Measuring Inclusive Access to Improved Seeds in Uganda: A Pilot Study

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INTRODUCTION

Access to seeds of improved varieties is a key driver of agricultural development in developing countries, because the features of improved varieties1 (higher yield, disease resistance, nutritional benefits, etc.) hold the potential to transform the lives of farmers who use them. Such benefits notwithstanding, the utilization of improved varieties remains low in much of Africa (Sheahan and Barrett 2017). Efforts such as The African Seed Access Index (TASAI) are dedicated to mapping bottlenecks in the seed value chain, including reasons for the low adoption rates of improved varieties and quality seeds. However, to date, these efforts have paid limited attention to the fact that the adoption rates are uneven among African smallholder farmers, and certain "vulnerable groups," mainly women, youth, and resource-poor farmers, persistently lag behind most male smallholder farmers, in access to and use of quality seeds. While this unequal access is widely acknowledged, accurate data are lacking about the size of the gap and contributing factors. This lack of data makes it more difficult to effectively intervene.

To respond to the challenge of insufficient data on inclusive access to quality seeds, Work Package 6, under the CGIAR Initiative SeedEqual, has set out to develop a set of metrics to assess inclusive access to improved seeds in a select group of countries in Africa and Asia. TASAI Inc. – the organization that coordinates the work of TASAI – has been engaged to develop the relevant metrics and corresponding data collection tools. TASAI's seed sector assessment tool (the TASAI survey) has been used in 23 countries to date, in some countries, multiple times. However, the primary data source for TASAI studies is seed companies and not farmers, and there is also limited focus on the vulnerable groups of interest to SeedEqual. Nevertheless, the TASAI survey is a tried-and-tested tool that has served as a good starting point for this exercise.

Accordingly, the TASAI team began with the selection of 10 TASAI indicators that (with some modification) – provide information relevant to inclusive access to quality seeds in the target country. In addition, based on a consultation with a set of international seed sector experts (see Appendix 6 for participating institutions), the team added 10 new indicators to gather data from farmers through household surveys, community seed banks, and quality declared seed (QDS) producer groups. This expanded group of 20 indicators was narrowed down to 17 during the first pilot study in Uganda, either because two indicators were combined into one or the particular indicator was deemed not relevant upon further consideration. Table 1 outlines the changes the indicators underwent during the research process. Importantly, the indicators that required household data collection introduced an additional time/cost element, but the researchers agreed that including farmers in the assessment was necessary, as otherwise the study would leave out the key vulnerable populations the SeedEqual project is targeting. Further, gathering information from multiple respondent groups also presented an important chance to validate and triangulate findings.

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1 Improved seeds are defined as "seeds of high yielding varieties, that are genetically and physically pure and carry high germination (%)" (Joshi and Braun 2022).

Table 1. Changes in inclusive access indicators

CHANGES IN INCLUSIVE ACCESS INDICATORS	ORIGINAL SET OF (TASAI) INDICATORS	REVISED SET BASED ON STAKEHOLDER FEEDBACK	INDICATORS ASSESSED IN UGANDA PILOT STUDY
NUMBER OF INDICATORS	**10**	**20**	**17**
1. Inclusive access through Community Seed Banks			
2. Inclusive access through **seed producer groups**			
3. Inclusive access through **seed producers**			
4. Purchases of seed of improved varieties			
5. [VG]'s* influence/input in participatory breeding approaches			
6. Availability of seed in small packages			
7. Affordability (Price)			
8. Varieties with special features commercialized			
9. Targeted seed promotion by companies/producers			
10. Targeted government subsidies			
11. Concentration and adequacy of agricultural extension services for smallholder farmers			
12. Concentration and adequacy of network of sources of seed			
13. Seed policy indicators			
14. Input in household decision-making related to purchase and use of seed of improved varieties.			
15. Input in household decision-making regarding financial decisions related to purchase and use of seed of improved varieties.			
16. Access to/ownership of assets related to purchase and use of seed of improved varieties.			
17. Leadership in community			**Combined**
18. Membership in agriculture-related community groups			
19. Link to buyer			
20. Exposure to "model/lead" farmer			
*VG refers to vulnerable groups.			
Indicators included			

The immediate goal of the pilot study was to test the data collection tools and use the findings and other learnings to improve those tools and refine indicators for subsequent data collection. The broader goal has been to create measurement tools that accurately assess and track gendered access to improved varieties, with the ultimate aim that this understanding will lead to programs that target the gaps and challenges identified by these assessments. To give the measurement a more realistic chance of sustainability, the goals of the pilot study also included the following:

- Build a measurement tool that is divided into several components/modules that may be administered by a different institution. For example, questions that fit well into the TASAI survey methodology would be included in future TASAI surveys, or questions that are best collected by community seed banks would be administered by those institutions or the national coordinating institution for the seed banks in the country. The hope is that this would make the task of data collection more manageable and sustainable.
- The analysis of the findings of the pilot study will also assess the extent to which results from different respondent groups (e.g., farmers, seed banks, research institutions, etc.) are able to capture similar aspects of inclusive access to seed of improved varieties. This will help determine whether any of the indicators that may be easier to track (does not require household surveys, for example) can present a good proxy measurement for other indicators that are more costly and time-consuming to assess.

Due to the unexpected early termination of the project, the research team has not been able to achieve these last two goals. However, we were able to complete the pilot study in Uganda, which yielded a rich data set and several interesting preliminary findings that this pilot study report presents in detail.

CONCEPTUAL UNDERPINNINGS

In preparation for this pilot study, the researchers reviewed available literature on existing seed sector assessment tools and applicable theoretical frameworks that may speak to the issue of inclusive access. In terms of seed sector assessment, none of the existing tools have a dedicated focus on inclusive access, which justifies the need for this research. In the area of gender research, the **Reach-Benefit-Empower-Transform (RBET) Framework** developed by Johnson et al. in 2018 presented a useful theoretical basis. The framework, presented in Table 1, may be used either as a planning or an evaluation tool. In this particular case, a relevant application may be to use RBET to categorize indicators in terms of their 'strength' to measure transformation, which will allow for a more nuanced weighting of the indicators. Note, however, that this task is yet to be carried out, as the original plan for this project included at least one more pilot study and carrying out the ranking exercise based on at least two studies. Nevertheless, we present the framework here as a reference for potential future studies.

Table 1. The reach-benefit-empower-transform framework

	OBJECTIVE	STRATEGY	INDICATORS
REACH	Include women in project activities	Invite women as participants; seek to reduce barriers to participation (e.g., implement a quota for seed subsidy program vouchers)	Number or proportion of women - participants in a seed system (e.g., as producers, users, or traders; attending a training; receiving seed extension advice)
BENEFIT	Increase women's well-being (e.g., seed security, food security, income, yield, health, etc.)	Design interventions keeping in mind gendered needs, preferences, and constraints to ensure that women benefit from project activities	Sex-disaggregated data for positive and negative outcome indicators such as productivity, income, assets, nutrition, time use, etc.
EMPOWER	Strengthen women's ability to make strategic life choices and to put those choices into action.	Enhance women's decision-making power in households and communities; address key areas of disempowerment	Women's decision-making power (e.g., over seed variety use, participation as seed entrepreneurs, etc.); reduction of outcomes associated with disempowerment (e.g., limited mobility, time poverty, etc.)
TRANSFORM	Works towards deep enduring change towards gender equality including changing harmful gender norms	Build personal and shared understanding of how gender norms affect men and women's ability to address gender-based constraints to seed access	Change in attitudes, norms, institutions, and policies towards expected roles, rights and entitlements of men and women. Eliminates stereotypes on men and women's roles in seed systems

Source: Johnson et al. 2018; (Adam and Njogu 2023)

> Primary data was collected from individual farmers, QDS groups, community seed banks, seed companies, and plant breeders that the CGIAR and NARs institutes work with – 690 respondents in total.

METHODS

Indicators tested in pilot study

The pilot study gathered information on 17 indicators presented in Table 2. (A more detailed description of the indicators is shared in Appendix 1.) The indicators are grouped into three categories, primarily based on the respondents (e.g., farmers, seed producers, breeders and research institutions).

Table 2. Indicators used in pilot study to measure inclusive access to seed of improved varieties

INDICATORS
FARMER-REPORTED INDICATORS
1. Purchases of seed of improved varieties
2. Availability of seed in small packages
3. Affordability (Price)
4. Exposure to "model/lead" farmer
5. Link to buyer
6. Input in household decision-making related to agricultural production
7. Access to/ownership of assets related to agricultural productivity
8. Membership in agriculture-related community groups
SERVICE TO SMALLHOLDER FARMERS
1. Targeted seed promotion by companies/producers
2. Targeted government subsidies
3. Concentration and adequacy of agricultural extension services for smallholder farmers
4. Concentration and adequacy of network of sources of seed
5. Inclusive access through Community Seed Banks
6. Inclusive access through seed producer groups (incl. quality-declared seed (QDS) and independent seed producers)
7. Seed policy indicators
RESEARCH AND DEVELOPMENT
1. Vulnerable Group's [VG]'s influence/input in participatory breeding approaches
2. Varieties with special features commercialized

Data sources – primary data

Primary data was collected from individual farmers, QDS groups, community seed banks, seed companies, and plant breeders that the CGIAR and NARs institutes work with – 690 respondents in total. In addition the choice of study was influenced by ISSD focus areas. Individual farmers, QDS groups, and the CSBs were located in the Northern and Western regions of Uganda (apart from Nakaseke Community Seed Bank, located in Central Uganda (Figure 1), while seed companies and plant breeders were predominantly located in and around Kampala in the Central Region. We also collected data from government entities, namely, the Directorate for Agricultural Extension Services (DAES), the Department for Crop Protection under the Ministry of Agriculture, Animal Industries, and Fisheries (MAAIF), and the National Agricultural Advisory Services (NAADS).

Figure 1. Map of Uganda (Uganda Maps & Facts - World Atlas)

Individual farmers (household surveys)

Following the methodology of the Women's Empowerment in Agriculture Index (WEAI), three primary household typologies were anticipated:

- Dual adult households (DHHHs) consist of both male and female members aged 18 and over.
- Female adult-only households (FAOHHs) comprise females aged 18 and over without any males aged 18 and over.
- Male adult households encompass males aged 18 and over without any females aged 18 and over.

As the survey focused on understanding the gender disparities in seed access, emphasis was placed on the first two household types, and male-only adult households were excluded from the final household lists before sampling.

Sampling

The estimated total household sample size (n) was 400, determined using Slovin's Formula: n = N ÷ (1 + Ne^2), where (N) represents the known population size of farming households based on data from the Uganda Bureau of Statistics (UBOS) to which a 5% error margin (e) was applied. The allocated respondents' households per region/district were then evenly distributed, resulting in 133 households from each of the three study districts. The study sites were villages where an active QDS group was already situated, totaling three villages per district and nine villages overall.

In each village[2], the field supervisor and enumerators sought permission from the Local Council I (LC1) Chairperson to conduct the survey. Collaborating with the Chairperson and sometimes other members of the Council, they compiled a comprehensive household list for the village, assigning each household to one of the 2 household categories of respondents mentioned above. Accordingly, enumerators collected data from 33 dual-adult households and 11 female adult-only households in each village (Table 3).

Enumerators operated in pairs, with female enumerators interviewing women in dual adult households, while male enumerators interviewed the men (spouses) in the household. Female adult-only households were interviewed by either a male or female enumerator. Because pre-mobilization was conducted late, in most cases the men in the households sampled were not available. To address this issue, the survey adopted the "zoning" approach. Villages in Uganda are sub-divided into zones; hence each enumerator pair would be assigned a zone, and, in each zone, households were interviewed using the snowball technique with a focus on households on the list where both the man and wife were present and were willing/available to participate in the survey.

Data collection for the households and QDS producer groups, which were located in the same areas, took 5 days, while the survey of 7 CSBs took another five days. The key informant interviews with plant breeders, CEOs of seed company, extension services, NAADS, and NSCS took several additional weeks since the survey period coincided with the busy end of year period. The survey tool included quantitative and qualitative questions. The survey tool was available in both online and offline versions, the latter as we anticipated that internet connectivity may be spotty. Indeed, most enumerators used the offline version; this was acceptable, but it was not as quick and easy to use as the online version, making the data collection longer and more cumbersome than anticipated.

2 A village usually consists of between 50 and 70 households and may be home to anywhere between 250 and 1,000 people. The local council I (LCI) is the lowest level of local government in Uganda and is responsible for a village or, in the case of towns or cities, a neighborhood. The LC I is led by a chairperson (LCI chairperson) and nine other executive committee members.

