The market does not differentiate the produce from either grain seed or (quality) QDS. Many farmers have not yet understood that they would benefit from higher yields arising from quality seed other than the unit price after harvest.

3.5 Maize seed availability, accessibility and affordability

We compared accessibility of QDS of crops promoted by ISSD with that of certified seed using a case of maize, a crop whose certified seed has been on market for decades. Maize is the most important cereal crop in Uganda consumed by both urban and rural areas and therefore widely grown by over 80% of smallholder famers. Figure 3.10 shows that maize seed productivity has been increasing partly explained by increased use of improved seed/varieties.

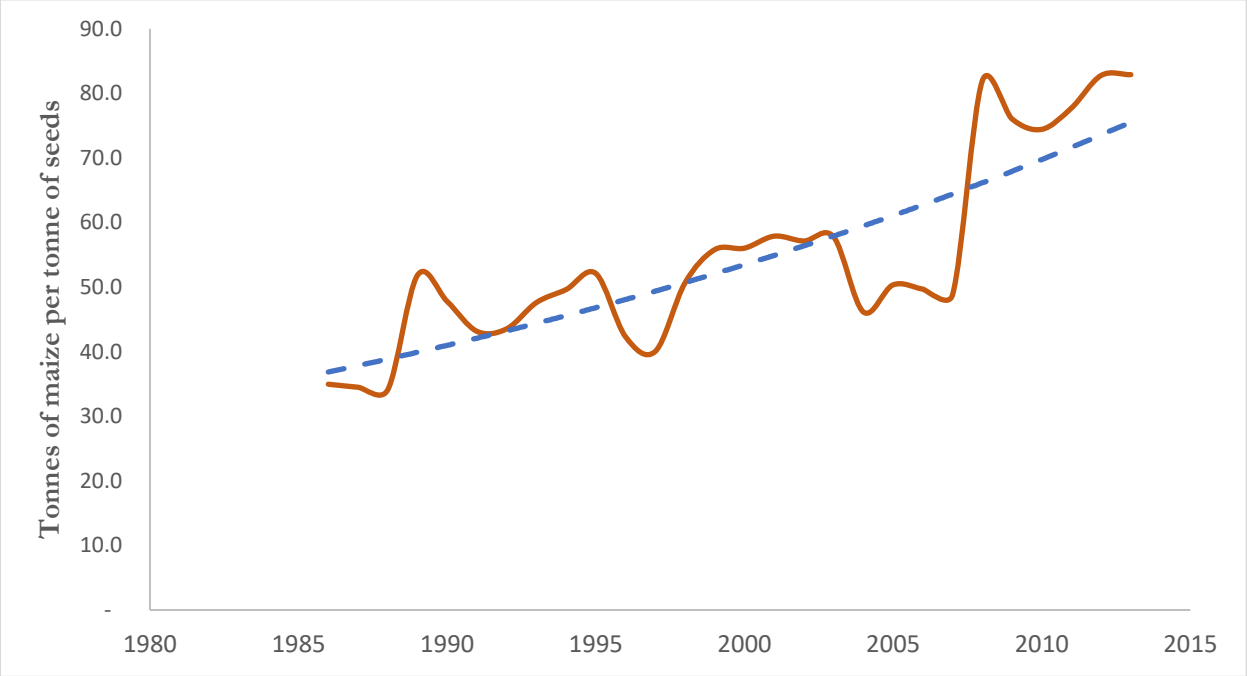


Figure 3. 10: Maize seed productivity in Uganda

Source: FAOSTAT data

Although not produced by LSBs, ISSD has been promoting uptake of quality maize seed by farmers in different regions. Like most of the crops, key informants estimated that, for maize production, a majority (about 60 to 80%) of farmers use home saved seed but of improved varieties. In their study, Mugisha and Diiro (2010) observed very high levels of adoption (about 80%) of improved maize varieties. An estimated 20% purchase maize seed from agro-dealers as this is readily available as reported by 46.7% of the farmers as well as key informants. Certified maize seed originates from various companies including NASECO, East African Seed Company, FICA seeds, Savana Seeds, Pearl Seeds, Equator Seeds, Crown Seeds and Victoria Seeds.

Certified maize seed is fairly accessible as reported by 46.7% of the smallholder farmers in the study area. Farmers are growing different maize varieties including *Longe* 7H, *Longe* 10, *Longe* 9, *Longe*5, *Bazooka*, MM3, UH 5051 and Dekalb (DK). For example, in Mbarara district, about 80% of farmers grow hybrid. The major source of certified seed for the smallholders include local government, agro-dealers and NGOs. The local government has been supplying certified maize seed through NAADS/Operation Wealth Creation. Farmers also buy from Agro-input dealers although they are mainly concentrated in urban and trading centers with few in rural areas and none in some of the sub-counties visited. Farmers have been trained to identify genuine seed; they buy seed based on the label.

A majority (72.8%) of farmers reported that certified maize seed is affordable by most farmers. The average price of seed across regions visited ranges between UGX 3500 to 5000 per kg for *Longe* 5 (OPV), UGX 6000 to 7000 per kg of *Longe10* and between UGX 8000 and 9000 for Bazooka. The DK variety costs UGX 10,000 per kg, while other *Longe* varieties cost UGX 5000 per kg. Whereas the prices are not low compared to those of QDS for the other crops, farmers said they can easily afford maize (say compared to beans) because they get higher returns (yields and income) from maize. This is a farmers' perception that maize is superior to the other crops, and lack of knowledge that using QDS for the other crops can also give high yields and income. Awareness creation among farmers is, therefore, a key factor that enhances affordability of QDS in such situations where farmers have a perception that the seeds are expensive and give low returns. Mugisha and Diiro (2010) attributed the high adoption of improved maize varieties to a highly successful campaign at developing and disseminating the varieties.

Farmers' responses on quality of certified maize seed are mixed. While some report that it is of good quality, others claim that the quality is not good. However, all the respondents attest that improved varieties have significantly higher yields compared to local varieties. Farmers who plant 10kg of home saved seed harvest 400 to 600 kg. However, those who plant the same quantity but of improved seed harvest about 800 to 1000 kg. A case was given in Dokolo district where a farmer planting 10kg of DK in an acre harvests 15 - 20 bags equivalent to 1.5 to 2 tonnes.

Generally, certified maize seed is readily available, fairly accessible and affordable to most farmers. However, most smallholder farmers us home saved seed by recycling the certified seed for up to six seasons. Whereas the seed quality can still be good up to three seasons, farmers lack this knowledge and recycle the seed over and over again. This affects the yields due to seed quality degeneration over time.

3.6 Farmers' perceptions on quality of QDS

Quality seed is crucial for crop production as poor quality seed affects the yield. Seed quality has four basic parameters; physical qualities, physiological qualities, genetic quality and seed health. Since actual quality of seed is only experienced through use (Thomas, 2006), in this evaluation we assessed quality parameters based on farmers' experience. Farmers tend to have a holistic view of quality based on benefits and multiple valued outcomes. Figure 3.11 displays farmers' experience using QDS in terms of the number of seasons a farmer has used seed from LSBs.

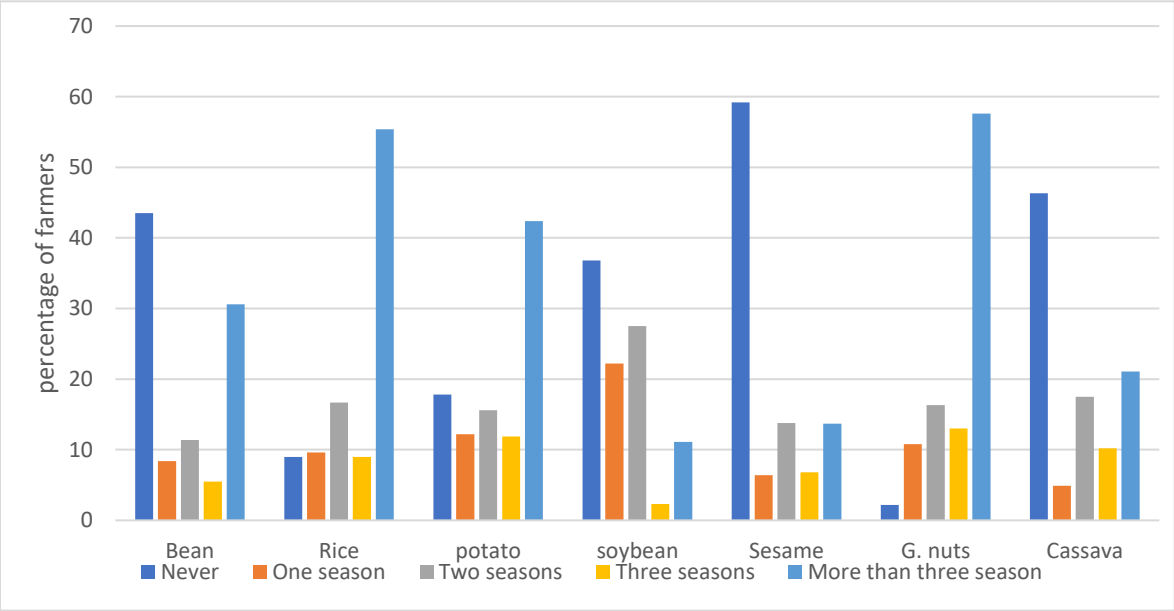


Figure 3. 11: Period for which farmers have used quality seed from LSBs

Farmers as well as key informants do concur that QDS is of high quality. Based on the key attributes valued by farmers, QDS was rated by farmers and extension officers as the best seed on the market. Table 3.29 provides a summary of farmers' perception on the quality of QDS compared to other types of seed. It should be noted that some of the farmers have never used QDS and therefore were asked to evaluate the quality of the type of seed they commonly use. This is shown in Table 3.29 under the columns "*Others*".

The quality of QDS for all the crops is rated as high and very high by 75.6% of the farmers. The percentage of farmers who rate QDS (75.6%) as high and very high is significantly higher than that for other seed types (64.5%). The trend is consistent for all other quality indicators. Over 70% reported fair and good germination rate, plant vigour and yield for all the crops using QDS. However, there is also a considerable proportion of farmers who rate home saved seed to be of high quality with good germination rate as well as plant vigour, especially for groundnuts.

The major difference between QDS and other seeds is exhibited by the yields, market and income trends for all the crops in the last four years. Across the crops, over 80% of the farmers said that they would recommend QDS to other farmers. The percentage of farmers using QDS who have registered an increase in the above trends is much higher than that for other seeds. With regard to market trend, remember that a majority of the non-QDS farmers plant mixed/local varieties, although some grow home saved seed of improved varieties. The market demand and price for improved varieties is higher than that of mixed varieties/ local varieties. However, not all seed for improved varieties is QDS. Since LSBs promote improved varieties and considering the rating of the various indicators, it is reasonable to conclude that LSBs have significantly contributed to improved quality of seed on the market.

Table 3. 29: Percentage of farmers reporting perceptions on seed quality

Indicator	Beans		Rice		Potato		Soybean		sesame		G/nuts		Cassava		All crops	
	QDS	Others*	QDS	Others	QDS	Others	QDS	Others	QDS	Others	QDS	Others**	QDS	Others	QDS	Others
Seed quality score																
Very high	16.7	7.9	35.5	14.3	11.7	5.6	50.0	42.8	55.7	12.3	26.1	25.0	58.5	12.8	29.8	12.7
High	51.3	38.4	28.3	28.5	58.4	53.7	37.9	36.5	40.0	69.5	46.1	25.0	35.9	67.4	45.8	51.8
medium	24.4	36.3	19.2	35.7	24.2	35.2	11.1	14.3	4.2	15.2	10.5	25.0	4.6	15.9	16.5	25.4
low	7.5	14.5	12.7	21.4	5.6	5.6	0.9	6.4	0	1.5	11.6	25.0	0.6	3.0	6.4	8.1
Very low	0	2.7	4.3	0	0	0	0	0	0	1.5	5.6	0	0	0.7	1.2	1.6
Germination																
Good	20.2	17.9	46.8	21.4	17.7	40.7	63.9	71.4	54.7	26.1	47.7	100	59.5	17.4	15.1	25.7
fair	65.9	61.9	36.8	57.1	63.3	44.4	32.4	19.0	42.1	65.9	35.6	0	39.2	74.2	79.9	60.4
poor	11.1	17.3	9.2	21.4	14.1	9.2	1.8	7.9	3.1	7.3	11.1	0	0.6	6.8	3.5	11.7
Very poor	2.6	2.7	7.0	0	4.8	5.6	1.8	1.5	0	0.7	5.6	0	0.6	1.5	1.4	2.0
Vigour																
Good	19.2	13.5	46.8	21.4	10.8	27.7	56.5	61.9	55.7	22.5	45.6	100	60.1	17.4	35.0	21.6
fair	61.9	52.3	35.5	50.0	69.7	51.8	38.9	26.9	42.1	68.1	36.1	0	39.2	72.7	50.9	58.1
poor	16.5	29.4	10.6	21.4	15.7	14.8	2.7	9.5	2.1	9.4	11.6	0	0.6	8.3	10.7	17.8
Very poor	2.4	4.8	7.1	7.1	3.6	5.6	1.8	1.6	0	0	6.1	0	0	1.5	3.2	2.9
Yield																
Very good	18.0	9.3	34.7	14.3	15.3	12.9	56.4	47.6	54.7	14.5	31.7	50.0	57.5	16.6	31.8	15.4
good	54.5	46.0	30.5	28.6	58.8	38.9	37.9	28.6	43.1	63.0	38.3	50.0	39.8	74.2	46.6	53.4
Fair	20.7	35.3	21.9	35.7	18.5	37.0	2.7	15.9	2.1	18.1	15.5	0	2.6	7.5	14.6	24.3
Poor	6.7	9.3	12.7	21.4	7.3	11.1	2.7	7.9	0	4.3	14.4	0	0	1.5	6.9	6.7
Yield trend																
Increased	54.5	20.0	43.3	35.7	55.6	48.2	86.1	58.7	80.0	32.6	46.1	50.0	81.1	33.3	59.5	31.4
Not changed	12.7	25.9	5.7	7.1	1.6	5.6	7.4	22.2	17.8	40.5	3.3	25.0	13.1	47.7	8.6	30.7
Decreased	28.7	23.2	31.9	28.6	18.5	29.6	2.7	11.1	2.1	8.7	36.1	25.0	3.9	7.6	20.8	16.7
Fluctuates	3.9	30.8	19.4	28.6	24.6	16.7	3.7	7.9	0	18.1	14.4	0	1.9	11.4	10.9	21.1