Table 3. Age and gender profile of household respondents by district

DISTRICT	DUAL HEADED HOUSEHOLDS (DHHHS) (N=277)		FEMALE HEADED HOUSEHOLDS (FAOHHS) (N=94)	AGE - 31+ (N=401)		AGE - 18-30 (N=247)	
	WOMEN	MEN	WOMEN	WOMEN	MEN	WOMEN	MEN
Dokolo	90	90	25	70	61	45	29
Gulu/Nwoya	94	94	33	60	55	67	39
Isingiro	93	93	36	91	64	38	29
Subtotals	**277**	**277**	**94**	**221**	**180**	**150**	**97**
		TOTAL	**648**			**TOTAL**	**648**

QDS producer groups

The survey engaged ten quality-declared seed (QDS) producer groups, also called "Local Seed Businesses" (LSBs), across northern and western Uganda (Table 4). The initial selection prioritized regions where the Integrated Seed Sector Development (ISSD) had established a substantial number of QDS producer groups, regardless of crop type. Next, regional LSB coordinators were consulted to identify districts with the most active QDS producer groups within each sub-region (Acholi and Langi for Northern Uganda, Ankole for Western Uganda). Finally, ten active QDS groups were purposefully selected per district (4 in Nwoya/Gulu, and 3 in Dokolo and Isingiro each). An "active" QDS group was defined as one whose members actively participated in seed production in the preceding cropping seasons (season A 2023 and season B 2022).

Data was collected using an online quantitative instrument, which enumerators used to conduct key informant interviews with QDS group leaders, as individuals or in groups. Next, focus group discussions (FGD) were held two days after the interview with all members of the QDS group. The FGD used a structured checklist of questions. The FGDs were segmented by gender and age (senior men ages 31+, senior women ages 31+, young men ages 18-30, and young women ages 18-30 years), resulting in a total of 12 focus groups. The segmentation ensured an inclusive and safe space for comprehensive dialogue. This approach yielded four transcripts per district, allowing us to feel reasonably confident that we had achieved information saturation, as, generally, 3-5 FGDs on a single topic are sufficient to do this (Namey et al. 2016).

Table 4. QDS groups interviewed by region

NAME OF QUALITY DECLARED SEED GROUP	REGION	SUB-REGION	DISTRICT	SUB-COUNTY	VILLAGE
1. Tic Ryemo Can Youth Group	North	Acholi	Nwoya	Anaka	Okir
2. Te Olam Okumgoro	North	Acholi	Gulu	Paicho	Laminoyoo
3. Ma Icayo Aye Konyi	North	Acholi	Nwoya	Anaka	Lamoki
4. Latyeng Farmers Group	North	Acholi	Gulu	Bungatira	Owak Subward
5. Aye Medongeca Seed Growers Coop Society	North	Langi	Dokolo	Agwata	Awelogwei
6. Yamalo Faming Group and Catering Service Ltd.	North	Langi	Dokolo	Agwata	Ajakdwong
7. Bedi Gen Farmer and Catering Service Ltd.	North	Langi	Dokolo	Agwata	Ajakdwong
8. Kyezimbira Catholic Women's Group	West	Ankole	Isingiro	Kigagate	Kyezimbira
9. Omutima Gwa Ruhiira Cooperative Society Ltd.	West	Ankole	Isingiro	Ruhiira	Kahurwa
10. Kanywamaizi Farmers and Traders Coop Society Ltd.	West	Ankole	Isingiro	Kabuyanda	Kanywamaizi IV

Community Seed Banks

A total of seven community seed banks (CSBs) located across three of Uganda's regions–Central, Northern, and Western Uganda – were surveyed (Table 5). This part of the data collection was undertaken by the Plant Genetic Resources Center (Box 1), whose team collected the data and submitted it to the TASAI team for analysis and write-up. This arrangement was selected for two reasons: one, the PGRC already knows and works with the

CSBs, and, two, the hope that the PGRC might become the focal point for subsequent data collection on CSBs. The seven CSBs were purposefully selected from seventeen CSBs affiliated with the PGRC. Selection criteria included location (CSBs located in the northern and western region, where the LSB survey was to be conducted) and activity level (most active in terms of seed conservation). In addition, one CSB from the central region was surveyed due to its proximity to Kampala, where other respondents were also surveyed. Data were collected using an online survey instrument and complemented by key informant interviews.

About the Plant Genetic Resources Center

The Plant Genetic Resources Centre (PGRC) is part of the Biodiversity and Biotechnology Program under the National Agricultural Research Laboratories (NARL) of the National Agricultural Research Organization (NARO) in Uganda.

PGRC's mission is "to ensure the conservation, management and sustainable use of Uganda's Plant Genetic Resources for Food and Agriculture (PGRFA) while optimizing their full potential in contributing to national development goals." (Source: PGRC website)

Box SEQ Box * ARABIC 1. About the Plant Genetic Resouces Center

Table 5. Names and locations of the CSBs surveyed in the Uganda SeedEqual pilot survey

NAME OF COMMUNITY SEED BANK	REGION	DISTRICT	SUB-COUNTY	VILLAGE
1. Don Bosco Seed Bank	Northern	Lamwo	Palabek Ogili	Apyeta Central
2. Ongako CSB	Northern	Omoro	Ongako	Tetugu
3. Pur Ber CSB	Northern	Omoro	Acet Town Council	Acet Central A
4. Nen anyim CBS	Northern	Lamwo	Paluga	Kaliro
5. Nakaseke Community Seed Bank	Central	Nakaseke	Nakaseke South	Nakaseke
6. Joy and Family Demonstration Farm	Western	Sheema	Kagango Division	Rubale
7. Kiziba Community Seed Bank	Western	Sheema	Kagango	Rwengando Trading Center

Seed companies

The TASAI Country Study in Uganda conducted in 2022 served as a primary data source whenever feasible. However, two specific indicators – the count of out-growers and the assessment of whether seed companies' promotional activities fostered inclusive access – necessitated additional data collection through an online questionnaire. To optimize resources and manage time constraints during the pilot phase, we contacted the 10 largest seed companies based on average seed volumes marketed, using TASAI data as our reference.[3] In instances where a leading company was unavailable for participation, a replacement was selected from the broader pool of seed companies that had participated in past TASAI surveys. Table 6 provides the list of 10 active seed companies in Uganda targeted for the pilot study. (See Appendix 2 for a complete list of active seed companies.)

> Data was collected using an online quantitative instrument, which enumerators used to conduct key informant interviews with QDS group leaders, as individuals or in groups

3 It is important to note that TASAI studies do not necessarily cover all companies in a country; rather, they focus on companies that produce and sell seed for one or more of four focus crops, which, in Uganda, are maize, beans, sorghum, and millet. This condition meant that the TASAI study covered 24 out of a total of 30 active/registered seed companies.

Table 6. Seed companies targeted for the Uganda seed pilot survey

SEED COMPANY	TARGETED FOR SURVEY	INTERVIEW METHOD
1. Crown Seeds Ltd	Yes	Phone
2. Daylight Agro-Tech Ltd	Yes	Phone
3. Equator Seeds Limited	Yes	Phone
4. Faith Agro Inputs Ltd	Yes	Phone
5. FICA Seeds Ltd	Yes	No response
6. Grow More Seeds and Chemicals Ltd	Yes	No response
7. NASECO (1996) Ltd.	Yes	Online
8. Pearl Seeds Ltd	Yes	Phone
9. Savana Seeds Ltd	Yes	No response
10. SeedCo Limited	Yes	No response

Plant breeders

To gather information on participatory breeding efforts, we planned to survey public crop breeding programs in institutions (NARO, CGIAR (CIP, IITA, Alliance of Bioversity Int'l and CIAT) and at universities (Makerere University (MUK) and Uganda Christian University (UCU)). In each program, the team leader for the respective crop was asked to complete the survey, either online or in an interview by phone, video conference, or in person. Table 7 presents the list of participants reached by the survey; Appendix 3 presents the full list of breeders contacted. In total, 14 (74%) of the initial target group of 19 responded to the survey.

Table 7. Respondents targeted for the breeder survey

NAME	TYPE OF INSTITUTION	INSTITUTE	CROP(S)	INTERVIEW METHOD
1. Dr. Godfrey Asea	National Agricultural Research System (NARS)	NARO - NaCRRI	Maize	In person
2. Dr. Jimmy Lamo	National Agricultural Research System (NARS)	NARO - NaCRRI	Rice	Online
3. Dr. David Kalule Okello	National Agricultural Research System (NARS)	NARO - NaSAARI	Groundnut	Online
4. Dr. Isaac Dramadri	Academic institutions	Makerere U. - MaRCCI	Cowpeas	Phone
5. Dr. William Esuma & Dr. Paula Arigaba	National Agricultural Research System (NARS)	NARO - NaCRRI	Cassava	Phone
6. Dr. Gorretie Ssemakula Nankinga	National Agricultural Research System (NARS)	NARO - NaCRRI	Sweet Potato	Online
7. Dr. Stanley T. Nkalubo	National Agricultural Research System (NARS)	NARO - NaCRRI	Bean	Phone
8. Dr. Frank Kagoda	National Agricultural Research System (NARS)	NARO - ZARDI	EA Highland Maize	Phone
9. Dr. Bernard Yada	National Agricultural Research System (NARS)	NARO - NaCRRI	Sweet Potato	Online
10. Dr. Moses Kiryowa	National Agricultural Research System (NARS)	NARO - NaCRRI	Horticulture	Online
11. Prof. Phinehas Tukamuhabwa	Academic institution	Makerere University	Soybean	In person
12. Dr. Adikini Scovia	National Agricultural Research System (NARS)	NARO - NaSAARI	Sorghum/Millet	Phone
13. Dr. Walter O Anyanga	National Agricultural Research System (NARS)	NARO - NaSAARI	Sim-Sim (Sesame)	Phone
14. Dr. Robin Tendo Ssali	CGIAR	CIP	Sweet Potato	Phone

Data sources - secondary data

Government agencies

Some of the indicators required official data from government agencies, namely, the National Agricultural Advisory Services (NAADS), the Directorate of Agricultural Extension Services (DAES) within the MAAIF, and the Crop Protection Department of the MAAIF through the NSCS. Table 8 shows the list of officials contacted, primarily by phone, and the document/source obtained.

Table 8. Government entities surveyed

ORGANIZATION	DOCUMENT/ DATA SET	PERSON; TITLE
National Seed Certification Services (NSCS), Crop Protection Department, Directorate of Crop Resources, MAAIF	Latest National Variety Catalogue List of active QDS groups	Dr. Mary Teddy Asio; Asst Commissioner, MAAIF
Directorate of Agricultural Extension Services (DAES), MAAIF	Public extension workers by gender; Digital tools for inclusive access to extension services	
National Agricultural Advisory Services (NAADS)	Number of women, youth and PWDs receiving seed subsidies; Vote Performance Report FY 2022/23 and 2023/24: Vote 152 NAADS	Mr. Charles Aben; Crop Development Officer

TASAI Studies

TASAI studies offer a comprehensive assessment of a country's formal seed sector. Conducted every other year (assuming available funding), the studies collect data on 22 indicators in 5 different categories: **Research and Development, Industry Competitiveness, Seed Policy and Regulations, Institutional Support,** and **Service to Smallholder Farmers.** TASAI data support decision-makers to develop evidenced-based interventions designed to achieve the four outcomes of competitive seed systems: availability, accessibility, affordability, and quality. The last TASAI study for Uganda was published in 2022, relying on data primarily from 2021. Whenever possible, the pilot study used TASAI data to provide information on an indicator or to triangulate the data collected from other sources.

Policy documents

Indicator 13 aims to assess the policy environment with an eye towards inclusive access to quality seed. We consulted the policies most relevant to the seed sector; however, Table 9 includes a number of other policies for future reference. The documents were sourced from various websites and from the Government Printer, where soft copies did not exist online.

> TASAI studies offer a comprehensive assessment of a country's formal seed sector. Conducted every other year (assuming available funding), the studies collect data on 22 indicators in 5 different categories: Research and Development, Industry Competitiveness, Seed Policy and Regulations, Institutional Support, and Service to Smallholder Farmers.

Table 9. List of relevant policies, legislation and guidelines reviewed in relation to inclusive access to seed

POLICY AREA	POLICY AND LEGISLATIVE INSTRUMENTS	REVIEWED FOR STUDY
Seed	National Agriculture Policy 2013	Yes
	National Seed Policy 2018	Yes
	National Agriculture Research Act 2005	Yes
	National Seed Strategy 2014/15 – 2019/20 (being updated)	Yes
	Seeds and Plant Act 2006	Yes
	Seeds and Plant Regulations 2019	Yes
	QDS regulations 2020	Yes
	Plant Variety Protection Act 2014	Yes
	PVP Regulations (in process)	Yes
	Plant Protection and Health Act of 2015	Yes
	Plant Protection and Health (Import and Export) Regulations 2020	Yes
	the Agricultural Chemical Act of 2006, etc.	Yes
Plant Genetic Resources for Food and Agriculture	International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) - Uganda acceded on 25 March 2003	No
	Nagoya Protocol of the CBD, which governs access and benefit sharing (ABS) of all genetic resources - Uganda became a signatory in 2015	No
	National Environment (Access to Genetic Resources and Benefit Sharing) Regulations, 2005	No
	Guidelines for Accessing Genetic Resources and Benefit Sharing in Uganda, 2007	No
Agricultural Extension Services	National Agricultural Extension Policy, 2016	No
	National Agricultural Extension Strategy 2016/17 -20/21, published 2016	No
	Extension Guidelines and Standards, undated	No
	Process-of-Registration-and-Accreditation-of-Agricultural-Extension-Service-Providers, undated	No
Land	The Constitution of Uganda, 1995	Yes
	The Uganda National Land Policy 2013	Yes
	The Land Act 1998, The Land (Amendment) Act 2010,	Yes
	The Land Regulations 2004	Yes
	The Succession Act, The Succession (Amendment) Act 2022	Yes
	Registration of Titles Act, Cap 320	Yes
Agricultural Financing	The Agriculture Credit Facility	No
	The Uganda Agriculture Insurance Scheme	No

Data collection tools

The data collection tools comprised structured questionnaires and focus group interview checklists, detailed in Appendix 2. These materials were prepared and made accessible via Alchemer.com, an online platform. To accommodate potential sporadic internet connectivity in rural areas, the survey tools were designed for both online and offline data collection. Using the offline mode limited the capability of the tool, as the skip logic function was not available; this made the questionnaires exceedingly long, making the work of the enumerators more cumbersome and challenging.

Enumerator training and pre-testing

The fieldwork team for the household surveys included 22 enumerators, two field supervisors, and a lead field researcher, who also supervised one of the study sites. The fieldwork team was supported by the TASAI team, led by the Data Analyst. Focus group interviews with farmers and QDS group members were conducted by 12 of the 22 enumerators in the morning and afternoon, respectively, on the third day of data collection. The FGD facilitators were drawn from the enumerator pool and also included the two field supervisors and lead field

> Fieldwork kicked off with a comprehensive training for enumerators and FGDs facilitators, conducted virtually on Friday, October 13, 2023. Following this, enumerators pretested the household survey tool in their respective locations.

researcher also conducted QDS producer group interviews. Data collection from breeders and companies was conducted by the lead field researcher. Data collection from community seed banks was undertaken by the PGRC team, and, in addition, one CSB was visited by a TASAI team member, who is based in Uganda and had easy access to the particular CSB. Finally, the lead field researcher also gathered data from government institutions.

Fieldwork kicked off with a comprehensive training for enumerators and FGDs facilitators, conducted virtually on Friday, October 13, 2023. Following this, enumerators pretested the household survey tool in their respective locations. Subsequently, on Sunday the 15th, the field supervisors joined the enumerators for a debrief meeting. This meeting aimed to gather feedback on the enumerators' experiences with the tool, including any challenges they encountered. The team also conducted household listings for the sampling frame and protocol, with input from the LC I Chairperson and other village leaders. The team also validated the conversion factor worksheet (Appendix 4) to allow enumerators to collect data in the unit/format reported by the farmer and convert it to 'standard' units for the study. For instance, while in Gulu, many farmers, especially men, could report their land size in acres, this was not the case in the other two study sites. So, unless already known, on day 1, the team identified measurements such as the length of the stick in feet which they use to measure the width and length of their land, or the measurements used by farmers when purchasing seed for a particular crop – whether grain or kernelled in bags or basins or tins, etc. The conversion factor worksheet allowed the team to define a metric equivalent of the various local measurements, thus providing unified data. Having this information a priori ensured that the enumerators were more likely to capture higher quality measurement data.

Despite the detailed preparation, logistical constraints arose as the travel time to the three study sites consumed the entire day, impacting the planned preparations. Consequently, these tasks had to be completed on Monday, affecting the allocated time for data collection. For a detailed timeline of the survey components, refer to Figure 2.

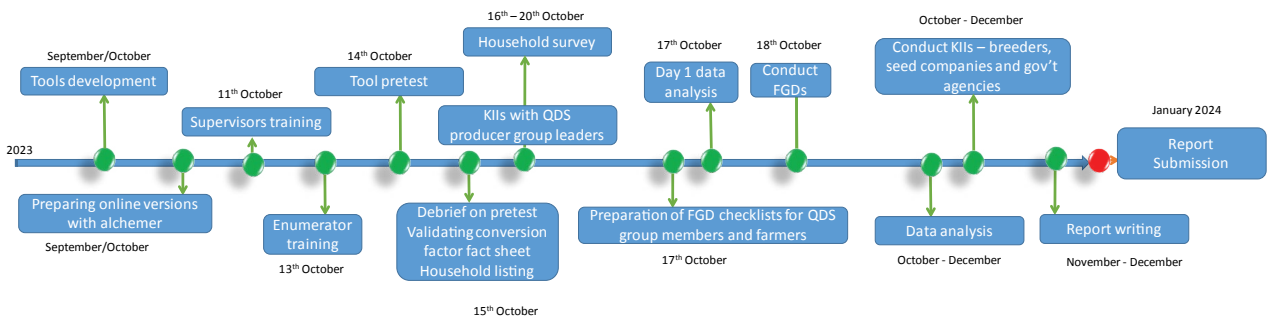


Figure 2. Study timeline

FINDINGS

This section presents the findings for each indicator. A few important points to note:

- **Selection of crops:** Prior to the survey, relying on local knowledge, the team assembled a list of crops that we anticipated farmers would grow in the surveyed areas. These were bean, cassava, groundnut, maize, millet, potato, rice, simsim (sesame), sorghum, soya bean, and vegetables.

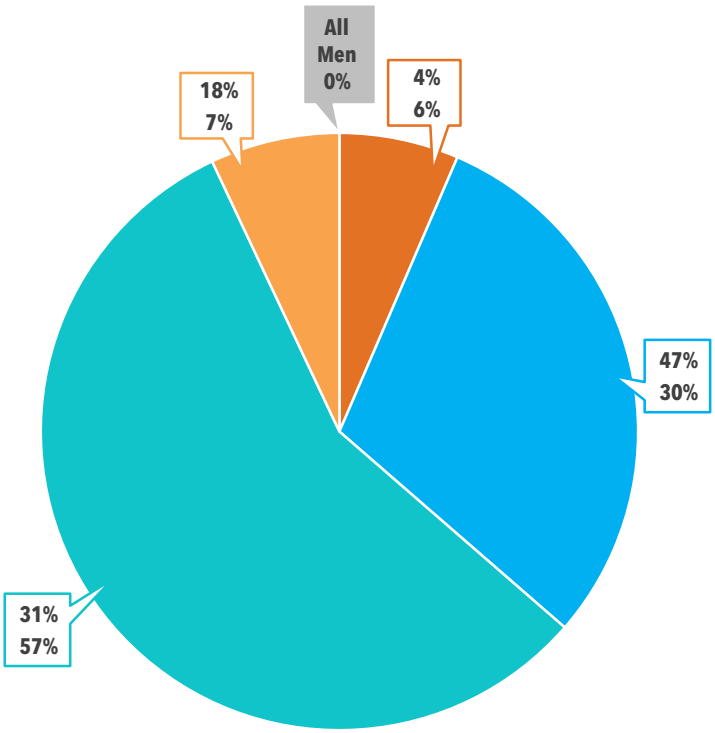


Figure 3. Crops grown by farmers surveyed

Based on the data, collectively, the farmers surveyed reported growing all these crops; however, to simplify the analysis, we have decided to narrow the report to the three most commonly grown crops. These were maize, bean, and cassava; however, the report only includes information on beans and maize

- **Analysis by gender, then age:** Because, for most indicators, we are tracking 3 different gender groups and at least 2 variables for crops (overall, bean, and maize), we have opted to present the analysis for gender and age separately.

    - **Gender groups:** The team decided to apply three comparisons when analyzing the data, as these presented the most useful comparisons to find if gender played a role in the case of the particular indicator. These include comparing responses (1) by men and women within the same household (dual-headed households, or DHHHs), (2) women in DHHHs vs. households headed by women only (FAOHHs), and, to a lesser extent, (3) men in DHHHs to women in FAOHHs, using the reasoning that in this case, both the man and the woman were household heads.
    - **Age groups:** Respondents were divided by age into "**youth**" (age 18 up to age 30) and "**seniors**" (age 30 and above). Results are presented for these two groups by indicator.

- **Association with use of quality seeds:** Whenever possible, we present data on the association between the particular indicator and the use of quality seeds, as reported by the farmers surveyed. Although the pilot study did not include statistical analyses, these associations highlight some potential links between the use of seeds of improved varieties and the pilot indicators.

Indicator 1: Purchases of seed of improved varieties

Use of seed of improved varieties

Although this indicator focuses on purchases of improved varieties, we started by asking about the use of improved varieties, because this allowed us to determine the percentage of the farmers who planted seeds also purchased those seeds. Accordingly, Figure 4 shows the percentage of farmers in the different groups who reported using (that is, planting) bean or maize seed. The data shows that beans were equally popular among all three gender groups, while 11% more of the seniors surveyed reported planting it than youth (68% vs 57%). In the case of maize, men and women in DHHHs reported planting maize in equal numbers; however, maize was planted by fewer women in FAOHHs (49% vs. the 64% reported by men and women in DHHHs). In terms of age, the picture was the "reverse" of that of beans; 14% more youth reported planting maize than seniors.

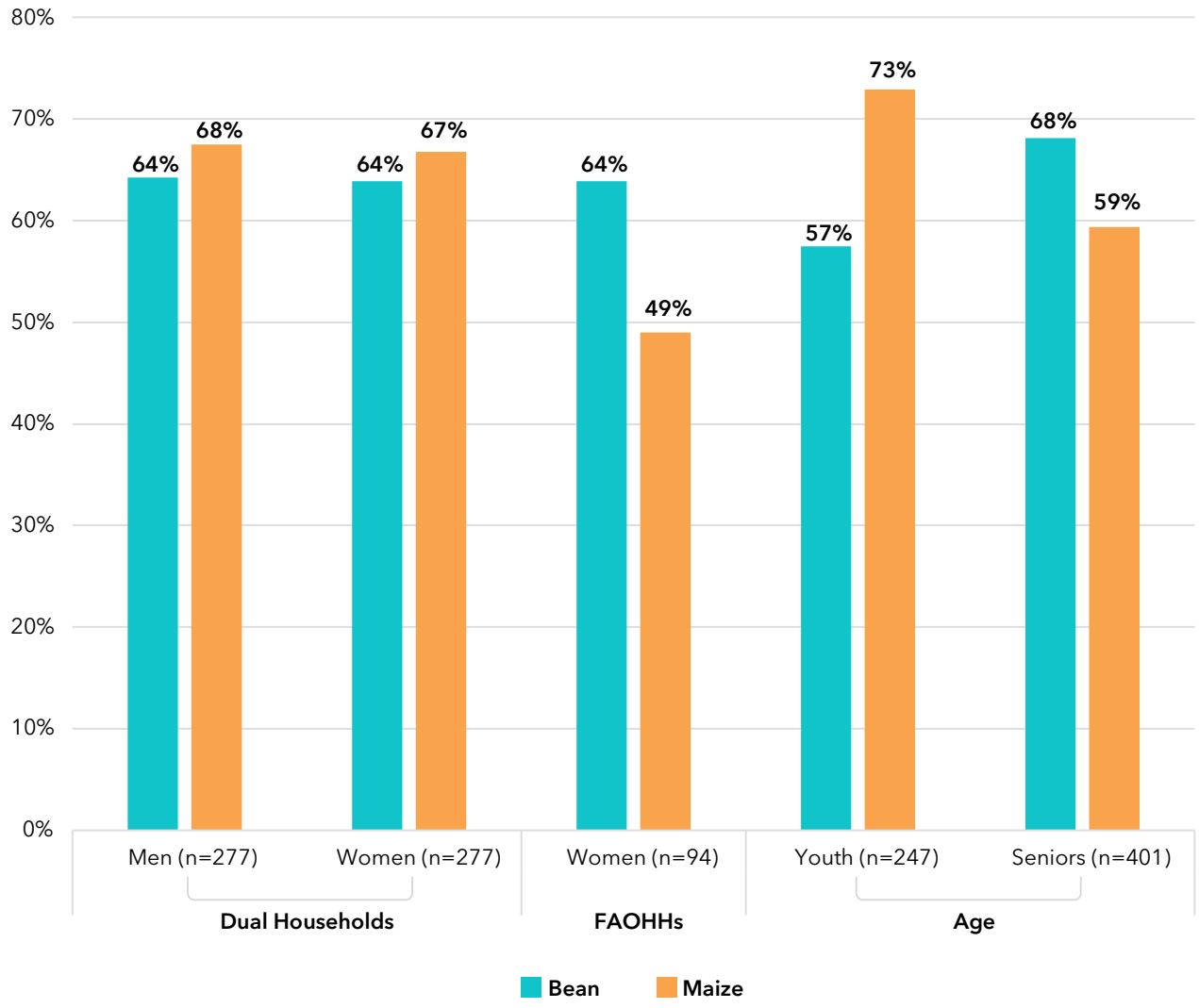


Figure 4. Percentage of respondents using (planting) maize and bean

Figure 5 focuses on the use of quality seeds reported by the different farmer groups who reported using/planting that crop; for all crops, the use of quality seeds is more-or-less the same for the different gender and age groups. Notably, the rates are all quite low. The pattern is different for beans, where women in FAOHHs reported higher rates of use than men or women in DHHHs, and youth reported a 33% higher rate of use than seniors. The data for maize is more even by age; by gender, men in DHHHs reported the highest rate, followed by women in DHHHs and in FAOHHs.