Indicator	Beans		Rice		Potato		Soybean		sesame		G/nuts		Cassava		All crops	
	QDS	Others*	QDS	Others	QDS	Others	QDS	Others	QDS	Others	QDS	Others**	QDS	Others	QDS	Others
Market trend																
Increased	74.7	24.9	26.9	14.3	65.3	72.2	87.0	74.6	69.5	33.3	44.4	100	72.5	23.4	63.3	34.2
Not changed	11.9	26.9	11.4	21.4	3.2	5.5	4.6	11.1	23.2	25.4	16.1	0	16.3	31.8	12.0	24.1
Decreased	2.9	6.3	26.9	7.1	4.0	3.7	3.7	4.7	3.2	7.3	25.0	0	5.8	21.9	9.2	9.8
Fluctuates	10.3	41.8	34.7	57.1	27.2	18.5	2.7	9.5	4.2	34.1	14.4	0	5.2	22.7	15.4	32.4
Income trend																
Increased	58.2	18.3	40.4	28.7	55.6	35.2	87.1	61.9	78.9	24.6	46.1	75	79.1	31.8	60.5	27.4
Not changed	11.4	28.0	4.9	7.1	1.6	7.4	4.6	19.0	17.8	26.1	6.1	0	16.9	36.4	8.6	26.3
Decreased	25.0	17.3	31.9	28.6	18.5	31.5	6.4	9.5	1.1	10.8	33.8	0	1.9	13.6	19.5	16.1
Fluctuates	5.3	36.3	22.7	35.7	24.2	25.9	1.8	9.5	2.1	38.4	13.9	25	1.9	18.1	11.3	30.1
Recommended for use	88.3	52.6	81.5	64.2	87.1	70.3	97.2	84.1	100	63.7	83.3	50	98.7	72.7	64.2	63.6

*Others include home saved and market seed. ** Only four respondents

3.7 The impact of LSBs on crop yields

One key outcome of using quality seed is high yields. We compared farmers' yields before and after using QDS. The results presented in Table 3.30 indicate significant differences in yields for all the crops. The highest percentage change is for cassava (80.8%) followed by potato (75.8%) and soybean (73%), while the least recorded percentage in yield change is 6% for rice. These results suggest that QDS produced by LSBs have significantly contributed to increased use of quality seed by the farming communities and correspondingly increased yields. However, the yields are still low compared to expected yield. This is because crop yields are affected by a number of other factors which could be seed- or not seed-related. For example, Tekkara et al. (2017) attributed 2.3% of variation in beans yield to the amount of seed and acreage planted. This means that even if farmers accessed and planted QDS but in inadequate amounts, the yields would still be below expected levels. Over-recycling of QDS is also another factor; some smallholder farmers do not frequently change their seed stock. For example, the average period after which seed is replaced is 7 seasons for groundnuts and 5 seasons for rice, whilst the quality of QDS remains for up to 3 seasons. Beans, potato and cassava are replaced on average after 3 seasons and soybean after 2 season.

Table 3. 30: Changes in crop yields attributed to use of QDS

Crop	Acreage /season		Seed rate/acre		Average yield/acre		% change in yield	t-values (yields)
	Before using seed type	Using seed type	Before using seed type	Using seed type	Before using seed type	Using seed type		
Beans								
QDS	0.8 (0.7)	1.0 (1.8)	35.3 (19.7)	34.7 (19.0)	270 (232)	302 (267)	11.8	1.35*
Other seeds	0.8 (0.7)	1.0 (2.7)	25.9 (12.4)	26.9 (11.8)	296 (176)	267 (306)	9.7	
Rice								
QDS	1.6 (4.2)	1.4 (1.2)	30 (11)	25.8 (11.5)	890 (382)	944 (424)	6.0	2.20**
Other seeds	0.9 0.7)	0.9 (0.8)	30.8 (10.1)	31.3 (10.4)	767 (228)	752 (226)	1.9	
Potato								
QDS	0.7 (1.4)	1.0 (1.0)	243 (184)	411 (351)	1135 (1787)	1996 (2026)	75.8	7.35***
Other seeds	0.8 (0.7)	1 (0.7)	253 (144)	308 (228)	1114 (1291)	1748 (2064)	56.9	

Crop	Acreage /season		Seed rate/acre		Average yield/acre		% change in yield	t-values (yields)
	Before using seed type	Using seed type	Before using seed type	Using seed type	Before using seed type	Using seed type		
Soybean								
QDS	4.2 (10)	1.9	20.3 (12.5)	18.4 (10)	304 (225)	526 (289)	73.0	1.77**
Other seeds	2.7 (5.4)	0.7 (1.0)	18.8 (10.8)	5.0 (9.2)	352 (170)	322 (185)	-8.5	
Sesame								
QDS	2.0 (3.8)	1.8 (2.7)	8.4 (5.2)	6.7 (4.5)	239 (147)	284 (192)	18.8	3.31***
Other seeds	1.5 (1.1)	1.5 (1.5)	6.9 (3.5)	8.2 (3.5)	177 (134)	175 (129)	-1.1	
Groundnut*								
QDS	1 (0.6)	1 (0.5)	30 (16.5)	26.5 (13.5)	230 (57.7)	296 (216)	28.6	0.98
Cassava								
QDS	1.4 (0.9)	1.8 (0.8)	8.1 (3.7)	7.2 (3.3)	1303 (415)	2356 (900)	80.8	6.72***
Other seeds	1.8 (2.6)	1.6 (1.3)	7.1 (3.3)	6.1 (1.9)	920 (279)	1252 (519)	36.0	

*Groundnut lacks enough observations for other seeds

To understand the contribution of QDS from LSBs on crop yields, we estimated the average treatment effects on those farmers who use bean and potato QDS as a case. For this particular analysis, we considered farmers who have ever used QDS as treated and those who have never as the control group. The results are summarised in Table 3.31. The other crops had few observations to get enough matches and therefore were left out. Results show a negative ATT for beans while that for potato is positive. We found no statistical significant effect of using QDS on yields for both crops. The results are consistent using different matching methods. These results should be interpreted with caution, as they do not mean that QDS does not increase yields. These results are explained by various factors; since some of the seed is sold as grain it is likely that there are farmers who have unknowingly used QDS from the market or from their fellow farmers. The other explanation especially for beans is that QDS is still good quality seed up to three seasons. However, the average yields are very low compared to potential yield of up to 900kg per

acre even for those who claim to use QDS. This is because there are other factors that affect yield outcomes apart from seed quality. Farmers mentioned challenges of extreme weather conditions, diseases and exhausted soils.

Table 3. 31: Average treatment effects of using QDS on crop yields

Crop	Matching algorithm	Number of beneficiaries	Number of control	Mean yield beneficiaries	ATT (SE)	t-value
Beans	Kernel matching	116	455	237	-23.4 (34.4)	0.496
	Radius matching (caliper =0.09)	116	455	236	-30.5 (25.8)	-1.04
Potato	Kernel matching	146	106	2784	23.6 (274.9)	0.931
	Radius matching (caliper =0.09)	147	106	2,828	112.8 (342.9)	0.74

Note; the outcome indicator is yield per acre; standard errors in parenthesis

The other positive impact on seed quality attributed to ISSD Plus is the decreasing trend of fake seeds. During the interviews with farmers, we noted that a majority of smallholder farmers were aware of the important attributes of quality seed. They had been trained and sensitised on how to identify genuine quality seeds. For instance, in Kigezi region Caritas, one of the business partners, has created awareness among farmers. Farmers are taught how to check on the packaging bag for expiry dates, how to look for certified agro-input dealers, demanding to get a receipt from the agro-input dealers and reporting to authorities in case of poor inputs. This has ultimately reduced fake seed on the market.

3.8 Relevance, effectiveness, efficiency and sustainability of LSBs in the seed sector

3.8.1 Relevance of LSBs

The main purpose of establishing LSBs was to avail quality seed to rural farm households. The target was rural households who have limited access to quality seed due to their location and resources but also due to lack of quality seed of key crops that have not received attention from seed companies. To what extent is the ISSD LSB approach consistent with the agriculture and national seed policies?

The concept of local seed businesses is consistent with the current national seed policy. It contributes to achieving the national objectives in line with priority area 3.2.2 (MAAIF, 2018) by producing QDS to reduce the use of home-saved seeds for crops that have low profit margins for seed companies as a transition into the formal seed system. The crops and varieties (iron rich bean varieties and oil crops; sesame and soybean) promoted by LSBs equally support the national strategy of promoting and building capacity of market-oriented farmers to produce, use and market quality seed focusing on crops and varieties with high food security and nutrition value. Moreover, LSBs address one key challenge of low production and productivity caused by limited use of quality seed identified in the National agricultural policy 2013.

In all the districts, the LSBs are producing seed of farmers' priority crops. Out of 303 LSBs initiated and supported by the ISSD Plus project (2016-2020), some 215 (70.9%) are operating implying that they have customers and therefore important for the communities. In the 215 LSBs, over 2,400 farmers are involved in seed production and about 35% of the sampled farmers have used QDS produced by LSBs. The QDS produced by LSBs provide an alternative for rural smallholders who do not have access to certified seed because of limited availability and/or high costs but also because LSBs provide quality seed for those crops that have been neglected by seed companies. Across the different categories of our respondents, the ISSD approach of working with LSBs is highly commended and ISSD supported LSBs have provided an entry point for other NGOs and government projects involved in seed production. They all prefer to work with groups involved in local seed businesses that have been supported by ISSD project.

3.8.2 Effectiveness of LSBs

The ISSD supported LSBs aimed to increase availability, access and affordability of high quality seed to rural smallholder farmers. The number of LSBs in seed production has been increasing over time; from 104 in the 2017 reporting period to 179 in 2018; in 2018 six new LSBs were established by Outscaling partners (OSPs), and in 2019 other 24 LSBs were established by self-funded OSPs (Oyee et al., 2020; Mastenbroek et al., 2019), an indication that the QDS business is growing. From ISSD records, since 2016, the project has initiated a total of 303 LSBs. An evaluation by ISSD shows that in 2019, 215 groups (70.9%) were producing QDS though at different levels; 16 % performed very well, 27% performed well, 44% performed fairly well and 13% performed poorly. The rating is based on acreage under seed production, revenue, access to land and storage facilities, consistent production and group marketing as well as investment in seed production. A total of 62 (28.8%) LSB groups were dropped. Table 3.32 shows that ISSD achieved less than 50% of the targets for number

of farmers producing QDS and the acreage planted with QDS. This might be attributed to the fact that ISSD over relied on other, out scaling partners to carry out most of the field activities. Since the OSPs also have their other objectives, they may not commit fully towards achieving the targets of ISSD. Furthermore, it takes time and effort to bring LSBs up to a professional level.

Table 3.32: Acreage and number of farmers producing and selling QDS, 2018 -2019

Target	2017	2018	2019	Percentage growth
Number of farmers				
Target	5000	6,500	7,500	
Achieved	-	1,421	2,405	69.2
Percentage	0	21.8	32.0	
Acreage planted with QDS (acres)				
Target	50,000	75,000	100,000	
Achieved	39,699	42,217	38,066	-9.8
Percentage achieved	79.3	56.2	38.0	

Source: ISSD report (Mastenbroek et al., 2019; Oyee et al., 2020)

Among the LSBs visited during the survey, about 15 to 20 farmers per group with an average membership of 26 farmers are able to produce QDS. Our findings match with ISSD records which show that about 44% of LSBs have not performed to ISSD expectations. The major limitations mentioned include limited land (farmers have small land holdings and the soils are exhausted) and lack of money to purchase foundation seed (FS). Nevertheless, the LSB approach has been highly commended by all our respondents including farmers and other stakeholders in the seed sector. There is clear evidence that LSBs have greatly contributed to quality seed availability of OPV crops which have long been neglected by registered seed companies. For example, there is no certified seed of groundnuts, potato and cassava planting material apart from QDS by LSBs. For beans in South Western Uganda there is CEDO (a seed company in Lwengo district), but still some of the bean seed is sourced from LSBs. From the focus group discussions there was a general consensus that the quantities were not sufficient and that the coverage should be increased.

3.8.3 Efficiency of LSBs

Efficiency is very important for any business to be competitive in a given sector. We attempted to assess how best LSBs engaged in production and marketing QDS are using their resources to maximise benefits and reduce costs. The challenge is that most of the costs associated with seed production and marketing are incurred by individual farmers whose data we are lacking so we are not able to do a cost benefit analysis. Nevertheless,

we used costs of 2019A to get insights on costs incurred by the LSBs vis-a- vis the benefits associated. Table 3.33 presents the average costs incurred by the LSBs. The costs include cost of foundation seed (FS), fertilizer, other chemicals (pesticides, etc.), seed inspection, labour, wages, utilities (electricity, water etc.), taxes/licence, transport, communication and rent. Cassava seed has the highest unit cost of production (UGX16,000 per bag of cuttings) and the lowest unit profit ratio (0.41). Sesame has the lowest cost (UGX77/kg) and the highest unit profit ratio (0.98).

Table 3.33: Average quantities bulked, costs and prices by LSBs per season (2019A)

Crop	Beans	Potato	Rice	Soybean	Sesame	Groundnuts	Cassava*
Quantity bulked (kg)	1,467	6,502	857	1,133	9,594	1,604	636
Estimated cost (UGX/kg)	1,373	629	1,718	800	77	2,080	16,000
Average selling price (UGX/kg)	3,900	1,600	2,950	3,500	4,700	4,000	27,000
Unit profit ratio	0.65	0.61	0.42	0.77	0.98	0.48	0.41

*The unit for cassava is bags

3.8.4 Sustainability of LSBs

Is the contribution of LSBs to the seed sector sustainable? Projects contribute significantly to growth in areas in which they are executed. However, often times achieving a systemic change of the intervention becomes difficult. When funding of a project stops, often the communities are not able to continue with the innovations. We asked farmers engaged in LSBs, key informants and the farming communities whether LSBs are sustainable after the ISSD Plus project.

A majority of our respondents believe that some of the LSBs will continue to produce QDS. However, they added that new LSBs (those established under ISSD Plus project) have not yet reached self-sustaining stage; they still need strengthening so as to get profits which will motivate them to stay in seed business. The fact that LSB objectives are well aligned with the national priorities by producing seed of national and farmer priority crops provides them a sustainable market. It has also attracted support from various institutions which can help them to sustainably produce for the market. However, to ensure sustainability and a greater impact, all the stakeholders will need coordination which is currently offered by ISSD. Table 3.34 shows the different institutions currently supporting farmer groups involved in LSBs. Most of the institutions/NGOs are involved in training farmers in good agronomic practices while a few have built them stores.