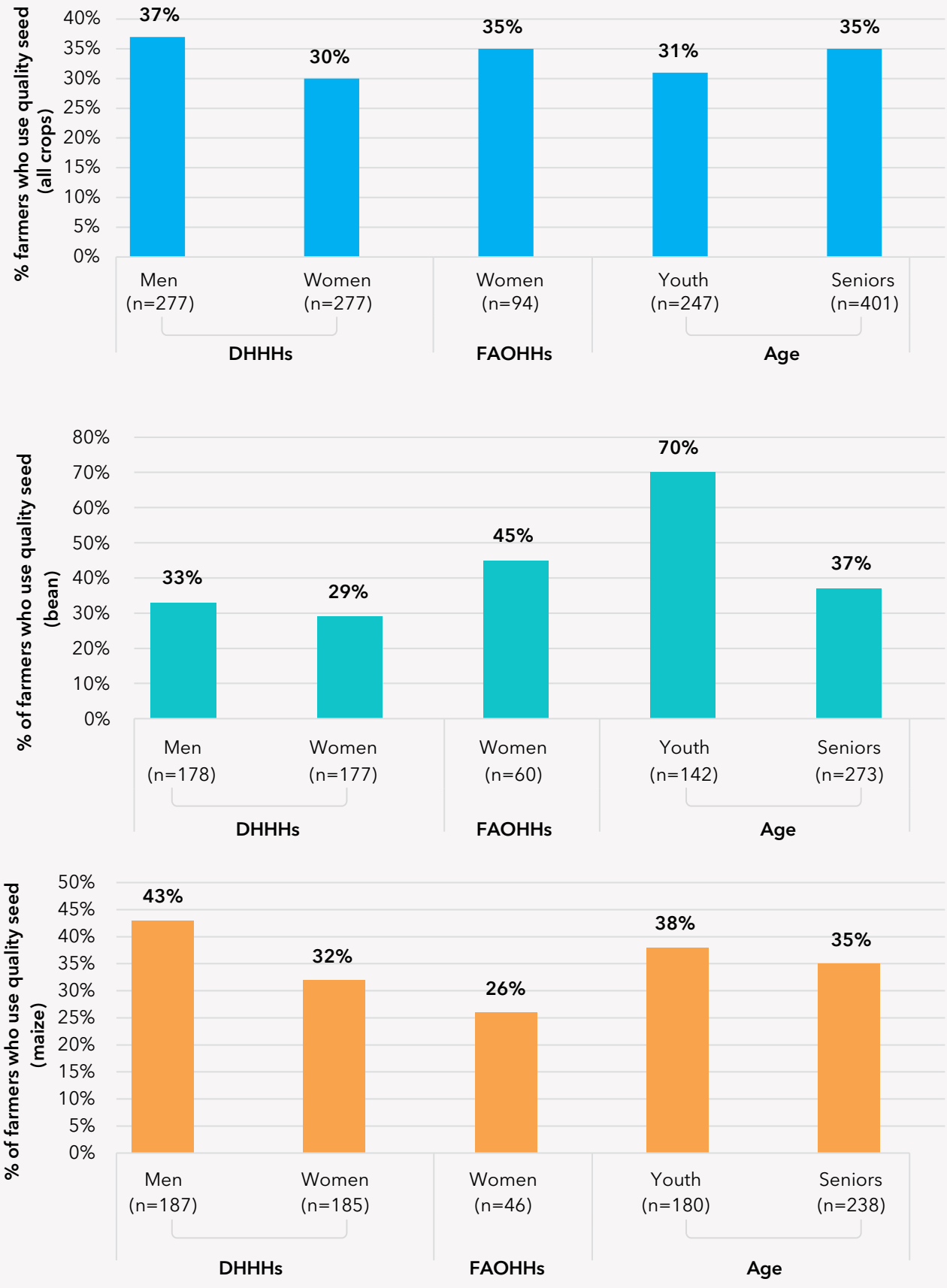


Figure 5 a/b/c. Rates of quality seed use by farmers

Purchases of seeds of improved varieties

When it comes to purchasing bean seed, Figure 6 shows, for the 5 respondent groups, the percentages of those that reported purchasing seed (of those who planted beans; blue bar), followed by the percentage of those who reported that they purchased quality seed of improved varieties (orange bar), and, for comparison, in green, the number of farmers who purchased quality seed as a percentage of all those who planted bean seed. The data shows that more men and youth purchased bean seeds than women and seniors. However, the highest rates of purchase for quality bean seed were reported by women in FAOHHs, and by seniors (a difference of 17 percentage points over youth). Perhaps most importantly, looking at the green bars, we see that the highest rate of purchase of quality bean seed was relatively low - 28%.

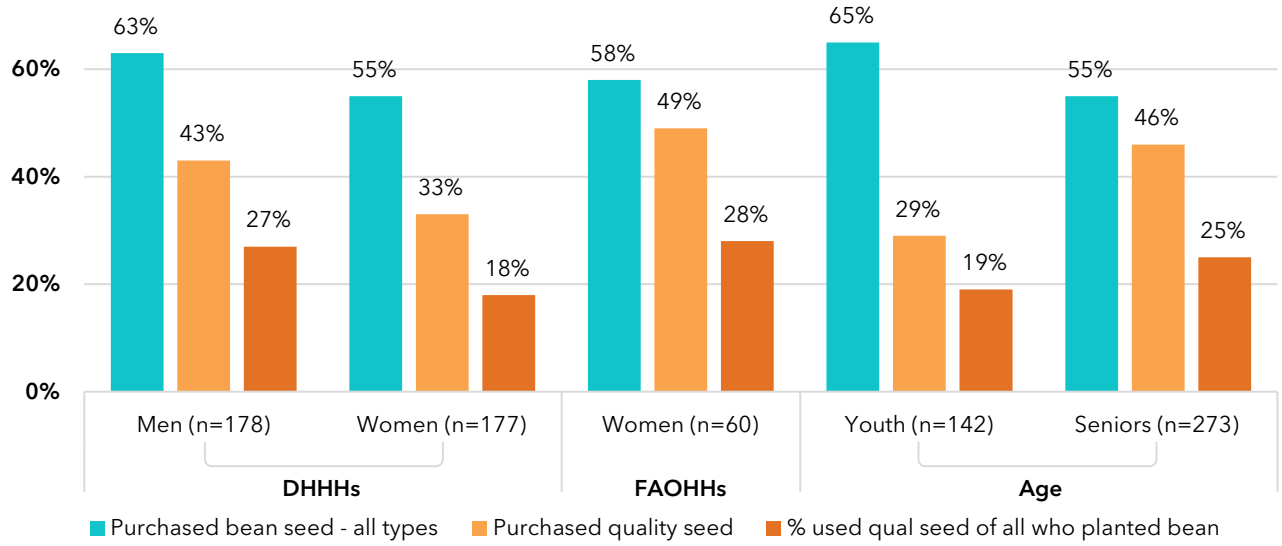


Figure 6. Purchases of bean seed by type and respondent group

Analyzing the data further, Figure 7 further disaggregates the quality seeds purchased by farmers into certified seeds and quality-declared seeds (QDS). There are two main findings here: one is that the vast majority of quality bean seed purchased by farmers is QDS; the percentage figures for QDS range from 67% - 94%, while the corresponding figures for certified seeds are much lower at 1% to 7%. However, the figure also shows that up to a quarter of respondents among men in DHHHs and youth reported that they did not know (or remember) what type of seed they purchased, so the data for those groups is approximate.

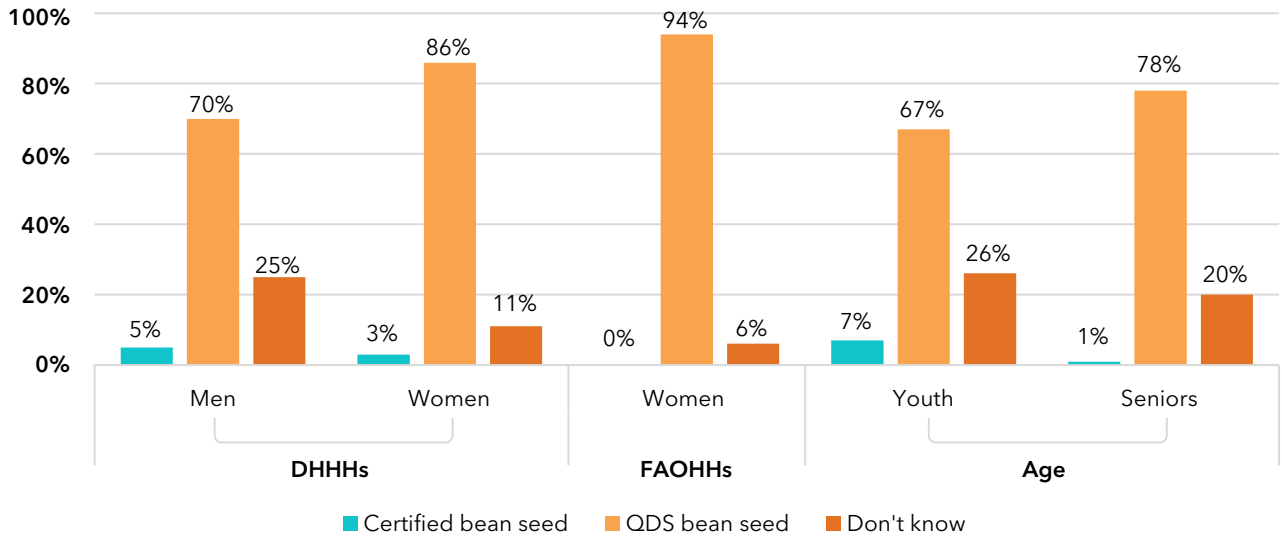


Figure 7. Breakdown of quality seeds purchased, by type (bean)

When it comes to purchasing maize seed, Figure 8 shows, for the 5 respondent groups, the percentages of those that reported purchasing seed (of those who planted maize; blue bar), followed by the percentage of those who reported that they purchased quality seed of improved varieties (orange bar), and, finally, in green, the number of farmers who purchased quality maize seed as a percentage of all those who planted maize. In contrast to beans, the data for maize shows that farmers were more likely to purchase quality seed than traditional varieties. Further, men in DHHHs reported the highest rates of purchasing quality seeds (76%), followed by women in DHHHs (61%), and finally, women in FAOHHs (56%). This is a fairly large gender gap. Across the two age groups, a higher percentage of seniors (72%) reported purchasing improved seeds, compared to 65% of youth. These findings reflect the availability of improved maize varieties in Uganda, with its long-standing emphasis on maize breeding. Looking at the green bars – the rates of purchase of quality seeds as a percentage of all farmers who planted maize - we see that the overall rates of purchase of quality maize seed range from 22% to 39%, with men in DHHHs and youth reporting the highest rates.

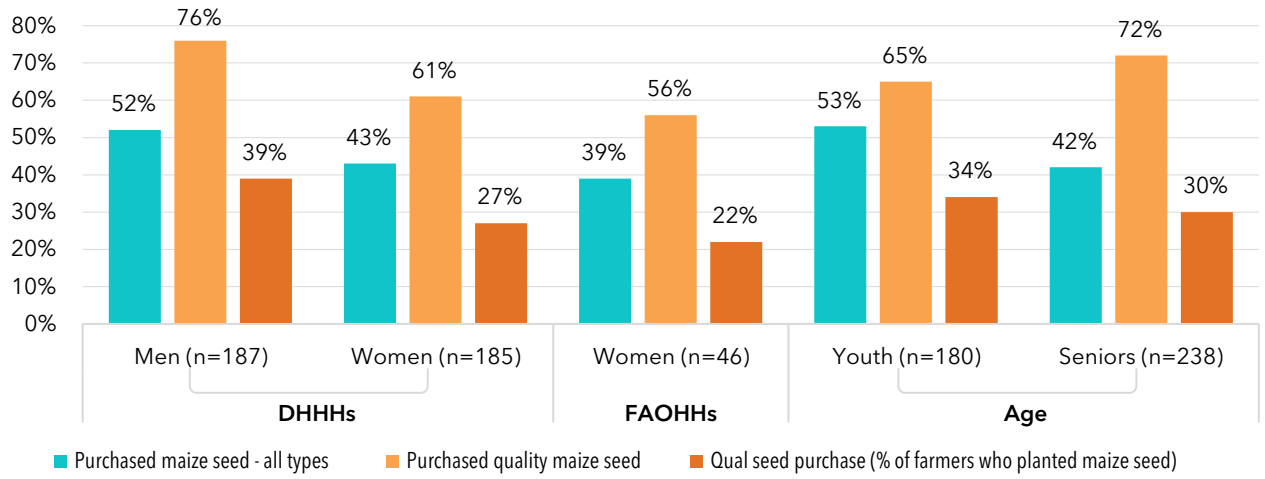


Figure 8. Purchases of maize seed by type and respondent group

Analyzing the data further, Figure 9 provides a breakdown of the type of quality seeds reported by farmers, asking whether they were certified or quality-declared seeds (QDS). Once again, reflecting the emphasis on developing maize varieties in the country, the majority of seeds purchased were certified seeds. Importantly, women in FAOHHs reported that all the quality seeds they purchased were certified; this, compared to the 69% reported by men in DHHHs and the 60% reported by women in DHHHs.

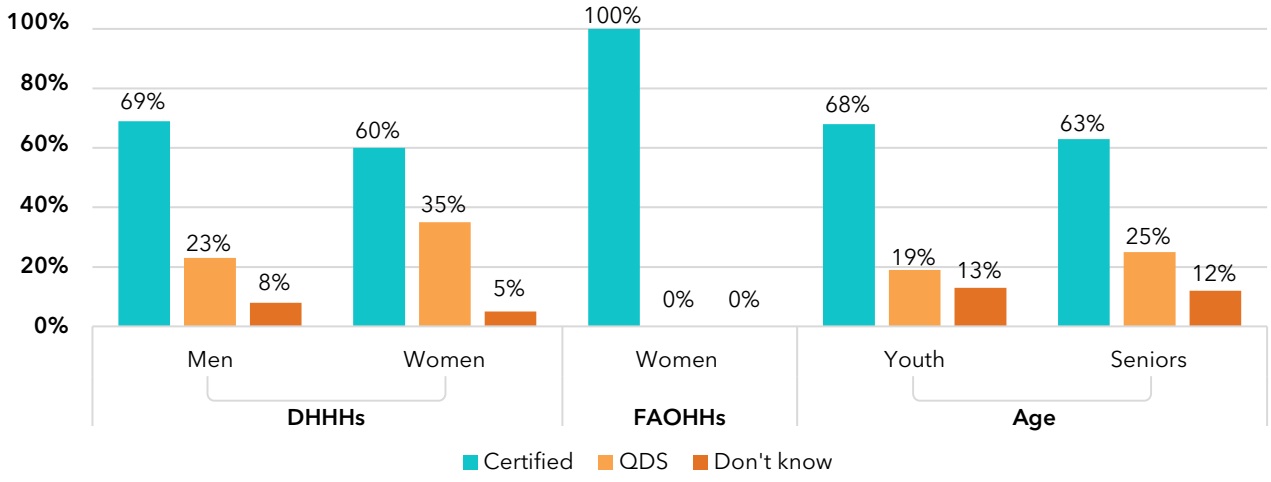


Figure 9. Breakdown of quality seeds purchased by type (maize)

> Men in DHHHs reported the highest rates of purchasing quality seeds (76%), followed by women in DHHHs (61%), and finally, women in FAOHHs (56%). This is a fairly large gender gap. Across the two age groups, a higher percentage of seniors (72%) reported purchasing improved seeds, compared to 65% of youth.

Indicator 2. Availability of seed in small packages

The availability of small package sizes is an indicator tracked by TASAI; the rationale is that small packages of seed often provide an entry point for a smallholder farmer to purchase small quantities of quality seeds - or try a new improved variety. Given that women and youth often have less purchasing power than men, this indicator is assumed to be more relevant to these groups.

To begin with, the survey asked if the seed farmers purchased was packaged seed. Figure 10 shows that, in the case of bean seed, most of the seed purchased was not packaged, while most of the maize seed purchased was packaged. Women in FAOHHs had the highest rate of purchasing packaged bean seed, while men in DHHHs reported the highest rate for maize. Broken down by age, seniors bought more packaged bean seed than youth (20% vs. 7%, respectively), while in the case of maize, the situation is the reverse: more youth purchased packaged seed (70%) than seniors (64%).

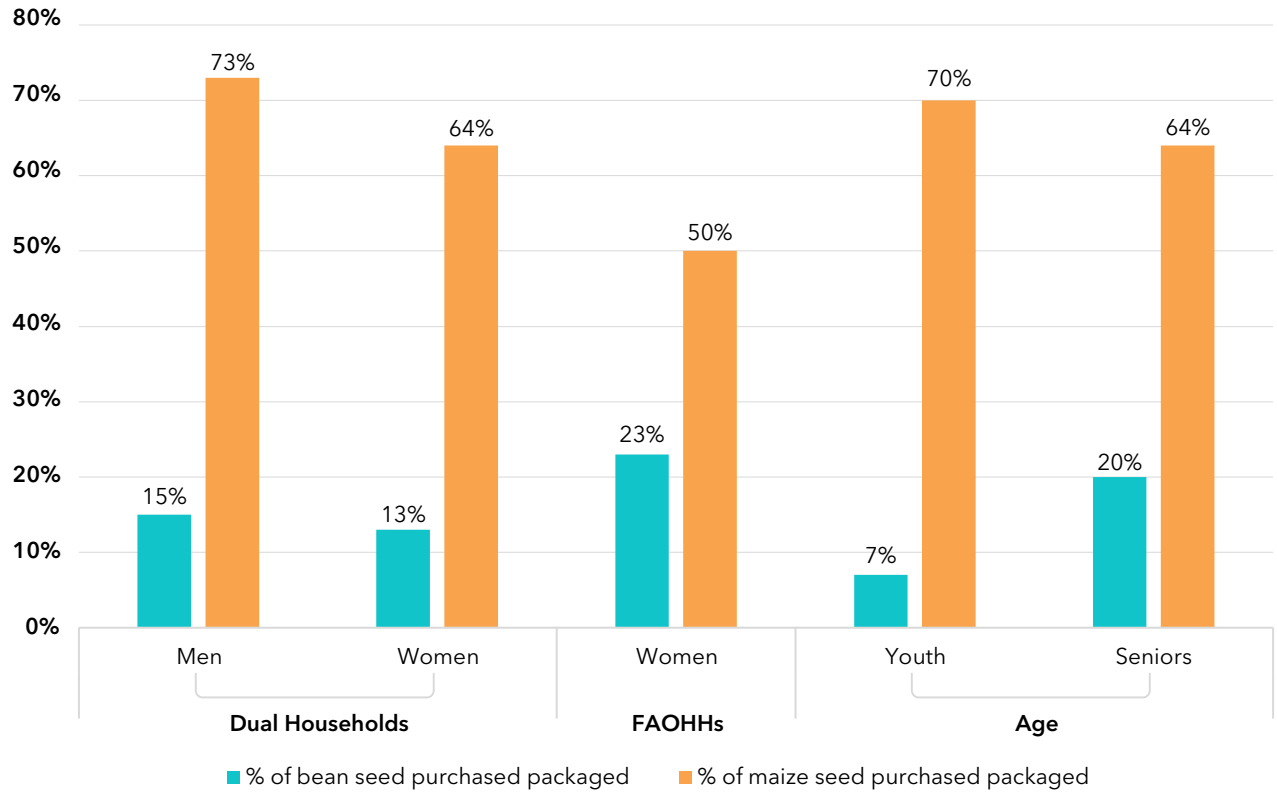


Figure 10. Purchases of packaged seeds by farmers

Next, we will look at the breakdown of package sizes by group, but we will do so only for maize, where the portion of packaged purchases is greater. Figure 11 shows that 89% or more of seed is purchased in bags of 10kgs or less. Further, in DHHHs men and women both purchased over half of maize seed in packages of 2 kgs or less, with men buying 5% more (58%) of this package size than their spouses (53%). In contrast, women in FAOHHs favored the >2-10kg package 2 to 1 to the smallest (2 kg or less) package size (60% vs 30%). When breaking down the data by age, we see a 7-point difference between youth and seniors when it comes to buying the smallest packages, with 57% of seniors reported doing so compared to 50% of youth. The situation is reversed for the next package size (2-5 kg), where youth reported buying 41% of seed in this package size compared to 33% reported by seniors.

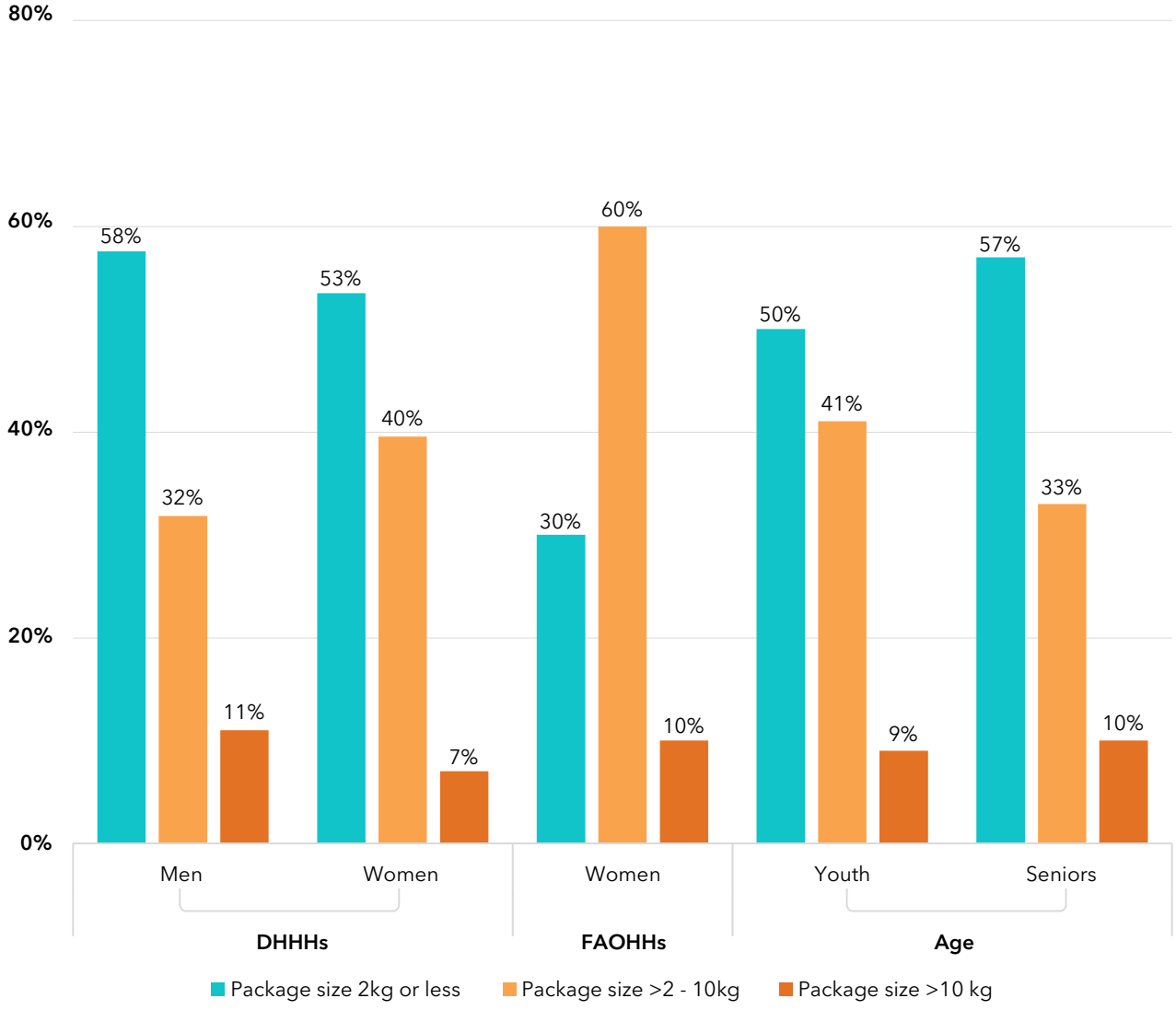


Figure 11: Breakdown of maize seed packages by size and respondent group

As a way of validating the household data, we can compare it with TASAI data on package sizes sold by seed companies.[4] Figure 12 below presents this comparison, showing that, just like household respondents, companies also report that approximately 90% of seed is sold in packages of 10 kgs or smaller. Further, the proportion of the two smallest packages sold (0-2 kg and 2-10 kg) were similar across seed companies and all respondent groups, with the exception of women in FAOHHs, whose preferences deviated from the rest.