Table 3. 34: Other institutions supporting seed production

Institution	Crop supported	Region	Support provided
District local governments, NAADS, OWC	All crops	All regions	Seed inspection and extension services (training in GAPs), provides market for seed
NARO	All crops	All regions	Foundation seed
SASAKAWA	Beans, groundnut, maize, millet and sorghum	Ankole	Training farmers
SNV	Potato, beans	Kigezi, Rwenzori	Training farmers
Self-Help Africa	Potato	Kigezi	Training farmers
AgroMax	Potato	Kigezi	Provide foundation seed
IFDC	Potato, rice	Kigezi, Eastern	Built stores, training in GAP and farming as a business, provides fertilizer
CARE	Potato	Kigezi	Built stores and training
Caritas	Potato	Kigezi	Training in GAP, built stores, inspection fee
FIEFOC (a World Bank project)	Rice	Eastern	Constructed infrastructure
ACDP	Rice	Eastern	Provide market for seed, built stores
JICA	Rice	Eastern	Training in GAP and provided threshers
World Vision	Soybean, cassava	Northern, west Nile	Provided FS
DINO project (a government project)	Sesame	West Nile	They buy seed
Agro-Exim,	Sesame	West Nile	Provide market
CARD Uganda	Groundnut	Eastern	Training farmers
ATAFA	Groundnut	Eastern	Provides seed
VEDCO	Groundnut	Eastern	Provide seed for multiplication
Harvest Plus	Groundnut	Eastern	Training in post-harvest handling
GIZ	Groundnut, Beans	Eastern, Ankole	Training, linking farmers to the market, sponsored irrigation systems
MBADIFA	Beans	Ankole	Training farmers in GAP
Aponye	Beans	Rwenzori	Training in GAP and farming as a business
Mmacks	Beans	Rwenzori	Provides market for seed

The farmer groups we interacted with believe that they have acquired sufficient knowledge to enable them to continue producing seed of different crops. However, they maintain that continuous training will be required. In some districts some extension workers and other members of the community were trained in seed production. If these trained personnel are facilitated and well-coordinated, they can facilitate continuation of the LSBs. Further, we noted that LSBs have established governance structures including committees with different responsibilities within the groups. For example, they have quality assurance, record keeping and marketing committees. The committees help the groups in purchasing inputs especially foundation seed, maintaining quality and marketing QDS. Our findings reveal that there is increased awareness on the importance of quality seed among the communities. Although there is still need for sensitization, a considerable proportion of farmers, above 50% across the various districts, appreciate the difference between QDS and seed from other sources. This has been attributed to seed fairs by LSBs.

Our findings also indicate that new groups have been formed while others have applied to start seed production based on experience from the ISSD supported LSBs, an indicator that LSB are likely to continue supplying QDS. For instance, in Kigezi region, 3 groups in Kabale and 2 groups in Kisoro have applied to Caritas Uganda to support them to start producing seed. In Rubanda district, a total of 22 groups (including Muchirwa farmers' group and Kigumira farmer group) grow seed for potato, beans and coffee. In Kisoro district, Nsanza and Bugala farmer groups have also adopted the LSB model for production of climbing beans seed. In Arua district, 3 more groups have also adopted the LSB model for producing soybean.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

This report presents evidence from various data sources to answer the key questions on availability, accessibility and affordability of quality seed to farmers, how LSBs have contributed to the seed sector, and the general quality of seed on the market.

Seed availability: in the last three years the supply of QDS by LSBs has been steadily increasing with small variations across the different crops and regions. Much as QDS is available in some communities where the LSBs are located, the quantities produced and supplied is inadequate and not available to a majority of the smallholder farmers. The supply-demand gap is partly widened by the fact that a substantial amount (up to 20%) of the seed is not reserved and sold as seed but as grain for home consumption. Other key factors affecting the supply of quality seed by LSBs include limited access to foundation seed (FS), quality of FS, limited land and limited capital.

Seed Accessibility: There are various sources of seed including LSBs, home saved, neighbours/friends/relatives, local markets, agro-dealers/seed companies, NGOs, and the government from which the smallholder farmers access seed. Home saved and local market are the farmer' most common sources, mainly for local varieties which the majority of the farmers grow. Across the crops, LSBs have significantly improved access to quality seed in their neighbourhoods, evidenced by the significantly higher proportion of beneficiary farmers using seed from LSBs compared to the control group. Access to QDS is constrained by, among others, limited availability of the seed (distant sources), low income for smallholder farmers that hinders affordability, farmers' lack of awareness about access points, lack of awareness that use of QDS can result into higher yields and incomes, and farmers' belief that their home saved seed is of good quality.

Affordability of QDS: The prices of QDS are lower than prices for certified seed indicating that LSBs have significantly contributed to increased affordability of quality seed. Nonetheless, there is a perception that QDS is expensive and unaffordable by the majority smallholder farmers due to lack of knowledge that it gives higher returns in terms of yields and income. Generally, prices of QDS are relatively low and closer to grain prices at farm gate level compared to the LSB stores which could be an incentive for farmers to buy QDS if more LSB farmers engage in seed production; however, quality control aspects as well as profitability need to be kept in mind. The key factors that influence affordability of QDS are mainly farmers' low income and seed market prices that are relatively higher than other alternative seed.

Seed Quality: The LSB approach is contributing significantly to the seed sector in terms of producing quality seed which farmers rate as the best on the market. The yields farmers get from using the QDS are significantly higher than what they used to get before, further suggesting that QDS produced by LSBs have significantly contributed to increased use of quality seed by the farming communities.

Based on the fact that LSB objectives are well aligned with the national priorities by producing seed of national and farmer priority crops, the steadily increasing number of LSBs producing seed profitably, and the increasing participation of various institutions in the LSB model, we conclude that the approach is sustainable. However, the impact will be greater if all the stakeholders are coordinated, a service currently offered by ISSD.

However, production and supply levels of QDS are still too low to fulfil the demand attributed partly to the lack of financial resources to buy foundation seed and put in the necessary storage facilities, constrained access to (quality) foundation seed, and shortage of land.

4.2 Recommendations

Based on the findings of our evaluation, we recommend the following in order to increase availability, accessibility and affordability of quality seed among the farming communities:

In order to increase availability of quality seed:

i. LSBs could partner with trusted local Savings and Credit Cooperatives (SACCOs) and be linked to microfinance support Centres so as to access affordable credit to increase their capital investment in QDS production and marketing.

ii. The structure and legality of LSBs should be streamlined to allow them to operate as independent entities to manage and execute contracts with other organizations that may increase their leverage for sustainability.

iii. Access to FS is still a big problem, we recommend decentralized multiplication of foundation by identifying and training more LSB farmers to multiply FS.

iv. In addition, there is need for Agricultural Research Institutes that can provide foundation seed on time and in desired quantities and of good quality to strengthen their linkages and partnerships with LSBs and other stakeholders.

v. Government projects and NGOs that provide seed to farmers could directly contract farmer groups (LSBs) to supply seed instead of contracting businessmen or purchasing from seed companies who actually buy from LSBs at a relatively cheaper price. This would encourage farmers to produce more QDS.

vi. There is need to engage local governments (specifically Districts Production Departments) to incorporate seed production activities in their budget. This is important for scaling out and for sustainability but also for reducing cost of production specifically inspection fee which LSBs feel should be paid by government.

In order to increase access to quality seed:

vii. Further sensitization with emphasis on demonstration gardens that exhibit the difference between QDS of improved varieties and home saved/market seed can increase awareness and consequently adoption of QDS.

viii. Formation of partnerships at local economy between local governments, NGOs and private sector players to sensitize farmers about the importance of using quality seed.

ix. Reliable markets for grain will encourage farmers to invest in quality seed. There is need to develop the grain value chain by engaging key stakeholders and actors including NGOs, local agro-processing industries and schools that purchase grain with strict quality standards thus creating backward linkage for quality seed.

x. Whereas QDS is generally known to be of high quality, some farmers have been discouraged from buying QDS because of the bad experience they have from poor quality certified seed which they sometimes receive from government (e.g. OWC). Clearly specified and well developed seed value chains with registered actors at each node will greatly contribute to quality of seed on the market and encourage farmers to adopt QDS.

xi. Continuous farmer training and sensitisation on how to identify genuine quality seeds should be carried out. At the same time, national level campaigns against fake seed and how they should be eliminated from the seed value chain should be mounted by the Ministry of Agriculture, Animal Industry and Fisheries in partnership with the key stakeholders promoting the seed value chain in the country.

xii. Since LSBs are still very few, continuous seed fairs should be maintained to create more awareness about improved quality seed.

xiii. More farmer groups at local government in all regions should be formed, trained and enrolled into LSBs that are certified for QDS production to increase access to quality seed by majority of farmers.

In order to improve affordability of QDS:

xiv. Subsidising QDS production (reduced cost of FS, fertilizer and pesticides, inspection fee) may significantly reduce the costs and ultimately the price of QDS hence enable more farmers to afford.

xv. Provision of low cost agricultural credit with a grace period for farmers may encourage farmers to invest in QDS.

xvi. Awareness should be created among the farmers about the extra benefits QDS has over the low quality seed. This will clear farmers' perceptions that QDS is expensive and unaffordable which is based on limited knowledge about yield and income benefits of using QDS.

xvii. Finally, in order to ensure sustainability and a greater impact on availability, accessibility and affordability of QDS, all the stakeholders in the seed value chain should be coordinated; ISSD and MAAIF could take lead in initiating the necessary coordination.

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ANNEXES

Annex 1: Case Studies/Success Stories

i. Potato

The Chairperson of Murugesi Tubehamwe Group that runs a potato LSB in Rubanda district is one of the biggest producer of potato Quality Declared Seed among the group members. She mainly grows Rwangume and Victoria varieties. She intimated that, before ISSD introduced the LSB model accessing quality seed was a big problem. She used to plant home saved seed and get low yields because it was poor quality seed. She used to plant 10bags of 100kg per bag of potato seed in one acre and harvest only 40 bags of 100kg per bag. But now, she plants 10bags of foundation seed and harvests 60bags of QDS from one acre. She has learnt the skills of farming as a business from the LSB and keeps records of her seed production. In 2018 during the first season, she planted 3bags of Victoria variety and harvested 19 bags of QDS (1 bag of 80kg) equivalent to 1.5 tons. In 2019 season B, she planted 5 bags of Rwangume and harvested 30 bags of QDS equivalent to 3 tons.

A bag of 100kg of seed (QDS) costs UGX 180,000 while same bag of home saved costs UGX 130,000 on average. She said that her earnings from potatoes (QDS) have significantly increased since she started production of QDS. She estimates her income to have increased from 40% before engaging in QDS production to 60%. Her main challenge is shortage of land and high cost of inputs required to produce QDS. She affirms that LSBs have improved availability of quality seed, increased incomes of households involved in seed production and has influenced the price of seed in the community.

ii. Rice

Namunasa Stream Rice Farmer Group is an LSB group found in Mazimasa Sub County in Butaleja District in Eastern Uganda. The group currently has 135 members growing rice as their main crop. However, Rice QDS is produced by only about 20 – 30% of the group members. Before ISSD intervention, farmers had a challenge of failure to access improved varieties, seed quality was very poor, the yield was low and generally, farmers' income was low. Before the LSBs were established farmers planted 30kg of seed in one acre and harvested one-tonne of rice of local variety. However, with WITA 9 QDS farmers plant 20kg in one acre and harvest between 1.3 – 1.8 tons of rice. For the last 2.5 years, the group has increased rice QDS from 10.8 tonnes in 2018 season A to 38 tons in 2019 although it reduced to 32.3 tons in season A of 2020. The group has increased revenue from UGX 27

million to UGX 80.75 million. The price of QDS is now UGX. 2500 per kg, while that of local varieties is UGX1600 per kg.

The main buyers include Busoga seed solution which buys about 45%, and others include the local community, Agriculture Cluster Development Project (ACDP), and Clone seed in Mukono. In his own analysis, the chairperson of the group claims that the LBS has increased seed availability from 20% to currently 60% while seed accessibility has changed from 10% to 40% within his sub county.

iii. Groundnuts

The Chairperson of Aye Medo Ngega farmer's cooperative which mainly produces ground nut seed in Amwoma Sub County, Dokolo District in Northern Uganda. The retired civil engineer, is an experienced seed producer who started by producing hybrid seed for 'Uganda seed' in 1998, and then produced rice seed for FAO also during the same time. His LSB group started dealing with ISSD in 2012 and that's when he received intensive training in ground nuts seed production. Since 2013, he has been planting ground nuts seed on at least 8 acres per season. In addition, he grows Simsim and Cassava seed.

Currently he grows serenut 14 because it is on high demand. Serenut 14R has big seed with a lot of oil. He started with serenut 6, 7 and finally 8R before serenut 14. He harvests between 90 and 100 bags per season. Each bag weights about 42kg. On average, it costs him UGX 1,600,000 to produce groundnuts on an acre. The average price per bag of 42kg is UGX 200,000. He harvests between 15-16bags in one acre each weighing 42 kg. This translates to approximately 5 tonnes of groundnut seed per season. He has a wide range of customers especially civil servants who book the seed before harvest. His customers come from; Dokolo, Lira, Oyam, Gulu and Nwoya. "I send them seed on a bus and they pay me through mobile money or sometimes, through the group's account". He keeps records from planting date to harvesting and this helps him to track the inputs used as well as costs.

iv. Sesame

Maecora cooperative society is a farmer group in Arua registered as a local seed business producing quality declared seed for sesame. The group has 206 members with 86 members growing seed for sesame, 50 members grow soybean seeds and 60 members grow cassava. The group started growing quality declared seed so as to improve their incomes and to increase food and nutrition in the sub county. The sub county initially faced a problem of fake seed before ISSD intervention and farmers did not have sources of quality seed. Farmers reported that the LSB model increased their access to improved varieties like

sesame 2 and 3 for sesame, Maksoy 3N and Maksoy 4N for soybean and Narocas 1 for cassava. This has increased availability and accessibility of quality declared seeds by farmers in the community. For example, the group is able to produce up to 3 tons of sesame QDS per season. About 40%of the seed is sold to SHEARS, 30% to local farmers and 30% to Gulu Agricultural Development Company (GADCO). Farmers in the group have been able to access better markets due to sell of high-quality seeds. The price margin that farmers get from selling QDS is high ie QDS for sesame costs UGX 10,000 per kg while grain costs UGX 5000 per kg, QDS for Soybean (Maksoy) costs UGX 6000 per kg while grain costs UGX 3000 per kg. This has increased their incomes. Farmers in the LSB appreciate the LSB model because of the training on seed production they receive and they also have access to foundation seed despite the challenges. Farmer groups have also been supported in different ways by a number of institutions like Nile pro, WENEPs, MAAIF, Local government (capacity building), ISSD, World bank, NURI (capacity building), NIGI (capacity building on food and nutrition), ACDP (provide stores).

v. Cassava

Aratarach farmers' cooperative society is an LSB located in Nebbi district in Kucwiny Sub County. The group has 320 farmers and the group policy is, each farmer is supposed to plant at least an acre of cassava. Previously, farmers did not have access to quality planting material but only accessed cassava cuttings from OWC that has supplied cassava planting material for the last 3 years or so, farmers mainly used home saved cassava cuttings and local varieties. The yield from home saved planting material and local varieties was low, for example if a farmer planted 8 bags of cuttings per acre, they harvested 20 bags of cassava. But after ISSD intervention, availability of and access to high quality varieties of cassava cuttings has improved. The LSB now grows improved varieties for cassava specifically NAROcas1 and NASE 19. The yields have improved, if a farmer plants 8 bags of QDS (NASE19) per acre, they harvest 200 bags of cassava. Group members earn a higher price margin from the sale of QDS. QDS for Cassava costs UGX 35,000 per bag while local planting material for cassava costs UGX 15,000 to UGX 20,000 per bag. Apart from earning more money from seed production, the farmer group has obtained extra support from institutions like NARO, ACDP, OWC and IFAD. Despite benefits obtained from the LSB model, these LSBs also face a number of challenges which have hampered production e.g. poor weather, too much sunshine which affects production, and unreliable market for seed.

vi. Soybean

Okanyu Can (LSB) is a group of farmers in Lira district. The group consists of 28 members who produce QDS of Soybean. The LSB farmer they were trained by ISSD in 2016 and started production in 2017. They mainly grow Maksoy 3N and Maksoy6N varieties and they get foundation seed from Makerere University. A kg of soybean foundation seed costs UGX 6000. The production of QDS has been steadily increasing; the group started with only 65kg foundation seed, the following season they purchased 110kg and in the 3rd season (2020A) they managed to purchase 551kg.

The LSB farmers of Okanyu Can group have high preference for Maksoy6N, they said that Maksoy6N is high yielding and on average, yields 7-8bags per acre. Each bag has an average weight of 115-120kg. This is equivalent to about 960kg per acre. Maksoy6N produces many pods, big seed size, grows tall, has a uniform color and its high quality seed. In 2018 B, and 2019 B, Okanyu Can LSB harvested 480kg and 600kg respectively of clean sorted seed of soybean which they sold at shs3000/kg. This translates to UGX 1,800,000. They package seed in 5kg packs and according to demand.

The chairperson of the group boosted of the ready market for QDS and said they can only afford satisfying 50% of that demand. She indicated that farmers are advised to sell through the groups to increase their bargaining power. However, if the individual farmer finds a better market, he/she is free to sell after taking record of the kilograms harvested otherwise, LSB farmers are required to bring 80% of the seed to the store and 20% can be retained for the farmers' seed and or sold out as grain. The group testified that QDS has improved their livelihoods because of the good prices. They are however, challenged by high cost of foundation seed and distance to the source of seed. They also lack storage facility for their produce therefore, incurring high cost on rent.

vii. Beans

Rwebishekye Farmers' Cooperative Society is an LSB located in Mbarara District, in Rwanyamahembe Sub County. This Local Seed Business (LSB) has 33 group members who are all growers of beans seed and the group constitutes of only women. Before joining the group, farmers had a challenges of prevalence high poverty rate and low incomes from produce. With ISSD intervention of the LSB model, the group started growing improved varieties of beans and have learnt better methods of farming. Currently, the group mainly grows QDS for NABE16 variety. Previously, a farmer would plant 30kg of bean grain and harvest utmost 200kg, but now after receiving training from ISSD, one can plant 30kg of NABE16 in one acre and harvest at least 500kg of beans. The LSB produces about 1.1 tonnes per season.

The LSB farmers have been linked to markets, they bulk their seed and sell collectively. Unfortunately, instead of farmers within the community, their main customer is Mr. Hakim Mugisha, a produce trader in Kampala. It would be interesting to know whether this trader sells the QDS as seed or as grain. The LSB farmers have benefited through increased incomes, they have formed a village savings and credit association (VSLA) using profits from the sale of QDS and they can easily access credit which they invest in farming. Some challenges faced by farmers include shortage of land which has hampered production of seed, hiring laborers in the area is very expensive, unreliable weather conditions with extreme sunshine and erratic rains, high rate of mixed foundation seed that leads to a loss of about 20% after sorting and high cost of the foundation seed.

Annex 2: Questionnaires and checklists

Annex 2.1: HOUSEHOLD SURVEY QUESTIONNAIRE

Access to Seed Household Survey

PREAMBLE

The Integrated Seed Sector Development (ISSD) Plus Project is a 4-year project coordinated by the Centre for Development Innovation (CDI) and funded by the Embassy of the Kingdom of the Netherlands, Kampala. The project is implemented by Wageningen UR Uganda in collaboration with the National Agricultural Research Organisation (NARO) for public varieties and food crops, the Ministry of Agriculture Animal Industry and Fisheries (MAAIF), and private sector for vegetable seed. The programme aims to strengthen the development of a vibrant, pluralistic and market-oriented seed sector that is able to address key challenges that hamper the growth of the seed sector d in Uganda. ISSD Plus project has four components: a) addressing bottlenecks in early generation seed (EGS) and creating an enabling environment for the seed sector; b) enhancing the Quality Declared Seed (QDS) system through supporting Local Seed Businesses (LSBs); c) promotion of uptake of quality seed, and d) promoting the use of advanced vegetable varieties.

This questionnaire is designed to capture data and information that will enable ISSD to understand how and to what extent the LSBs intervention has contributed to farmers' access to QDS, increased seed availability and affordability by the smallholder farmers as well as LSBs contribution to improving seed quality. The overall objective is to document successful interventions in bridging the huge gap that exists between the formal and farmer seed supply systems in the country.

Household ID _____

Survey instrument

Information and data will be kept **in strict confidentiality and will only be used for ISSD objectives. Your maximum support and cooperation is highly needed in responding to questions below and providing correct information.**

Consent by the respondent to permission for using the information

Name of respondent_____

Respondent consents to participate in this survey

1. Yes (continue the interview)
2. No (Ask why, thank the respondent and terminate the interview)

If no, why? _____

I. GENERAL INFORMATION

1. Date of interview				
2. Name of supervisor				
3. Name of enumerator				
4. Name of respondent				
5. Category of household	1.Beneficiary 2.Control			
Location (to be coded)	6. Zone	7. District	8. Sub county	9. Village
10. Name of respondent	11. Person interviewed 1 Household head 2.Spouse 3.Farm manager	12. Sex of respondent 1. Male 2. Female	13. Telephone numbers 1 _____ 2 _____	14. Age of respondent/ farmer (years)
15. Marital status 1 Married 2 Not married	16. Education of the household head (yrs)	……	17. Education of the spouse (yrs)	……..

18. Type of household	1. Female Headed Household (FHH)* 2. Male Headed Household (MHH)

**FHH applies for where the woman is not married but living alone, woman is widowed, or the husband does not stay at home for most part of the year (at least during the growing season)*

Remarks_____

_____

_____

19. How many people live in your household including yourself _____

Category	**Number**	**Category**	**Number**
Children 0-5 years		Adult males (above 18 years)	
Children 5-18 years		Adult females (above 18 years)	

20. What is your main occupation 1. Farming 2. Nonfarm business 3 Gov't/NGO job 4 Others (specify)……..

21. What is your secondary activity 1. Farming 2. Nonfarm business 3. Gov't/NGO job 4. None

22. Do you belong to any farmers group that offer farming support e.g. inputs, advisory services etc? 1.Yes 2.No
23. What are those groups and what services/support have you received from the groups?

Group Name	Services received *(Use codes below the table-consider multiple responses)*	Supporting Institution *(use codes below the table)*

Service codes 1. Seed 2. other agro inputs 3. Training 4. Extension/advisory services 5. Produce marketing 6. Savings and credit 7. agricultural loans 8. Post harvest handling 9. agricultural tour 10. Others specify

Institution codes: 1. ISSD 2. Fellow farmers. 3. District farmers association 4 Other NGOs 5. NARO 6. Government Extension officer 7. NAADS/OWC 8. Others (specify)…..

24. How many acres in total land holding does the household own? ACRES_____
25. How many acres does the household use for crop production (including borrowed / hired land) ACRES_____

26. What is your **main** source of labour for crop production? 1. Hired labour 2. family labour
27. For how long have you been in crop farming business? ……..years
28. Do you have access to credit 1 Yes 2 No
29. What is your main source of money that you invest in crop production (buying inputs e,g seed, labour) 1. Crop farming 2. Livestock farming 3. Non farm business 4. Loans 5. Monthly salary 6. remittances 7. I don't spend money in crops 8. Others (specify……
30. Do you have access to extension services ? 1.Not at all 2. Sometimes 3 readily available

SECTION II: ADOPTION OF IMPROVED VARIETIES /QDS

1. *Which crops did you grow in 2019?* ***(ODK will select ONLY crops that apply in each region. For example, in Kigezi only potato will appear)***

1 Bean 2 Rice 3 Soybean 4 Potato 5 Sesame 6 Cassava 7 Ground nut

Season1 (**Feb-June**)						
Season 2 (**August – December**)						

VARIETIES GROWN IN 2019

2. Indicate which **variety** has been acquired, which can be either local or name of "improved" variety, <u>if more than one variety for each source, consider this then as different crop</u> (new line).

Varieties grown in 2019A season

Crop	Variety	Acreage	Source of seed	Qtty bought / planted (kg)	Purchase price /kg	Qtty harvested	Qtty consumed	Qtty given out for seed	Qtty wasted	Qtty sold (kg)	Sale price/ kg	Qtty saved for next season (kg)
Beans												
Rice												
Soybean												
Potato												
Sesame												
Cassava												
Ground nut												
Maize												

3. Varieties grown in 2019B season and utilization

Crop	Variety	Acreage	Source of seed	Qtty bought / planted (kg)	Purchase price /kg	Qtty harvested	Qtty consumed	Qtty given out	wasted	Qtty sold (kg)	Sale price/ kg	Qtty saved for next season (kg)
Beans												
Rice												
Soybean												
Potato												
Sesame												
Cassava												
Ground nut												
Maize												

Codes for crops	1=Bean 2 =Rice 3= Soybean 4=Potato 5= Sesame 6= Cassava 7= Ground nut
Codes for seed source	1=Own saved seed 2=Neighbour /friend/relative 3=local Market (e.g. shops, market) 4=Local Seed Business (see name p1) 5=Agro-dealer or Seed Company 6=Gov't extension NAADS/OWC 7=Project NGO 8=Others (specify)
CODES FOR VARIETIES:	
Beans-	1=NABE14, 2=NABE15, 3=NABE16, 4=NABE17, 5=NABE18, 6=NABE19,7=NABE20, 8=NABE21, 9=NABE12C, 10=NARO BEAN1, 11=NARO BEAN2, 12=NAROBEAN3, 13=NAROBEAN4C, 14=NAROBEAN5C 15 = Mixed local varieties 16 =Roba 1, 17 = RWR10 18=K132 19 = Ohers (specify)
Irish Potatoes-	1=Victoria, 2=Rwangume (NAROPOT4), 3=Kinigi 4= Kachpot 5= Rwashaki 6 =Other local varieties
Rice-	1=Upland rice, 2=Nerica4, 3=Nerica10, 4=Namche1, 5=Namche2, 6=Namche3, 7=Namche4, 8=Namche5 9= AR1189, 10=Nerica 1, 11= Nerica 6, 12= Superica 2, 13= witta 9, 14=Local variety 15=others
Soybeans-	1=Maksoy3N, 2=Maksoy4N, 3=Maksoy5N
Sesame	1. Sesame 1 2. Sesame 2 3. Sesame 3 4=local varieties
Cassava	1. NAROCAS 1 2. NASE 14 3. NASE 19 4= local varieties 5= others (specify)
Groundnut	1 Red beauty 2 . Serenut 11T 3. Serenut 12R 4. Serenut 13T 4 Serenut 14R 4 Serenut 2 5 Serenut 3R 6 Serenut 5R 7 Serenut 6T 8 Serenut 8R 9. Serenut 9T 10= Others (specify)
Maize	

4. For each crop indicate who in the household is responsible for… 1 Male 2. Female 3. Both

Crop	Purpose of the crop 1 Cash 2 food 3 Both	Who in the household is responsible for buying the seed?	Who in the household is responsible for using the seed?	Who in the household decides how much land to allocate for seed production?	Who in the household is responsible for marketing seed?
Bean					
Rice					
Soybean					
Potato					
Sesame					
Cassava					
Groundnut					
Maize					

SECTION III: AVAILABILITY, ACCESSIBILITY, QUANTITY, QUALITY AND AFFORDABILITY OF QDS

NOTE: quality seed (either from seed companies, seed producing groups or community members that are SPECIALISED and have a very good reputation)

1. For each of the crops you grow indicate your two most important sources of seed and give reasons

Crop	Most important source (use codes above)	Seed category **as per the farmers perception** 1 Certified seed 2 QDS 3 Grain seed	Number of times the seed has been replanted so far	Reason for the source* (*multiple responses allowed*)	Second source	Reason*
Bean						
Rice						
Soybean						
Potato						
Sesame						
Cassava						
Ground nut						
Maize						

* **Codes for reasons** 1.The quality is good 2.The seed is affordable 3. It is the only source available 4. Easily accessible /seed outlets are close by 5. The seed is most suitable for my land 6. The crop will not require a lot of input 7. Seed is always available 8 Others specify)…….