4 The primary respondents for TASAI studies are registered seed companies (or producers, depending on the country).

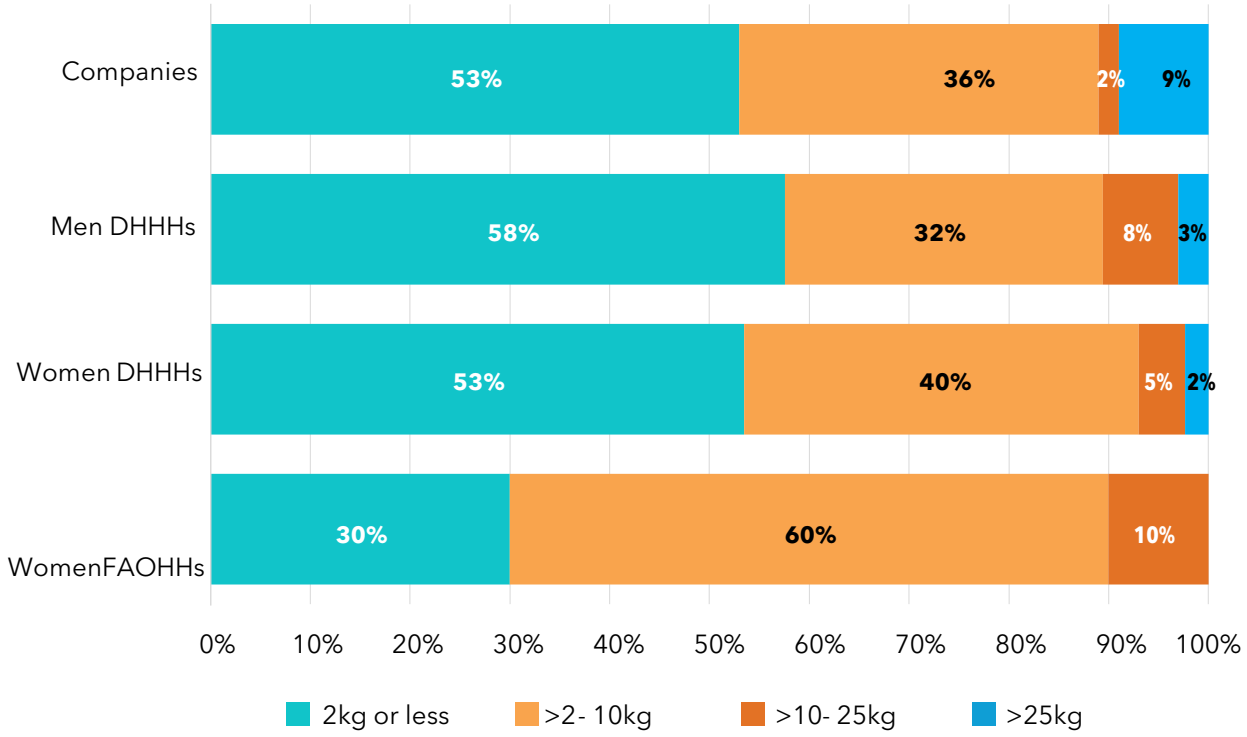


Figure 12. Comparison of package sizes for maize seed from TASAI survey and HH survey

In addition, the household survey asked farmers to report if the package size(s) they purchased were the ones they needed/wanted to purchase. Over 90% of women (who bought packaged seeds) in both groups indicated that they were able to purchase the 'right' package size for both beans and maize. The same was true for men for maize; however, for beans, 50% of men (who had purchased seed) responded that they were not able to buy the package size they wanted. Note, however, that the 50% here refers to only 6 respondents, because this group is a subset of those who purchased packaged seeds of improved varieties. Nevertheless, two reported that they preferred 10kg packages, while the other four would have liked 3kg, 4kg, 5kg, and 25kg packages, which indicates that, perhaps with the exception of the 25kg package, which may not be widely available, the desired quantities did not differ significantly from the commonly offered package sizes.

Indicator 3: Affordability (Price)

Farmers who reported that they bought seeds were asked to report the price for which they purchased those seeds. Table 12 summarizes the findings. As expected, seeds of improved varieties cost more across the board, regardless of which group purchased it. The price differential between traditional and seed of improved varieties is significantly greater for maize, where the prices of the seed of improved varieties are 4-5 (that is, 400-500%) times that of traditional seeds; in contrast, the same differential for beans is no more than 35%. Looking at the prices paid by gender, it is interesting to note that, for both beans and maize, men reported paying the lowest prices, followed by married women; women in FAOHHs reported paying the highest prices for both improved bean and maize seeds. To illustrate the difference, we calculated the 'surcharge' women paid (Figure 13 and Figure 14), which, for beans, reached 16% and for maize seed, was as high as 38%. The research did not probe the reasons for these differences during fieldwork; however, anecdotally, enumerators reported that it is common for one person (often, a man) to purchase seed at the request of a woman, and the person buying the seed may increase the quoted price a bit to compensate for their time and effort. In terms of differences between the two age groups, seniors paid higher prices for seed of improved varieties for both bean and maize, although the difference was minimal.

Table 12. Prices of maize and bean seeds as reported by farmers

GENDER		PRICE - UGX			PRICE - USD[1]		
CROP	CROP TYPE	DUAL HHS		FAOHHS	DUAL HHS		FAOHHS
		MEN	WOMEN	WOMEN	MEN	WOMEN	WOMEN
Bean	Improved	4,094.82	4,240.63	4,734.14	1.08	1.12	1.25
	Traditional	3,147.63	3,429.09	3,194.79	0.83	0.90	0.84
Maize	Improved	13,062.97	14,517.40	18,066.67	3.44	3.82	4.75
	Traditional	3,141.41	2,663.94	1,140.00	0.83	0.70	0.3
AGE		PRICE - UGX			PRICE - USD		
Crop	Crop type	Youth	Senior		Youth	Seniors	
Bean	Improved	3,995.34	4,347.27		1.05	1.14	
	Traditional	3,196.75	3,342.39		0.84	0.88	
Maize	Improved	13,715.52	14,200.83		3.61	3.74	
	Traditional	2,775.23	2,647.62		0.73	0.70	

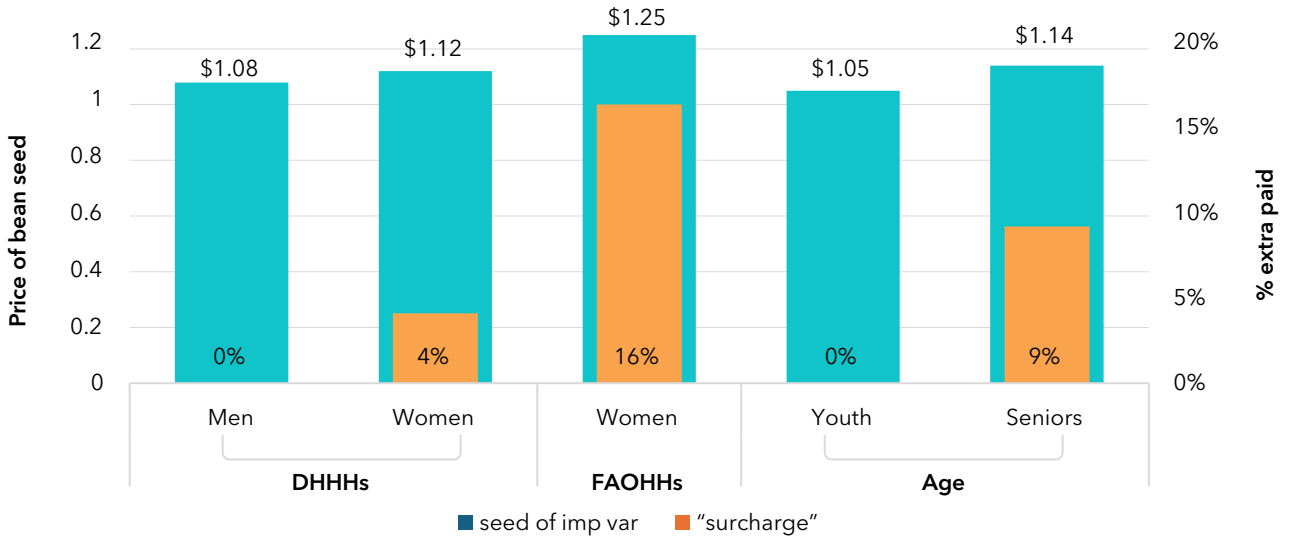


Figure 13: Price comparison of bean seed across gender and age groups

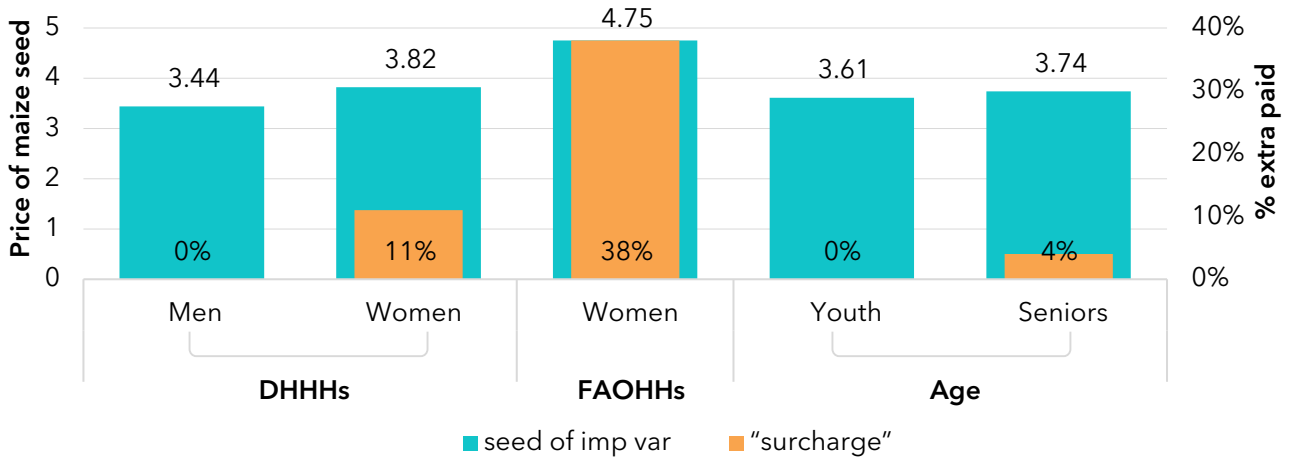


Figure 14. Price comparison of maize seed across gender and age groups

The survey also asked respondents to indicate if they were able to purchase the quantity they wanted, and, if not, to give a reason why. Table 10 shows that, at least in the case of maize and beans, no more than 5% of respondents indicated that they had not been able to purchase the quantity they wanted. Importantly, the reason for this in all cases was the high price of seed.

Table 10. Reasons for not purchasing desired quantities of seed

"Were you able to purchase the quantity you needed/wanted?"	DHHHs		Women in FAOHHs	Age	
	Men	Women		Youth	Senior
Number who responded 'No' – bean seed	6	1	3	1	9
Percentage of those who purchased bean seed	5%	1%	1%	0%	3%
Number who responded 'No' – maize seed	7	6	1	6	8
Percentage of those who purchased maize	4%	3%	2%	3%	3%
Reasons given:					
High prices	100%	100%	100%	100%	100%
Other	-	-	-	-	-

TASAI studies also collect data on the price of seeds, and it may be informative to compare price data from TASAI with that reported by farmers. The latest TASAI data for Uganda is from 2021 (Mabaya et al, 2022). Table 11 shows the average prices of bean and maize seeds reported by TASAI, QDS producers, and farmers surveyed. Overall, the three sources report similar prices with the exception of maize (hybrid), for which the price reported by farmers is about threefold the price collected by TASAI. However, it is important to note that TASAI data was collected in 2021, and according to the Lead Researcher of the pilot, 2023 was an unusual year due to two main reasons: One, a drought in western Kenya drove up demand for maize seed and the sales to Kenya created a deficit in the Ugandan market. Two, demand was also increased due to the "Parish Development Model," a government initiative that disbursed funds to savings and credit cooperatives, which farmers used to purchase inputs, in the process increasing demand. Because seed companies and distributors took some time to catch up with the demand, there was a temporary shortage of maize seed in the country, resulting in a higher price.