2. What is the distance from your home to the nearest source of QDS/planting material?…..km (**1 mile = 1.6km**)
3. What is the distance from your home to the nearest source of certified seed/cuttings?…..km (**1 mile = 1.6km**)
4. What is the distance from your home to the nearest source of grain seed/cuttings?…..km (**1 mile = 1.6km**)
5. What is the distance from your home to the source of seed/cuttings where you always buy from ……..km (**1 mile = 1.6km**)
6. If the nearest seed source is different from where you usually buy seed from, what is the reason for buying from a more distant source? …….
7. What means of transport do you use to buy the seed? 1 Walk 2. Bodaboda 3 Vehicle 4. Bicycle 5 others (specify)…….
8. On average how much money do you spend on transport (***return trip***) to go and buy seed (UGX)……
9. How do you procure your seed? 1 individually 2 as a group 3 with a few friends
10. How many agro-dealers (/sell certified seed) do you know in this subcounty?.....
11. How many LSB/stores (sell QDS) do you know in this subcounty? ……..

Name of LSB	Crop

12. Have you used quality declared seed (seed sold by local seed businesses – LSBs) in the last 4 years 1 Yes 2 No

For varieties of beans, rice, soybean, potato, sesame, cassava and ground nuts) obtained from LSBs, ask the following questions.

Quality of QDS based on Farmers' perceptions (*FOR FARMERS WHO HAVE NOT USED QDS ASK THE QUESTIONS BELOW IN REFERENCE TO THEIR MAIN SOURCE OF SEED in 12 above*)

	Bean	Rice	Soybean	Potato	Sesame	Cassava	Ground nut
1. How long have you used seed of <crop name> from LSBs? 1= Never 2= One season 3=Two seasons 4=Three seasons 5=More than three seasons							
2. How do you rate the quality of the seed obtained from LSBs compared to your own (home) saved seed? 1.Very high 2.High 3.Medium 4.Low 5.Very low							
3. Give reason (s) for your response? (**You can give multiple responses**) 1. Good germination 2. Poor germination 3 .Seed is clean (not mixed with stones and dust) 4. Seed is mixed with other things such as stones and dust 5. Seed size is uniform 6. Seed size is not uniform 7.Seed is same colour (same variety) 8.Seed is not the same- mixed varieties 9. Seed infested with insect pests such as weevils 10. Seed is healthy (not infested with insect pests such as weevils) 11. Others, specify……							
4. How was the germination of the seed? 1. Good 2. Fair 3. Poor							
5. How was the vigour of the crop? 1. Good 2. Fair 3. Poor							
6. How was the yield of the crop? 1.very Good 2. Good 3 Fair 4. Poor							
7. Based on your experience with seed from LSBs, would you recommend seed from LSBs to another person? 1 Yes 2. No (go to Qn. 6)							
8. If no, why? (***use codes in 3 above***)							
9. Please describe the trend of yields since you started using QDS 1 Increased 2 Not changed 3 Decreased							

4 Keeps fluctuating							
10. How many kg of seed per acre were you planting **before** you started using QDS (for cassava, "how many bags…)							
11. How many kg of seed per acre do you now plant when using QDS ?							
12. What was the average **yield per acre before** you started using QDS (**kg**)							
13. What is your **current** average **yield per acre** after you have started using QDS (**kg**)							
14. What was the average **acreage per season before** you started using QDS (**acres**)							
15. What is the average **acreage per season under the crop** now that you started using QDS (**acres**)							
16. Please describe the trend of income from the following crops since you started using QDS 1. Increased 2. Not changed 3. Decreased 4. Keeps fluctuating							
17. How do you describe the market of your produce since you started using quality declared seed 1 Increased 2 Not changed 3 Decreased 4 Keeps fluctuating							
18. Are you aware of "fake" seed of the following crops? 1 Yes 2 No							
19. If yes to above do you associate fake seed with a particular source? 1 Yes 2 No If yes indicate the source for each of the crops (***use source codes***)							
20. If yes to above please describe the trend of fake seed on the market in the last four years 1 Increased 2 not changed 3 decreased 4 sometimes there sometimes not 5 I don't know							

21. What setbacks have you experienced by using seed from LSBs?							

Availability of QDS

	Bean	Rice	Soybean	Potato	Sesame	Cassava	Ground nut
1. How do you acquire QDS 1. I book in advance 2. I book in advance from seed companies 3 I just go to the LSB store and buy 4. I buy from members of LSB groups 5. I buy it from stockists 6. I just buy from agro-dealers 7 Others (specify)							
2. Do you always get the amount of seed you want? 1. Yes 2 . No (go to Qn. 3)							
3. If No, how much seed did you want last season (kg)							
4. From the amount of seed you wanted last season, how much did you get? (Kg)							
5. What was the reason for not getting the quantity you wanted? 1 The seed was not available/enough 2 .The price was high for me 3 Time for planting had passed 4 The quality was not good 5 Others (specify)……							
6. If you never got the amount of seed you requested/wanted, what did you do to solve the shortage?							
7. Is seed from LSBs available at the most preferred time of the season? 1 Yes (go to Qn. 2) 2 No (go to Qn. 3)							
8. If Yes, when exactly is it available? 1. A season earlier 2. At the start of the planting season 3. Mid-season 4. Others, specify …							
9. If not available at the preferred time of the season, when would you want it to be available? 1 Before/at the start of the planting season							

2 Mid-season 3 Others, specify ……..							
10. Do you make advance orders for seed from the LSB? 1. Yes 2. No							
11. If yes, to what extent are your advance orders for QDS met? 1. Always met 2. sometimes met 3. never met							
12.. How do you describe the trend of quality seed availability in the last 4 years 1. Not readily available 2 Fairly available 3 Readily available							

Accessibility to QDS (*FOR ALL FARMERS INCLUDING THOSE WHO DO NOT USE QDS*)

	Bean	Rice	Soybean	Potato	Sesame	Cassava	Ground nut
1. What is the distance **in km** (**1 mile = 1.6km**) to the nearest LSB/ LSB outlet (store) from your home?							
2. What distance **in km** (**1 mile = 1.6km**) would be the most suitable for you to travel to access seed?							
3. Are you aware of seed access points such as weekly village markets and seed fairs created by LSBs to sell seed? 1. Yes 2. No							
4. If yes, are you satisfied with the seed access points (village markets and seed fair)? 1. Yes 2. No							
5. If not satisfied, give reasons for the response 1. Unavailability of preferred varieties 2. Distant seed outlets 3. High prices for seeds 4. Late supply of seed 5. Other, specify							

6. How do you describe the trend of quality seed accessibility in the last 4 years 1 Not readily accessible 2 fairly accessible 3 Readily accessible							

Affordability of QDS (*FOR ALL FARMERS INCLUDING THOSE WHO DO NOT USE QDS*)

	Bean	Rice	Soybean	Potato	Sesame	Cassava	Ground nut
1. What is the price of **grain/planting material** in the local market (UGX)							
2. What is the price of **certified seed** from agro-dealers/seed companies?							
3. What is the price of **QDS** (from LSBs)							
4. What is the price of seed from fellow farmers who had initially got seed from LSBs?							
5. What do you say about the price of seed (per kilogram) supplied by **LSBs?** 1. Affordable to most people in the community 2. Expensive, few people can afford it 3, Very expensive: Very few people in the community can afford							
6. If 2 or 3 for price above, how much would you be willing to pay for QDS /Kg							
7. What package size is affordable to most farmers in this community (e.g. 1kg, 2kg, 5kg)?							
8. How often do you buy QDS/ seed 1= Every season 2= after two seasons 3= after three seasons 4=after four seasons 5 Never							

SECTION IV: Variety preference and their availability seed

- This section explores how farmers define quality seed. Please write down the definition that farmers give on quality seed. Note for enumerators: Quality seed has a high germination rate, is pure in variety and is inspected or growers have a good reputation. Improved varieties are all varieties that have been released by NARO.
- Fill in the table below. Note that there is a difference between hybrids and open/self-pollinated crops, between quality seed (either from seed companies, seed producing groups or community members that are specialised and have a very good reputation) and seed that is not of quality (home saved seed for more than 3 seasons, grain /tubers bought from the local market and planted as seed), improved varieties (released from NARO) and local varieties (those that have existed in the communities for a long time).

1. **Overview of seed replacement, source of quality seed and improved varieties, and availability**

Crop	1. How often do you replace your seed stock (number of consecutive seasons)	2. Are there enough varieties of quality seed available to choose from? 1 Yes 2 No	3. Is there enough quantity available of your desired varieties? 1 Yes 2 No (go to Qn. 4)	4. If no, please indicate which varieties (***use codes above***)
Beans				
Rice				
Soybean				
Potato				
Sesame				
Cassava				
Groundnut				
Maize				

2. What are the advantages of using quality seed?
    1. High yielding
    2. Early maturing
    3. Good market for grain/tubers
    4. Drought tolerance –
    5. Pest & Disease resistant
    6. Others, specify ……

3. Are you aware of the availability of quality seed of the desired varieties?
    1. Yes 2 No

4. In the past 4 years how have you changed the type of seed/planting material of the following crops (*Changing from using grain/planting material to high quality seed/planting material*)

Crop name	**Use of grain seed /planting material** 1=Stopped using, 2=Still using, 3= I use less than before 4= Never used)	**Reason for changing**
Beans		
Rice		
Soy bean		
(Irish) potato		
Sesame		
Cassava		
Groundnut		

Codes of reasons for changing: 1=Poor quality, 2= Expensive, 3=Not available,

4=Other please specify… …

5. For those still **using own (home) saved seed** What are the reasons (circle the answers that farmers give) **– Applies to farmers who used home saved seed**
   1. No money to buy seed/high price for seed
   2. Lack information on quality seed
   3. Quality seed not available in market
   4. Do not trust the seed sellers
   5. Long distance to agro-dealer/seed companies
   6. High yielding
   7. Early maturing
   8. Only used for home consumption
   9. Good market for grain /tubers
   10. Drought tolerance -
   11. Pest & Disease resistant
   12. Only available variety
   13 Other, _____

6. Through which channel do you get to know about new varieties? (circle the answers mentioned by the farmer)
   1. Radio / TV (go to Qn. 10)
   2. Printed media

3. Demos/ Field days
4. Trade shows/Seed event/fairs
5. Weekly village markets
6. Road shows
7. Word of mouth – informal conversation
8. Social media platforms such as facebook, twitter
9. Local Seed Business (LSB) Associations
10. Others, specify _____

7. What is the name of the radio/TV station that aired the message

Station	Zone	Station	Zone
1 Radio West	Ankole	10 Might Fire - Kitgum	North
2 Millenium FM	Ankole	11 Guide FM Kasese	Rwenzori
3 Radio Buddu	Ankole	12 KRC	Rwenzori
4 NBS FM Jinja	East	13 Voice of kamwenge	Rwenzori
5 Open Gate	East	14 Voice of Toro	Rwenzori
6 Trinity FM Kapchorwa	East	15 Radio Pacis - Arua	West Nile
7 Voice of Kigezi	Kigezi	16 Radio Paidha	West Nile
8 Unity FM	North	17 Spirit FM	West Nile
9 Mega FM	North		

8. Who provides you this information on the new varieties? (circle the answers mentioned by farmers)
    1. Fellow farmers
    2. District farmers association
    3. Research/NARO/ZARDI
    4. NAADS/DLGs/OWC
    5. CBOs, NGOs, Donors
    6. Seed companies and agro-dealers
    7. LSBs
    8. Sub county extension officers
    9. Traders
    10. ISSD/ LSB association staff
    11. Others, specify _____

9. (Alternative) In the last 4 years have you bought seed from seed companies/Agro-dealers,
    1 Yes 2 No
10. If yes what was unique about these varieties?

    1. High yielding
    2. Early maturing
    3. Good market for grain/tubers
    4. Drought tolerance -

5. Pest & Disease resistant
6. Only available variety
7. Other, specify _____

11. Have you encountered challenges with seed from seed companies/agro-dealers? 1 Yes 2.No. **Applies to farmers who used certified seed**

12. **If yes,** specify the crop and the challenges

Crop	**Challenge**

13. How do you agree with the statement that; ISSD /LSBs have…….:
Response codes: 1. strongly disagree 2. disagree 3. neither disagree nor agree 4. Agree 5.Strongly agree

Indicator	**Response (codes)**	**Explanation for your response**
Increased seed availability in the community?		
Increased farmers' seed accessibility in the community?		
Improved quality of seed grown in this community?		
Increased quality seed on the market		
Contributed to increased adoption of improved crop varieties in the community?		
Contributed to use of better farming practices		
Increased income from crops in your household?		
Increased acreage for the promoted seed crops		
Improved crop output		
Improved crop productivity		
Improved volumes sold		
Contributed to marketing /selling your produce at a higher price?		
Increased food in my household?		
Increased food in the community?		

Access to Seed Household Survey

Annex 2.2 MARKET SURVEY QUESTIONNAIRE

PREAMBLE

The Integrated Seed Sector Development (ISSD) Plus Project is a 4-year project coordinated by the Centre for Development Innovation (CDI) and funded by the Embassy of the Kingdom of the Netherlands, Kampala. The project is implemented by Wageningen UR Uganda in collaboration with the National Agricultural Research Organisation (NARO) for public varieties and food crops, the Ministry of Agriculture Animal Industry and Fisheries (MAAIF), and private sector for vegetable seed. The programme aims to strengthen the development of a vibrant, pluralistic and market-oriented seed sector that is able to address key challenges that hamper the growth of the seed sector d in Uganda. ISSD Plus project has four components: a) addressing bottlenecks in early generation seed (EGS) and creating an enabling environment for the seed sector; b) enhancing the Quality Declared Seed (QDS) system through supporting Local Seed Businesses (LSBs); c) promotion of uptake of quality seed, and d) promoting the use of advanced vegetable varieties.

This questionnaire is designed to capture data and information on seed production and marketing. It will help us to understand the supply and demand of seed in the study area.

- This questionnaire is meant for producers and traders of seed. These are mainly LSBs, Cooperatives, and Agro-dealers
- It should therefore be administered to the managers and owners of the businesses
- Enumerators may take side notes or state specific issues that arise during the interviews on the questionnaire and raise these specific areas during the questionnaire delivery session.
- No answer is right or wrong but the enumerators role is to guide (but not lead) the interviewees in order for them to understand well the question.

Household ID _____

Survey instrument

Information and data will be kept **in strict confidentiality and will only be used for ISSD objectives. Your maximum support and cooperation is highly needed in responding to questions below and providing correct information.**

Consent by the respondent to permission for using the information

Name of respondent_____

Respondent consents to participate in this survey

Yes (continue the interview)
No (Ask why, thank the respondent and terminate the interview)
If no, why? _____

Market Survey Questionnaire (for LSBs and stockist /agro-dealers)

PART A: General information

1. Date of interview				
2. Name of supervisor				
3. Name of enumerator				
4. Name of respondent				
5. Category of respondent /business	1 LSBs 2 Agro-dealer 3 Stockists 4 Co-operative 5 Others (specify) ……..			
6. Name of the LSB/Cooperative /trader				
7. Telephone numbers				
Location (to be coded)	8. Zone	9. District	10. Sub county	11. Category of subcounty 1.Project area 2.Control
12. Village	13. Sex of respondent 1. Male 2. Female	14. Age of respondent (years)	15. Level of education (yrs)	16. Membership Youth …… Men…… Women…….

17. What role do you play in the business?

1 Sole Owner 2. Staff/ Committee member 3. Manager/ Chairperson 4 Director 5 Group member 6. Others (specify)….

18. What seed do you produce/sell? (***multiple options are possible***)

1 Bean 2 Rice 3 Soybean 4 Potato 5 Sesame 6 Cassava 7 Ground nut 8 Hybrid Maize 9 OPV Maize 7 Others (specify)…….

19. Which product would you consider your flagship product?

1 Bean 2 Rice 3 Soybean 4 Potato 5 Sesame 6 Cassava 7 Ground nut 8 Hybrid Maize 9 OPV Maize 7 Others (specify)…….

PART B: LSBs production and use of Foundation Seed

20. Do you produce any foundation seed for the product above?

1 Yes 2 No

	Bean	Rice	Soybean	Potato	Sesame	Cassava	Ground nut
21. If no above, who supplies your Foundation Seed (FS)?*							
22. How often do you use FS for your seed production? 1 Every season 2 Once in two seasons 3 Once in 3 seasons 4 Once in 4 seasons							
23. How do your members acquire/purchase FS 1 Individually 2 as a group/ LSB							
24. How would you describe the quantities of FS available for your planting 1. Very sufficient 2. Sufficient 3. Somewhat sufficient							

4. Insufficient 5. Very insufficient							
25. Do you preorder your Foundation seed from your suppliers? 1 Yes 2 No							
26. If yes, how much time do you give them? 1. 1-3 months 2. 3-6 months 1 6-9 months 2 9-12 months 3 Over 12 months							
27. Do your suppliers timely service your orders for FS? 1 always delay 2 sometimes delay 3 deliver on time							
28. How adequate are your suppliers in providing the amount of seed that you order for ? 1 Very adequate 2 adequate 3 somewhat adequate 4 inadequate 5 very inadequate							
29. If not very adequate, what proportion would you consider to be the unfulfilled demand?							
30. What do you consider a maximum price per kg (***bag for cassava)*** you are willing to pay for your FS?							
31. Do you give feedback to your FS suppliers?							

1 Yes 2 No							
32. How do you describe the relationship with your FS suppliers? 1 Business relationship 2 Personal &business relationship 3 Strategic relationship							
33. What is your means of Communication with FS supplier? 1 Physical contact 2 Telephone calls 3 social media 4 broadcast messages 5 Others (specify) ……..							

***Codes for FS supplier**; 1 Farmers 2 Private breeder 3 NARI 4 ZARDI
5 SeedCo. 6 LSB 7 Cooperative 8 others (specify)……

34. What are your challenges in accessing foundation seed?

…….
…….

PART C: Production and sales of QDS

35. Seed grown in 2019A season (Feb – June)

Crop	Variety	Source of FS	Qtty bought and distributed to members	Purchase price /kg	Qtty of seed delivered by farmers	Price /kg offered to the farmer	Mode of payment
Beans							
Rice							
soybean							

Potato							
Sesame							
Cassava							
Ground nut							

Codes for crop varieties

Beans- 1=NABE14, 2=NABE15, 3=NABE16, 4=NABE17, 5=NABE18,
6=NABE19,7=NABE20, 8=NABE21, 9=NABE12C, 10=NARO BEAN1,
11=NARO BEAN2, 12=NAROBEAN3, 13=NAROBEAN4C, 14=NAROBEAN5C
15 = Mixed local varieties 16 = Roba 1 17=RWR0 18=K132 19=Ohers (specify)

Irish Potatoes- 1=Victoria, 2=Rwangume (NAROPOT4), 3=Kinigi 4=Kachpot 5=Rwashaki
6=Other local varieties

Rice- 1=Upland rice, 2=Nerica4, 3=Nerica10, 4=Namche1, 5=Namche2, 6=Namche3,
7=Namche4, 8=Namche5 9=AR1189 10=Nerica1 11=Nerica 6 12=Superica 2
13=Witta 9 14=Local variety 15=Others

Soybeans- 1=Maksoy3N, 2=Maksoy4N, 3=Maksoy5N 4=Maksoy 1N, 5=Maksoy 2N
6=Namsy 4M, 7=Local variety 8=others (specify)……..

Sesame 1. Sesame 1 2. Sesame 2 3. Sesame 3 4= Local varieties

Cassava 1. NAROCAS 1 2. NASE 14 3. NASE 19 4=local varieties
5=Others (specify)

Groundnut 1 Red beauty 2 . Serenut 11T 3. Serenut 12R 4. Serenut 13T
4 Serenut 14R 4 Serenut 2 5 Serenut 3R 6 Serenut 5R
7 Serenut 6T 8 Serenut 8R 9. Serenut 9T 10=Others (specify)

Codes for source of foundation seed: 1 Farmers: 2 Private breeder 3 NARI
4 ZARDI 5 SeedCo. 6 LSB 7 Cooperative 8 others (specify)……

Codes for means of payment: 1 cash on delivery/at purchase 2. < 2 weeks 3. 2 – 4 weeks
4 after 4 weeks 5 a bank Cheque 6 others (specify)…….

36. Seed grown in 2019B season (August – December)

Crop	Variety	Source of FS	Qtty bought and distributed to members	Purchase price /kg	Qtty of seed delivered by farmers	Price /kg offered to the farmer	Mode of payment
Beans							
Rice							

soybean							
Potato							
Sesame							
Cassava							
Ground nuts							

37. Seed availability: production and marketing in 2019 A season

Crop	Variety	Qtty of seed aggregated	Qtty wasted (during processing, storage etc)	Qty sold (kg)	Marketing channel	Type of customers	Sale price/kg	Mode of payment	Reasons for choice of marketing	Qtty not sold (preserved for next season)
Beans										
Rice										
soybean										
Potato										
Sesame										
Cassava										
Ground nuts										

Codes for seed customers (buyers): 1 individual farmers 2 seed companies 3 NGO

4 Gvt/OWC 5 Stockists/agro-traders 6 District Farmers' association 7 Others (specify)

Codes for marketing channels: 1 LSB store 2 daily market 3 weekly/monthly markets

4 seed shows 5 retail shop 6 Others (specify)……

Codes for choosing a marketing channel; Offer a higher price 2 easily accessible

3 many customers demand is high 4 Others (specify)…….

Codes for mode of payment: 1 cash on delivery/at purchase 2. < 2 weeks 3. 2 – 4 weeks after 4 weeks 5 a bank Cheque 6 others (specify)…….

38. Seed availability: production and marketing in 2019 B season

Crop	Variety	Qtty of seed aggregated	Qtty wasted (during processing, storage etc)	Qtty sold (kg)	Marketing channel	Type of customers	Sale price/kg	Mode of payment	Reasons for choice of marketing	Qtty not sold (preserved for next season)
Beans										
Rice										
soybean										
Potato										
Sesame										
Cassava										
Ground nuts										

Codes for seed customers (buyers): 1 individual farmers 2 seed companies 3 NGO

4 Gvt/OWC 5 Stockists/agro-traders 6 District Farmers' association 7 Others (specify)

Codes for marketing channels: 1 LSB store 2 daily market 3 weekly/monthly markets

4 seed shows 5 retail shop 6 Others (specify)……

Codes for choosing a marketing channel; Offer a higher price 2 easily accessible
3 many customers demand is high 4 Others (specify)…….

Codes for mode of payment: 1 cash on delivery/at purchase 2. < 2 weeks 3. 2 – 4 weeks after 4 weeks 5 a bank Cheque 6 others (specify)…….

39. What are your average transaction costs per season?

Item	Bean	Rice	Soybean	Potato	Sesame	Cassava	Ground nut

FS Seed							
Fertilizer							
Other chemicals (pesticides, herbicides etc)							
Seed inspection							
Labour							
Wages							
Utilities (Electricity, water etc)							
Taxes/licence							
Transport							
Communication							
Rent							
Others							
Total							

	Bean	Rice	Soybean	Potato	Sesame	Cassava	Ground nut
40. How much seed on average do you aggregate per season? (in kg)							
41. How much seed did you aggregate last season (**1st season 2020**)?							
42. How would you describe the quantities of seed you produce compared to seed demand 1 Very sufficient 2 Sufficient							

3 Somewhat sufficient 4 Insufficient 5 Very insufficient							
43. Do you supply all your customers with all the seed they want? 1 Yes 2 No							
44. If no what proportion are you able to supply compared to demand ?							
45. What is the reason for not meeting the demand 1 farmers have small land 2 seed production is demanding 3 a majority farmers cannot afford the price 4 others (specify)……..							
46. Do your customers preorder for their Seed? 1 Yes 2 No							
47. If yes, what proportion of them preorder their Seed?							
48. Do you sell all the seed you aggregate in a season? 1 Yes 2 No							
49. If No above give reasons 1 Demand is low 2 The price is low 3 Sometimes it is not ready for sell 4 Others (specify)							
50. What do you do with the unsold seed? 1 Treat and Store							

2 Sell to grain traders 3 Sell as grain to consumers 4 Sell to feed mills 5 Others (specify) ……							
51. How would you rate the demand for your Seed? 1 Very high 2 High 3 Medium 4 Low 5 Very Low							
52. What is your source of market information 1 Other farmers 2 ISSD 3 NGO 4 Gvt /extension /OWC/NAADS 5 agro-dealers 6 Farmers association 7 others (specify)							
53. How often do most of your farmers (your customers) buy seed from you? 1 Every Season 2 once in two seasons 3 once in three seasons 4 once in four seasons or more							
54. What value do you add to your seed after harvest (***multiple choices are possible***) 1 drying 2 sorting 3 Grading 4 labeling & Packaging 5 Seed treatment 6 others (specfy)							

55. What size of seed packages do farmers prefer to buy?							
56. What would you consider a minimum price for your seed per kg/ to make a profit? ***(Per bag for cassava)***							
57. What was the highest price you sold at last **year 2019** (UGX/kg)							
58. What was the highest price you sold at last **season 2020** (UGX/kg)							
59. What is the price of grain / planting material (per kg/bag)							
60. How many other LSB do you know that produce seed?							

61. Are your seed and seed stores inspected? 1 Yes 2 No

62. If yes, by who?
1 District Agric. officials 2 NSCS 3 Private Inspector
4 Group Agronomist 5 Other (specify)

63. How many times do they inspect your seed during the season?
1 Once 2 Twice 3 Thrice 4 More than thrice

64. Are there costs you incur for inspections?
1 Yes 2 No

65. If yes, what cost category do they fall in?(multiple choices allowed)
1 Fees 2 Transport 3 Allowances 4 other

66. Who pays for the costs of inspection?
1 Farmers 2 LSB 3 ISSD 4 Gvt/district /MAAIF

67. Any challenges you have when obtaining government certification?

……..
…….....

68. What are your limitations to increasing seed production and sales?

i……
ii……
iii……
iv……....
v……

69. Do you get feedback from your customers? 1 Yes 2 No
70. How do you describe the relationship with your customers?
    1 Business relationship 2 Personal relationship 3 Strategic relationship

71. What is your mode of communication? 1 Physical contact 2 phone calls
    3 social media 4 broadcast messages 5 Others (specfy) ……..
72. Do you give feedback to the farmers? 1 Yes 2 No
73. What is your mode of communication? 1 Physical contact 2 phone
    3 social media 4 broadcast messages 5 Others (specfy) ……..
74. How do you describe your relationship with the farmers?

    1 Business relationship 2 Personal &business relationship 3 Strategic relationship
75. What is your mode of communication with your customers ?
76. Physical contact 2 phone calls 3 social media 4 broadcast messages Others (specfy) ……..
77. Any comment or information that would be useful to your local seed business to ensure efficient, sufficient and timely supply of QDS?
    …….
    ……..
    ……

PART D: Sales by Agro-dealers / stockists

	Bean	Rice	Soybean	Potato	Sesame	Cassava	Ground nut
78. How much seed do you sell per season? (in kg)							
79. Do you sell all the seed you stock in a season? 2 Yes No							

80. If no, what do you do with the unsold seed? 1 Treat and Store 2 Sell to grain traders 3 Sell it as grain 4 Return it to producers							
81. How would you rate the demand for seed? 1 Very High 2 High 3 Medium 4 Low 5 Very Low							
82. Do your customers preorder for their seed? 1 Yes 2 No							
83. What proportion of them preorder their seed?							
84. What is the minimum price for your seed per kg (***bag for cassava***) to make a profit?							
85. What is the source of your seed (suppliers)? 1 Individual farmers 2 LSB 3 Other farmer groups 4 SeedCo 5 Cooperative 6 NARO institutes 7 NGOs 8 others (specify)……							

86. Do you preorder your seed from the supplier? 1 Yes 2 No							
87. If yes, how much time do you give them? 1 1-3 months 2 3-6 month 3 6-9 months 4 9-12 months 5 Over 12 months							
88. Do your suppliers timely service your orders for seed? 1 Yes 2 No							
89. How would you rate the quality of the seed from your suppliers 1 Very high 2 High 3 Medium 4 Low 5 Very Low							
90. How would you rate your trust in the QDS/ certified seed from suppliers? 1 Very trusted 2 Trusted 3 Somewhat trusted 4 Untrusted 5 Very untrusted							
91. How would you rate their reliability? 1 Very reliable							

2 Reliable 3 Somewhat reliable 4 Unreliable 5 Very unreliable							
92. Do your suppliers adequately service your orders for seed? 1 Very adequate 2 Adequate 3 Somewhat adequate 4 Inadequate 5 Very inadequate							
93. To what extent are you satisfied with quantities of seed you get from your suppliers 1 Very satisfied 2 Satisfied 3 somewhat satisfied 4 Unsatisfied 5 Very unsatisfied							
94. If quantity supplied is inadequate, what proportion would you consider to be the unfulfilled demand?							
95. Are you able to increase your sales to meet the demand? 1 Yes 2 No							
96. If yes, by how much can you increase your sales?							
97. What do you consider a maximum price per kg you are willing to pay for the seed?							