Table 11. Seed prices, as reported by TASAI, QDS producers, and farmers

	AVERAGE SEED PRICES (UGX/KG)		
CROP	COMPANIES (TASAI)	QDS PRODUCERS	FARMERS
Year	**2021**	**2023**	**2023**
Maize (hybrid)	5,883	-	15,216
Maize (OPV)	2,410	-	2,315
Bean	5,083	4,718	4,357

Indicator 4: Exposure to "model/lead" farmer

This indicator probes whether model farmers present an avenue to increased use of seed of improved varieties, and whether our data shows any differences by gender and age. To collect more nuanced data, the survey question also asked about other sources of information through which farmers may learn about quality seeds. The results (Table 12) show that, although model farmers are a reasonably frequent source of information on seed of improved varieties, at the level with radio/TV ads, the most common source is people known to the farmer - their neighbors, friends, relatives.

Table 12. Sources of information on quality seeds and percentage of respondents receiving information through the particular channel

INFORMATION SOURCES ON SEED OF IMPROVED VARIETIES	DUAL HOUSEHOLDS		FAOHHS	AGE CLASSIFICATION	
	Men	Women	Women	18-30 years	31+ years
Demonstration plot	25%	21%	26%	16%	28%
Model farmer	43%	37%	34%	35%	42%
Radio/TV ad	43%	34%	33%	38%	38%
Print ad/billboard	3%	4%	5%	3%	4%
Mobile ad (SMS or WhatsApp message)	12%	5%	8%	8%	8%
Neighbor/relative/friend (word-of-mouth)	75%	50%	46%	52%	65%

The survey also asked respondents to rate the strength of the influence of a model farmer on their decision to use improved varieties on a scale of 1-5 ("no influence at all" to "a lot of influence"). As shown in Figure 15, all gender and age groups reported a moderately strong influence, with women in FAOHHs indicating the strongest influence on their decision to use quality seed. In a future study, it may be useful to gather data on the ratings of other sources of information to see which one is the most trusted by farmers.

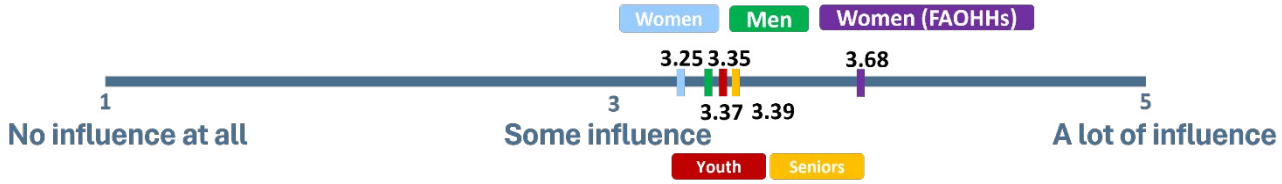


Figure 15. Influence of model farmers on purchases of quality seed

Indicator 5: Link to buyer

Respondent farmers were asked about their links to buyers; we were interested in whether there are any differences by gender or age in the channels used by farmers to get their produce to buyers. Table 13 shows the results of this question, which was prepopulated with eight options and also allowed respondents to enter their own response. Two of the options that included produce bulking, either through collection centers or rural agents, were listed among the top 3 buyers by all three gender groups. In addition, about a third of men and women in DHHHs listed "contract farming for off-takers" as a frequently used link to a buyer. Finally, "other" appeared among the top 3 buyers for both groups of women and referred to "local market" and "transporting to neighboring center." Comparing the two age groups, produce bulking by independent agents and contract farming off-takers were cited by both groups among their top 3 options. Overall, the data shows that all farmers use much the same links to buyers, with small, reported differences in their frequency of use.

> An important question for our study is whether links to buyers are associated with higher rates of use/purchase of seed of improved varieties – and if there are any significant differences by gender or age. The data suggest a clear association between being linked to buyers and the reported use of seed of improved varieties (of all crops).

Table 13. Farmers' links to buyers for seed produced

LINK TO BUYER	DUAL HOUSEHOLDS		FAOHHS	AGE	
	Men	Women	Women	Youth	Seniors
Contract farming for off-takers (aggregators, processors, exporters, or wholesalers)	32%	34%	21%	19%	24%
Bulk marketing through farmer field school, extension workers, cooperative, NGO, or trade association	22%	6%	16%	8%	11%
Media - via radio/TV programs or e-marketing platforms	19%	5%	6%	8%	8%
Agricultural fairs and exhibitions	2%	-	-	0%	1%
Produce bulking or collection centers set up by **private companies**	28%	20%	23%	15%	18%
Produce bulking by independent rural bulking agents (with satellite stores)	25%	34%	40%	27%	19%
Government procurement (e.g., school milk program in W. Uganda)	1%	1%	1%	1%	1%
Produce logistics and transport service provider	18%	-	1%	4%	6%
Other	8%	29%	27%	17%	12%

Figure 16 shows the relationship between link to buyers and use of improved varieties; that is, it tests the assumption that those with links to buyers (regardless of the type of link) would report higher rates of use of quality seed. The data bears this out, as it shows that those with links to buyers have higher reported rate of use of quality seed, and, conversely, those who report no links to buyers use less quality than 'other' seed.

An important question for our study is whether links to buyers are associated with higher rates of use/purchase of seed of improved varieties – and if there are any significant differences by gender or age. Figure 16 below shows the results of this analysis. The data suggest a clear association between being linked to buyers (of one or more type listed in Table 13) and the reported use of seed of improved varieties (of all crops). For example, men with links to buyers report over twice the frequency of use of quality seed than those without a link: 53% vs. 20%. The corresponding association is even stronger for the two groups of women we surveyed: 59% vs. 12% for women in DHHHs and 70% vs. 3% for women in FAOHHs. In short, being linked to buyers is associated with greater use of seed of improved varieties; moreover, being linked to a buyer seems to have a stronger association for women than for men. The same association between link to buyer and using improved varieties holds for the two different age groups as well, although the differences by age are smaller than by gender.

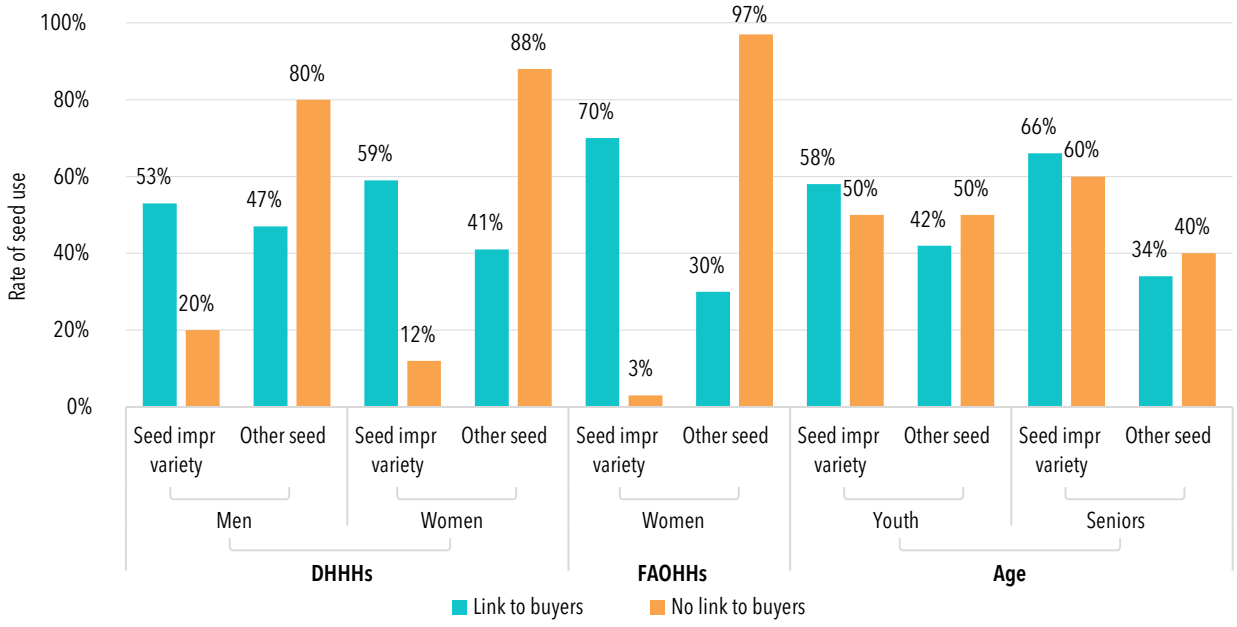


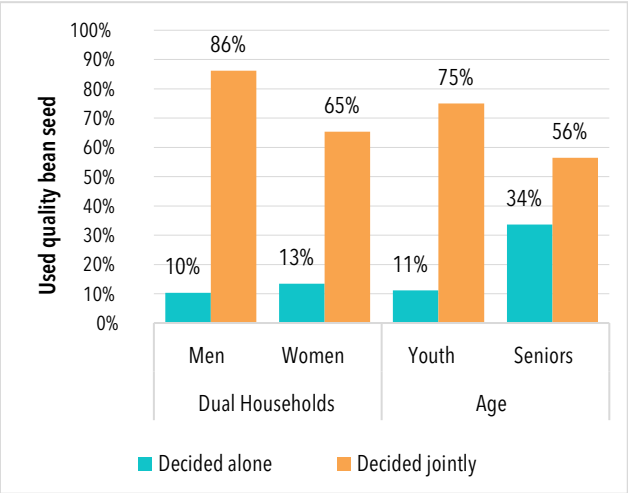
Figure 16. Association between link to buyer and use of seed of improved varieties (all crops)

Indicator 6: Input in household decision-making related to agricultural production

This indicator looks at the dynamics of decision-making regarding which crop varieties to plant. Table 14 presents the responses. Perhaps not unexpected, the overwhelming majority (96%) of women in FAOHHs reported making this decision on their own. The same figure was reported for both bean and maize. In DHHHs, the majority of spouses reported making the decision jointly, although the assessment of men and women differed somewhat. Namely, in the case of beans, there was a 10% gap between men and women in DHHHs, with fewer women feeling that the decision was made jointly. For maize, the results are the opposite, with 3% more women reporting that the decision was made jointly. These differences notwithstanding, it appears that in most households, deciding which varieties to plant is a joint decision. Disaggregating the data by age, we find that the majority of people in both age groups make the decision jointly; however, young people report higher rates of joint decision making for both crops, with a bigger difference in the case of bean.

Table 14. Decisions about which crop variety to plant

WHO DECIDED TO PLANT THE CROP VARIETY GROWN	DUAL HOUSEHOLDS		FAOHHs	AGE	
Beans	**Men**	**Women**	**Women**	**Youth**	**Seniors**
Another member of the household and I did it together.	-	-	2%	-	0%
Another member of the household did it alone.	1%	2%	-	3%	0%
Decision was made outside the household (e.g., variety was provided by subsidy program, NGO, etc.)	-	-	2%	-	0%
I did it alone.	11%	14%	96%	14%	29%
My spouse and I did it together.	84%	74%	-	80%	63%
My spouse did it alone.	4%	8%	-	3%	6%
Maize					
Another member of the household and I did it together.	0%	1%	4%	1%	1%
Another member of the household did it alone.	0%	2%	-	1%	0%
Decision was made outside the household (e.g., variety was provided by subsidy program, NGO, etc.)	0%	1%	-	1%	-
I did it alone.	5%	4%	96%	10%	19%
My spouse and I did it together.	88%	91%	-	81%	77%
My spouse did it alone.	8%	2%	-	7%	3%



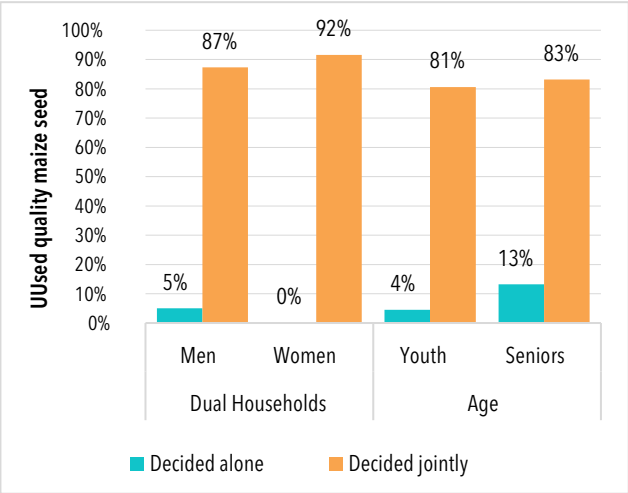


Figure 17a/b: Association between joint decision making and use of improved bean seed

A related question is whether there is an association between joint decision making and the use of seed of improved varieties. To answer this question, we looked at the type of seed used against deciding jointly or alone. Figure 17a/b shows across the board, farmers who reported using quality seeds were much more likely to make decisions jointly than alone. Note that women in FAOHHs are not included in this analysis.