98. What do you consider a minimum price per kg you are willing to sell the seed?							
99. Does anyone come to inspect your seed? 1 Yes 2 No							
100. If yes, by who? 1 District Agric. 2 Officials 3 NSCS 4 Private Inspector 5 Group Agronomist 6 Others (specify)							
101. How often do they inspect your seed in a year? 1 Once 2 Twice 3 Thrice 4 More than thrice							

102. What are the major limitations to increasing your sales?

i……

ii……

iii……

iv……....

v……

103. Do you give feedback to your suppliers? 1 Yes 2 No

104. How do you describe the relationship with your suppliers? 1 Only business 2 business/personal friends 3 strategic relationship

105. What is your mode of communication? 1 Physical contact 2 phone 3 social media 4 broadcast messages 5 Others (specfy) ……..

106. How do you describe the relationship with your customers?

1 Business relationship 2 Personal &business relationship 3 Strategic relationship

107. What is your mode of communication with your customers ?

4 Physical contact 2 phone calls 3 social media 4 broadcast messages Others (specfy) ……..

108. What are your challenges in marketing seed?

…….

…….....

103Any comment or information that would be useful to your business to ensure efficient, sufficient and timely supply of QDS?

…….

……..

……

Annex 2.3 FOCUS GROUP DISCUSSION INTERVIEW GUIDE (Stakeholders)

Access to Seed Household Survey

PREAMBLE

The Integrated Seed Sector Development (ISSD) Plus Project is a 4-year project coordinated by the Centre for Development Innovation (CDI) and funded by the Embassy of the Kingdom of the Netherlands, Kampala. The project is implemented by Wageningen UR Uganda in collaboration with the National Agricultural Research Organisation (NARO) for public varieties and food crops, the Ministry of Agriculture Animal Industry and Fisheries (MAAIF), and private sector for vegetable seed. The programme aims to strengthen the development of a vibrant, pluralistic and market-oriented seed sector that is able to address key challenges that hamper the growth of the seed sector d in Uganda. ISSD Plus project has four components: a) addressing bottlenecks in early generation seed (EGS) and creating an enabling environment for the seed sector; b) enhancing the Quality Declared Seed (QDS) system through supporting Local Seed Businesses (LSBs); c) promotion of uptake of quality seed, and d) promoting the use of advanced vegetable varieties.

This questionnaire is designed to capture data and information that will enable ISSD to understand how and to what extent the LSBs intervention has contributed to farmers' access to seed, increased seed availability and affordability by the smallholder farmers as well as LSBs contribution to improving seed quality. The overall objective is to document successful interventions in bridging the huge gap that exists between the formal and farmer seed supply systems in the country.

FG ID _____

Information and data will be kept in strict confidentiality and will only be used for ISSD objectives. Your maximum support and cooperation is highly needed in responding to questions below and providing correct information.

Consent by the respondents to permission for using the information

Respondent consents to participate in this survey

Yes (continue the interview)
No (Ask why, thank the respondent and terminate the interview)
If no, why? _____

Date of interview

Name of facilitator
Name of notes taker
Zone /region
District
Sub county
Category of FGD (Beneficiary / Control)

1. What are your **five** major crops in this sub county? (also ask what they consider as women / men/ youth crop)

   Onwards focus on ISSD crops, Consider to use a table

2. For each crop what are your common/main sources of seed? (***in control sub counties probe whether farmers know about LSBs)***
3. For each of the crops rank the seed sources according to their importance (where a majority of farmers get seed; **rank 1 – serves majority of the farmers**) Ask for reasons for the ranking **in order of importance** (***1 most important)***
4. For each crop, what attributes do you consider to say that the seed is of good quality?
5. Using the quality attributes mentioned above for each crop score the seed from different sources (***0-10 ; very poor - very good***)
6. Using the quality attributes mentioned above for each crop what is your general description of the seed on the market in this area/subcounty (1 poor 2 fair 3 good 4 very good)

7. For each of the crops how do you categorise the seed from the various sources (***is it grain, QDS or certified seed***)
8. How many agro-dealers that sell **certified seed** in this subcounty?
9. How many farmers/groups/stockists sell **QDS** in this subcounty?
10. Is there 'fake seed ' in this subcounty/district? Yes / No
11. If yes for each crop how do you know that the seed is fake?
12. If No how have you managed to control fake seed in this community?
13. For each of the crops how do you describe **high quality(QD/certified) seed** availability (***1 Not available*** 2 ***rarely available 3 sometimes available 4 readily available)***
14. For each of the crops how do you describe **high quality** seed accessibility (***1 Not accessible*** 2 ***not easily accessible 3 somehow accessible 4 readily accessible)***
15. For each of the crops how do you describe **high quality** seed affordability (1 ***not affordable 2 not affordable by majority famers 3. relatively affordable 4. affordable by a majority of farmers)***
16. **Focusing on QDS from LSBs** what is the price per kg (or bag for other planting materials)?

What is your opinion about the price for QDS from LSB (1 ***not affordable 2 not affordable by majority famers 3. relatively affordable 4. affordable by a majority of farmers)***

17. In case the group says it is not affordable what is the fair price for each crop that farmers would be willing to pay?

18. Has the LSB model resulted into production of seed for other crops not promoted by ISSD? Mention the crops

Thank you for your participation

Annex 2.4: FOCUS GROUP DISCUSSION INTERVIEW GUIDE *(LSBs)*

Access to Seed Household Survey

PREAMBLE

The Integrated Seed Sector Development (ISSD) Plus Project is a 4-year project coordinated by the Centre for Development Innovation (CDI) and funded by the Embassy of the Kingdom of the Netherlands, Kampala. The project is implemented by Wageningen UR Uganda in collaboration with the National Agricultural Research Organisation (NARO) for public varieties and food crops, the Ministry of Agriculture Animal Industry and Fisheries (MAAIF), and private sector for vegetable seed. The programme aims to strengthen the development of a vibrant, pluralistic and market-oriented seed sector that is able to address key challenges that hamper the growth of the seed sector d in Uganda. ISSD Plus project has four components: a) addressing bottlenecks in early generation seed (EGS) and creating an enabling environment for the seed sector; b) enhancing the Quality Declared Seed (QDS) system through supporting Local Seed Businesses (LSBs); c) promotion of uptake of quality seed, and d) promoting the use of advanced vegetable varieties.

This questionnaire is designed to capture data and information that will enable ISSD to understand how and to what extent the LSBs intervention has contributed to farmers' access to seed, increased seed availability and affordability by the smallholder farmers as well as LSBs contribution to improving seed quality. The overall objective is to document successful interventions in bridging the huge gap that exists between the formal and farmer seed supply systems in the country.

FG ID _____

Information and data will be kept in strict confidentiality and will only be used for ISSD objectives. Your maximum support and cooperation is highly needed in responding to questions below and providing correct information.

Consent by the respondents to permission for using the information

Respondent consents to participate in this survey

Yes (continue the interview)
No (Ask why, thank the respondent and terminate the interview)
If no, why? _____

Date of interview

Name of facilitator
Name of notes taker
Zone /region
District
Sub county
Category of FGD (Beneficiary / Control)

Onwards focus on ISSD crops, Consider to use a table

1. For each crop what are your common/main sources of seed? (***in control sub counties probe whether farmers know about LSBs)***
2. For each of the crops rank the seed sources according to their importance (where a majority of farmers get seed; **rank 1 – serves majority of the farmers**) Ask for reasons for the ranking **in order of importance** (***1 most important)***
3. For each crop, what attributes do you consider to say that the seed is of good quality?
4. Using the quality attributes mentioned above for each crop score the seed from different sources (***0-10 ; very poor - very good***)
5. Using the quality attributes mentioned above for each crop what is your general description of the seed on the market in this area/subcounty
   (1 poor 2 fair 3 good 4 very good)

6. For each of the crops how do you categorise the seed from the various sources (***is it grain, QDS or certified seed***)
7. How many agro-dealers that sell **certified seed** in this subcounty?
8. How many farmers/groups/stockists sell **QDS** in this subcounty?
9. Is there 'fake seed ' in this subcounty/district? Yes / No
10. If yes for each crop how do you know that the seed is fake?
11. If No how have you managed to control fake seed in this community?
12. For each of the crops how do you describe **high quality(QD/certified) seed** availability (***1 Not available*** 2 ***rarely available 3 sometimes available 4 readily available)***
13. For each of the crops how do you describe **high quality** seed accessibility
    (***1 Not accessible*** 2 ***not easily accessible 3 somehow accessible 4 readily accessible)***
14. For each of the crops how do you describe **high quality** seed affordability
    (1 ***not affordable 2 not affordable by majority famers 3. relatively affordable 4. affordable by a majority of farmers)***
15. **Focusing on QDS from LSBs** what is the price per kg (or bag for other planting materials)?

What is your opinion about the price for QDS from LSB (1 ***not affordable 2 not affordable by majority famers 3. relatively affordable 4. affordable by a majority of farmers)***

16. In case the group says it is not affordable what is the fair price for each crop that farmers would be willing to pay?

17. To what extent have the members been committed to participate in LSB activities please describe the trend over time (including no. of farmers producing seed)
18. Has the LSB model resulted into production of seed for other crops not promoted by ISSD? Mention the crops

19. Has the ISSD/LSB approach inspired formation of other groups to produce seed in this area? If so mention the groups and which crop seed they produce
20. Are your expectations of forming an LSB being met? ***Please explain***
21. What do you like about the LSB? would you like this approach to be used for other crops?
22. What challenges do you find engaging in LSB?
23. Which institutions/NGOs/ individuals have supported you /promoted LSBs and what kind of support?
24. Do you think you can manage the LSBs without external support? please explain

Thank you for your participation

Annex 2.5: KEY INFORMANT INTERVIEW GUIDE

Access to Seed Household Survey

PREAMBLE

The Integrated Seed Sector Development (ISSD) Plus Project is a 4-year project coordinated by the Centre for Development Innovation (CDI) and funded by the Embassy of the Kingdom of the Netherlands, Kampala. The project is implemented by Wageningen UR Uganda in collaboration with the National Agricultural Research Organisation (NARO) for public varieties and food crops, the Ministry of Agriculture Animal Industry and Fisheries (MAAIF), and private sector for vegetable seed. The programme aims to strengthen the development of a vibrant, pluralistic and market-oriented seed sector that is able to address key challenges that hamper the growth of the seed sector d in Uganda. ISSD Plus project has four components: a) addressing bottlenecks in early generation seed (EGS) and creating an enabling environment for the seed sector; b) enhancing the Quality Declared Seed (QDS) system through supporting Local Seed Businesses (LSBs); c) promotion of uptake of quality seed, and d) promoting the use of advanced vegetable varieties.

This interview guide is designed to capture data and information that will enable ISSD to understand how and to what extent the LSBs intervention has contributed to farmers' access to seed, increased seed availability and affordability by the smallholder farmers as well as LSBs contribution to improving seed quality. The overall objective is to document successful interventions in bridging the huge gap that exists between the formal and farmer seed supply systems in the country.

FG ID _____

KEY INFORMANT (*District agricultural officer, subcounty agricultural officers, LSB/ group chairpersons, lead farmers, ZARDI crop scientist,NGOs, agro-dealers/seed company manager and stockists.*

Information and data will be kept in strict confidentiality and will only be used for ISSD objectives. Your maximum support and cooperation is highly needed in responding to questions below and providing correct information.

Consent by the respondents to permission fo

r using the information

Respondent consents to participate in this survey

Yes (continue the interview)
No (Ask why, thank the respondent and terminate the interview)
If no, why? _____

Date of interview
Name of facilitator
Name of notes taker
Zone /region
District
Name of respondent
Contact of respondent
Sub county
Category of KI

1. What are your **five** major crops in this sub county? (in order of importance, also ask what they consider as women / men/ youth crop)

Onwards focus on ISSD supported crops, Consider to use a table

2. For each crop what are the common/main sources of seed? (***in control sub counties probe whether farmers know about QDS/ LSBs)***
3. For each of the crops rank the seed sources according to their importance (where a majority of farmers get seed; **rank 1 – serves majority of the farmers**) Ask for reasons for the ranking **in order of importance** (***1 most important)***
4. What percentage of farmers do you think **plant QDS** in the district/sub county?
5. What percentage of farmers do you think **plant certified** seed in the district/sub county?
6. In your own opinion do you think farmers know the difference between certified, QDS and grain? Or care what type of seed they plant?
7. What is your general description of the seed on the market in this area/ sub county
   (1 poor 2 fair 3 good 4 very good)
8. What is your opinion about LSB?
9. Using a scale of 0-10 (***0-10 ; very poor - very good***) how would you score the quality of (**LSB crop)** seed
10. How many farmers/groups/stockists sell **QDS** in this sub county?
11. How many agro-dealers that sell **certified seed** in this sub county?
12. Do you have a problem of 'fake seed ' in this sub county/district?
13. If yes what have you done to protect the farmers? And how is the trend of fake seed on the market in the last 4 years? (***increasing, constant, decreasing***)
14. If No how have you managed to control fake seed in this area?
15. For each of the crops how do you describe **high quality(QD/certified) seed** availability (1 ***rarely available 2 sometimes available 3 readily available)***

16. For each of the crops how do you describe **high quality** seed accessibility
    (1 ***not easily accessible 2 somehow accessible 3 readily accessible)***
17. For each of the crops how do you describe **high quality** seed affordability
    (1 ***not affordable by majority famers 2. relatively affordable 3. affordable by a majority of farmers)***
18. **Focusing on QDS from LSBs** what is the price per kg (or bag for other planting materials)?
    What is your opinion about the price for QDS from LSB (1 ***not affordable by majority famers 2. relatively affordable 3. affordable by a majority of farmers)***
19. In case **it is not affordable** what is the fair price for each crop that farmers would be willing to pay?
20. (***CHAIR LSB*)** To what extent have the members been committed to participate in LSB activities please describe the trend over time (***since 2016 including no. of farmers producing seed***)
21. Has the LSB model resulted into production of seed for other crops (***by the ISSD LSBs***) not promoted by ISSD? Mention the crops

22. Has the ISSD/LSB approach inspired formation of or other groups to produce seed in this area? If so mention the groups and which crop seed they produce
23. What do you like about the LSB model? Would you like this approach to be used for other crops? Is it sustainable? Please explain
24. (***CHAIR LSB*)** What challenges do you find in managing LSB?
25. (***CHAIR LSB*)** Which institutions/NGOs/ individuals have supported you /promoted LSBs and what kind of support? What kind of partnerships/collaboration do you have? Will they continue even after the project?
26. Do you think you can manage the LSBs without external support? please explain

27. To what extent do you think ISSD supported LSBs have contributed to /benefited the members /community/agriculture sector in terms of the following in the ***last four years***;

Indicator	Change (No change, increase, decrease)	Change attributed to ISSD/LSBs intervention (Small, Medium, Large, Very large)
Access to improved crop varieties		
Access to high quality (**QDS/certified**) seed		
Access to other agro-inputs (e.g. fertilizer, pesticides)		

Access to better market for produce		
Quality seed availability		
Change in quality of seed on the market		
Access to premium prices for produce		
Change in price of quality seed		
Changes in crop income		
Change in crop profitability		
Change in crop yields		
Quantity of produce sold		
Demand for extension/advisory services		
Market participation by small scale farmers		
Food and nutrition security		

(*LSB MANAGERS & LEAD FARMERS*) Choose the 3 most important changes you attribute to ISSD supported LSBs and provide an estimate of the change: Before ISSD compared to today:

Indicator	Rank	Before	Today
Change in demand for improved seed			
Change in demand for other agro inputs e.g. fertilizer and pesticides			
Change in access to high quality seed			
Change in seed availability			
Change in output			
Change in quantity of produce sold			
Access to new markets			
Change in quality of seed on the market			
Change in price of seed			

Change in crop profitability			
Change in crop yields			

Thank you for your participation

Annex 2.6: KEY INFORMANT INTERVIEW GUIDE (*ISSD staff/ Out-scaling partners).*

Access to Seed Household Survey

PREAMBLE

The Integrated Seed Sector Development (ISSD) Plus Project is a 4-year project coordinated by the Centre for Development Innovation (CDI) and funded by the Embassy of the Kingdom of the Netherlands, Kampala. The project is implemented by Wageningen UR Uganda in collaboration with the National Agricultural Research Organisation (NARO) for public varieties and food crops, the Ministry of Agriculture Animal Industry and Fisheries (MAAIF), and private sector for vegetable seed. The programme aims to strengthen the development of a vibrant, pluralistic and market-oriented seed sector that is able to address key challenges that hamper the growth of the seed sector d in Uganda. ISSD Plus project has four components: a) addressing bottlenecks in early generation seed (EGS) and creating an enabling environment for the seed sector; b) enhancing the Quality Declared Seed (QDS) system through supporting Local Seed Businesses (LSBs); c) promotion of uptake of quality seed, and d) promoting the use of advanced vegetable varieties.

This interview guide is designed to capture data and information that will enable ISSD to understand how and to what extent the LSBs intervention has contributed to farmers' access to seed, increased seed availability and affordability by the smallholder farmers as well as LSBs contribution to improving seed quality. The overall objective is to document successful interventions in bridging the huge gap that exists between the formal and farmer seed supply systems in the country.

Information and data will be kept in strict confidentiality and will only be used for ISSD objectives. Your maximum support and cooperation is highly needed in responding to questions below and providing correct information.

Consent by the respondents to permission for using the information

Respondent consents to participate in this survey

Yes (continue the interview)
No (Ask why, thank the respondent and terminate the interview)
If no, why? _____

Date of interview

Name of facilitator
Name of notes taker
Zone /region
District
Name of respondent
Contact of respondent
Position/designation

1. Please give us a brief about the ISSD plus project (***objectives and area of operation)***
2. What was the criteria for choosing the project area (***zones, districts and sub counties)***
3. What was the criteria for choosing the crops in the various districts
4. When did the ISSD plus project start implementing activities in the field?
5. What are the key activities that you had planned to do?
6. Did you change the objectives along the way?
7. How many LSBs were initiated by ISSD in each district? How many were targeted? If the number initiated is different from the target, what caused the variance?
8. How many LSBs have been successful? How many have collapsed?
9. What factors do you attribute the success of some LSBs?
10. What factors do you attributing to the failure of some LSBs?
11. How many farmer groups /individual farmers/households are involved? From **2016 – 2020** (Males, female and youth)? What other activities do the groups do? Who supports the activities?
12. What factors did you consider in selecting participants/beneficiaries?
13. To what extent has ISSD supported LSB increased seed availability, as a result of LSBs (change in volume of QDS seed produced and sold) (beans, rice, soybean, potato, cassava, sesame, groundnut)
    from 2016. ……Kg, 2017……2018……
    .2019……2020……..…..(percentage increase)

14. What percentage of farmers do you think **have adopted QDS** in the district/sub county?
15. What percentage of farmers do you think **plant certified** seed in the district/sub county?
16. In your own opinion do you think farmers know the difference between certified, QDS and grain? Or do they care what type of seed they plant?
17. What is your general description of the seed quality on the market in this area/sub county (1 poor 2 fair 3 good 4 very good)
18. Using a scale of 0-10 (***0-10 ; very poor - very good***) how would you score the quality of (**LSB crop)** seed
19. How many farmers/groups/stockists sell **QDS** in this sub county?
20. How many agro-dealers that sell **certified seed** in this sub county?
21. How has the problem of 'fake seed ' affected adoption of QDS produced by LSBs? please explain

22. What is the trend of fake seed on the market in the last 4 years? (***increasing, constant, decreasing***)
23. For each of the crops how do you describe **high quality(QD/certified) seed** availability (1 ***rarely available 2 sometimes available 3 readily available)***
24. For each of the crops how do you describe **high quality** seed accessibility (1 ***not easily accessible 2 somehow accessible 3 readily accessible)***
25. For each of the crops how do you describe **high quality** seed affordability (1 ***not affordable by majority famers 2. relatively affordable 3. affordable by a majority of farmers)***
26. What is your opinion about the price for QDS from LSB (1 ***not affordable by majority famers 2. relatively affordable 3. affordable by a majority of farmers)***
27. In case **it is not affordable** what is the fair price that farmers would be willing to pay?
28. To what extent have the members been committed to participate in LSB activities please describe the trend over time (***since 2016 including no. of farmers producing seed***)
29. Has the LSB model resulted into production of seed for other crops (***by the ISSD LSBs***) not promoted by ISSD? Mention the crops
30. Has the ISSD/LSB approach inspired formation of or other groups to produce seed in this area? If so mention the groups and which crop seed they produce
31. What is unique about the LSB model? Would you like this approach to be used for other crops? Is it sustainable? Please explain
32. On a scale of 1 – 10; to what extent do you think the ISSD plus has achieved its objectives (promoting ***uptake of quality seed and supporting LSBs***) please explain your score?

33. What would you want to do differently if you were to upscale / out scale the LSB model?
34. What would you recommend for anyone else implementing a similar project?
35. Which institutions/NGOs/ individuals have supported you /promoted LSBs and what kind of support? What kind of partnerships/collaboration do you have? Are they likely to continue even after the project?
36. Do you know of another similar model that has been formed by non-beneficiaries in this or neighbouring community as a result of ISSD / LSB intervention?

37. To what extent do you agree with the statement that; ISSD supported LSBs ……..

Response codes: 1. strongly disagree 2.I disagree 3. neither disagree nor agree 4. Agree 5 Strongly agree

Indicator	**Response (codes)**	**Explanation for your response** *Including figures where possible*
Access to improved crop varieties		
Access to high quality (**QDS/certified**) seed		
Access to other agro-inputs (e.g. fertilizer, pesticides)		

Access to better market for produce		
Access to premium prices for produce		
Increased household crop income		
Change in crop profitability		
Quality seed availability		
Demand for quality (**QDS/certified**) seed		
Reduced fake seed on the market		
Reduced post harvest losses of seed		
Investment in crop production		
Change in price of seed		
Improved volumes of seed sold		
Change in crop yields		
Increased acreage for target crops		
Quantity of produce sold		
Change in quality of seed on the market		
Change in access and control of seed by men		
Change in access and control of seed by women		
Change in access and control of seed by youth		
Demand for extension/advisory services		
Access to extension/advisory services		
Market participation by small scale farmers		
Investments in climate smart interventions and businesses		
Food and nutrition security		

38. To what extent do you think ISSD-supported LSBs have contributed to /benefited the members /community/agriculture sector in terms of the following in the ***last four years;***

Indicator	Change (No change, increase, decrease)	Change attributed to ISSD/LSBs intervention (Small, Medium, Large, Very large)
Access to improved crop varieties		
Access to high quality (**QDS/certified**) seed		
Access to other agro-inputs (e.g. fertilizer, pesticides)		
Access to better market for produce		
Access to premium prices for produce		
Increased household crop income		
Change in crop profitability		
Quality seed availability		

Demand for quality (**QDS/certified**) seed		
Reduced fake seed on the market		
Reduced post harvest losses of seed		
Investment in crop production		
Change in price of seed		
Improved volumes of seed sold		
Change in crop yields		
Increased acreage for target crops		
Quantity of produce sold		
Change in quality of seed on the market		
Change in access and control of seed by men		
Change in access and control of seed by women		
Change in access and control of seed by youth		
Demand for extension/advisory services		
Access to extension/advisory services		
Market participation by small scale farmers		

39. What challenges do you find in managing/implementing the LSB?

Thank you for your participation

Annex 3: List of Key Informants Interviewed

#	Name of KI	District	Designation
1.	Nyirabuntu Lillian	Kisoro	Agricultural Extension officer (Beneficiary)
2.	Sebizazani Elias	Kisoro	Chairperson of LSB
3.	Rakali	Kisoro	District Agricultural officer
4.	Robert Tumuhibise	Kigezi	Project coordinator ISSD, Caritas
5.	Mbonye Kenneth	Kisoro	Agricultural Extension Officer Kanaba (Control subcounty)
6.	Twishime Lawrence	Kisoro	NGO (ICAN) Bukimbire (Treatment sub)
7.	Ategeke Edward	Kisoro	LSB Chairperson; Nyakabingo farmers for development

8.	Byaruhaga John	Rubanda	Potato breeder and trainer
9.	Akankwasa Annah	Rubanda	LSB Chairperson; Murujesi Tubehamwe group
10.	Uzatunga Innocent	Kigezi	NARO KAZARD-ISSD contact person
11.	Rose Kansime	Rubanda	Agricultural extension officer (beneficiary)
12.	Bruce Byamukama	Kigezi	Self-help Africa
13.	Dez Nsimire	Isingiro	Sub county extension worker Kamubizi (Control Subcounty)
14.	David Tuhumwire	Isingiro	Agricultural extension officer (Beneficiary)
15.	Natukunda Dennis	Isingiro	Lead farmer
16.	Tumwesigye patrick	Isingiro	District Agricultural officer
17.	Birigwa Bob	Mbarara	Agricultural extension officer (control)
18.	Mwebaze Andrew	Mbarara	Chairperson of LSB
19.	Mulamuzi Ezra	Mbarara	Agricultural extension officer(Beneficiary)
20.	Alex Atuhaire	Mbarara	Chairperson of MBADIFA
21.	Muhwezi Dandas	Mbarara	District agricultural Officer
22.	Majoro Kyomugisha	Ankole	NARO- MBAZARD – ISSD contact person
23.	Byabasambu Twimukye	Kamwenge	LSB Chairperson
24.	Abigaba Charles	Kamwenge	Lead farmer
25.	Muhumuza Claver	Kamwenge	DAO
26.	Kasaija Gereva	Kamwenge	Agricultural extension officer (control)
27.	Tumuhibisibwe Aloysius	Kamwenge	Agricultural extension officer (beneficiary)
28.	Andrew Bagainy	Kamwenge	LSB trainer
29.	Gumoshabe Innocent	Kamwenge	NARO
30	Tusubira Edson	Kyenjojo	District Agricultural Officer
40	Rodgers	Rwenzori	ISSD staff
41	Nuru Kiiza Kisembo	Kyenjojo	Chairperson of LSB
42	Juliet Nyakaisike	Kyenjojo	Agricultural extension worker(beneficiary)
43	Byaruhanga Eriah	Rwenzori	NGO/Partner; Joint Effort to save the environment (JESE)
44	Mbabazi Zainabu	Kyenjojo	Lead Farmer
45	Twijukye Aloysius	Rwenzori	NGO/Agency, Partner ; ACDP
46	Mayanja Emmanuel	Buyende	Agricultural Extension Officer Bugaya (Treatment)
47	Mwase IBANDA	Buyende	District Agricultural Officer
48	Babirye Irene	Buyende	Buyende town council extension worker
49	Awor Wesonga	Eastern	Implementing partner- Card Uganda
50	Kuchuna Patrick	Butaleja	Extension worker- Control
51	Lyade Amos	Butaleja	Extension worker- treatment
52	Asman Koire	Butaleja	Lead farmer – Rice
53	Wasige Hussein	Butaleja	Manager farmers' cooperative Mazimasa (beneficiary)
54	David Apiou	Dokolo	Agricultural extension worker (control)

55	Alex Omara)	Dokolo	Agricultural extension worker(beneficiary
56	Okaka Sam	Dokolo	District Agricultural officer
57	Ambrose Oceng	Dokolo	ISSD implementing partner
58	Ochieng Angellos	Dokolo	LSB chairperson Amwoma subcounty (beneficiary)
59	Dennis Owani	Lira	Agricultural extension officer(beneficiary)
60	Christine Joyce Adong	Lira	ISSD staff
61	Alum Dorcus	Lira	District Agricultural Officer
62	Apele Busira	Nothern	NARO Expert
63	Otim Jackson	Northern region	Staff of Northern Uganda Local Seed Business Association
64	Joyce Piwa	Nebbi	DAO
65	Mananu Edna	Nebbi	Agricultural extension officer (control)
66	Ofoyuru Fred	Nebbi	Agricultural extension officer (beneficiary)
67	Walter Avaga	ARUA-Madi-Akolo	Agricultural extension officer (control)
68	Eres Aweri	West Nile	NARO agronomist
69	Grace Ozitiru	ARUA-Madi-Akolo	DAO
70	Maguma Alex	ARUA-Madi-Akolo	Agriculture Officer Rhino camp (beneficiary)
71	Christine Kawuma	Kampala	ISSD secretariat
72	Bitamisi Nyakato	Kampala	ISSD secretariat