Indicator 7: Access to/ownership of assets related to agricultural productivity

Participating farmers were asked to provide information on their access to various assets related to agricultural productivity. Table 15 presents the findings, providing averages for all 3 groups separately and combined. The overall trend, with a few exceptions, is that men have the greatest access to these assets, followed by women in DHHHs. Women in FAOHHs are usually in last place. The assets that showed the most disparate levels of "access are land (owned solely)," "seed of improved varieties," "extension services – in person and virtual" – and "transport – owned by family". Also notable is that inputs such as "fertilizer – inorganic," "mechanized equipment," and "virtual extension services" were accessed by no more than a third of any of the three gender groups, indicating low access to these assets overall in the community.

Looking at access to agricultural assets by age, the overall pattern is that seniors report greater access to assets, which is perhaps not surprising, as they have had more time to accumulate assets and resources. The only difference to this pattern was observed in land ownership, where 83% of youth reported owning land jointly compared to 74% of seniors. This could be possibly explained by the fact that the majority of the youth (54%) do not solely own land as compared to their seniors (41%). Land ownership showed the most disparate rates of access by age; others (highlighted in the table using darker colors to indicate a larger difference) were seed of improved varieties, non-mechanized equipment, extension services, transport owned by family, and fertilizer.

Table 15. Access to agricultural assets by farmers

ACCESS TO/OWNERSHIP OF ASSETS RELATED TO AGRICULTURAL PRODUCTIVITY	DUAL HOUSEHOLDS		FAOHHs	COMBINED AVG.	AGE	
	Men (N=277)	Women (N=277)	Women (N=94)		Youth	Seniors
Tools - manual (e.g., hoes, rakes, watering cans, etc.)	98%	99%	97%	98%	98%	98%
Hired labor	79%	74%	59%	74%	74%	73%
Land (owned jointly)	78%	86%	51%	78%	83%	74%
Transport - hired	74%	83%	71%	77%	81%	76%
Seed of improved varieties	70%	58%	56%	63%	58%	66%
Land (own solely)	69%	36%	64%	54%	46%	59%
Non mechanized equipment (e.g., tarpaulins, hermetic bags etc.)	66%	55%	48%	59%	51%	63%
Extension services - in person	65%	49%	47%	56%	51%	58%
Transport - owned (by family)	62%	55%	27%	54%	49%	57%
Land (rent or borrow)	61%	58%	52%	58%	60%	58%
Fertilizer - organic manure	47%	39%	39%	42%	31%	49%
Extension services - virtual (by phone, SMS, WhatsApp)	37%	25%	28%	31%	28%	32%
Mechanized equipment (examples above)	35%	33%	26%	33%	34%	32%
Fertilizer - inorganic	30%	27%	24%	28%	24%	30%
N=	**277**	**277**	**94**	**648**	**247**	**401**

Given the importance of land, let us take a more careful look at it. Table 16 below provides information on the average land area that men and women cultivate. Note that this includes both land owned and accessed,[5] as

5 By 'access' we mean any way a person may have access to land outside of ownership, such as leasing, renting, or being allowed to use another person's land for free.

use of seeds and other inputs is governed by the overall area cultivated. On average, women in DHHHs cultivate the most land (3.35 acres), followed by men in DHHHs (2.74 acres), and women in FAOHHs (2.47 acres.) Looking at the average size of land holdings by age, on average, seniors cultivate about 22% more land than youth, which is not surprising given that people tend to accumulate assets over time.

Table 16. Average size of land parcels worked by farmers

	AVG. SIZE OF LAND AREA CULTIVATED (ACRES)		
	Own	**Access**	**Own and access combined**
Men in DHHHs	1.32	1.42	2.74
Women in DHHHs	1.43	1.92	3.35
Women in FAOHHs	1.04	1.43	2.47
Youth	1.13	1.33	2.46
Seniors	1.44	1.72	3.16

The study also considered whether the data revealed an association between land ownership/access and use of seed of improved varieties. To simplify this analysis, we decided to look at the average landholding size for each respondent group and look at the rates of quality seed use among those with below or above average size land holdings. The results in Figure 18 show that, for men and women in DHHHs, above average size landholding is associated with higher rates of use of quality seed (82% vs. 64% and 63% vs. 55%, respectively). For women in FAOHHs the results indicate that the size of land holding does not show a clear association with use of improved varieties. Disaggregated by age, the data shows that among youth and seniors, those with above average landholdings also report higher rates of seed of improved varieties use. The difference is 19% (50 vs 69%) for youth and 12% (62 vs 74%) for seniors.

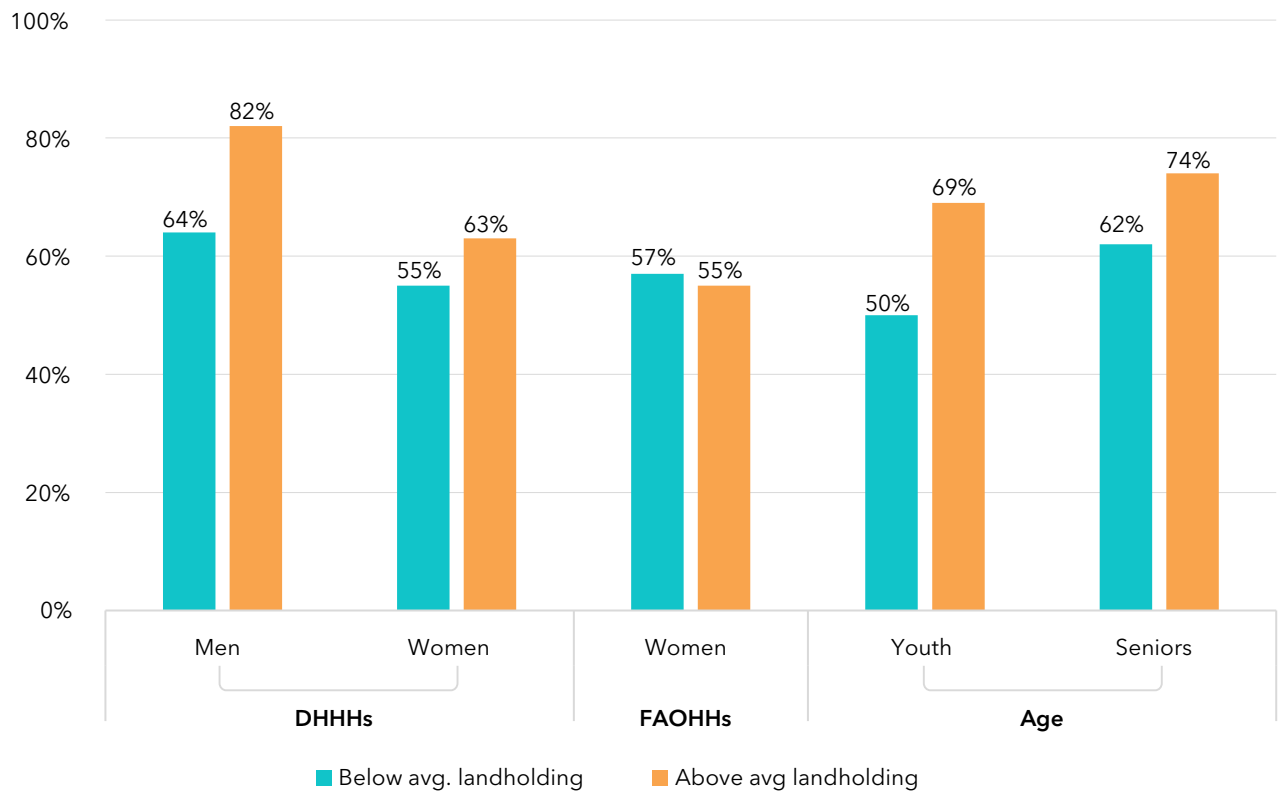


Figure 18. Association between size of land cultivated and use of seed of improved varieties

Indicator 8: Membership in agriculture-related community groups

Two questions in the household survey asked participants to provide information on their membership in various agriculture-related community groups, including whether they held leadership positions. The survey was prepopulated with two options – cooperative/association and SACCO (the commonly used term for a savings and credit cooperative) –, both common community groups in Uganda. Respondents could also enter their own response. Table 17 presents the responses, indicating that, across all three groups, respondents were more likely to belong to a SACCO than to a cooperative/association. Analyzed by gender, women from either household type were more likely to belong to a SACCO than men: 51% of women in FAOHHs indicated membership, followed by 45% of women in DHHHs, compared to 31% of men surveyed. Women in FAOHHs also led in the rate of membership in cooperatives (18%), followed closely by men (15%), while 7% of women in DHHHs reported belonging to a cooperative/association.

When asked about leadership roles in either organization, men reported the highest rates, followed by women in FAOHHs and women in DHHHs. The data suggest that, while men's membership rates are lower than that of women, men hold more leadership positions than women. In addition, we have found that women in FAOHHs are more likely to hold a leadership position than women in DHHHs. When it comes to age groups, seniors report considerably higher rates of membership than youth in both cooperatives and SACCOs.

Table 17. Membership and leadership in agriculture-related community groups

INDICATOR	AGRIC. COMM GROUP.	DHHHs		FAOHHs	AGE	
		Men	Women	Women	Youth	Seniors
Membership agriculture-related community groups	Cooperative/Association	15%	7%	18%	7%	15%
	SACCO	31%	45%	51%	32%	45%
	Other	11%	5%	6%	6%	9%
	n=	277	277	94	247	401

Figure 19 below provides information on the association between membership in agriculture-related community groups and the use of seed of improved varieties. The data here show a strong association between being a member of an agriculture-related community organization, especially a cooperative, and use of quality seeds. The strongest association was observed for women in FAOHHs who belonged to cooperatives: 100% of this group reported using quality seeds compared to 27% of the group who said they were not a member of any organization. Age was not a distinguishing factor for this indicator, as the rates of use of quality seeds were nearly identical for youth and seniors.

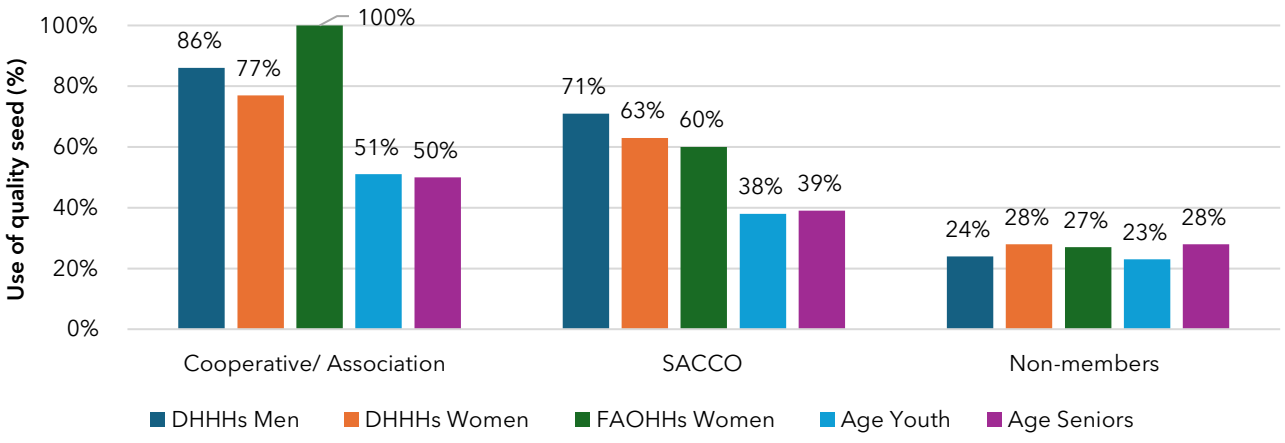


Figure 19. Association between membership in community organizations and use of improved varieties

Indicator 9. Targeted seed promotion by seed companies/QDS producer groups to women & youth

This indicator considers whether seed producers – in this case, QDS producer groups and companies – target women and youth in particular in any of their promotional activities; that is, do promotional activities present an avenue to more inclusive access to seed of improved varieties? Table 18 lists the promotional activities listed by one or more of the 10 QDS producer groups and 6 seed companies surveyed. For each activity, the table indicates whether the listed strategy targets all customers or if it is intended to reach women or youth in particular. The results show that the vast majority of promotional strategies target all customers, and only a few (highlighted in orange) are used as targeted promotion by a few QDS producers or seed companies. These include on-farm demonstrations targeting women or youth, training offered to youth by QDS producers, partnering with local farmer groups (presumably, women and youth groups), and selling seed at competitive prices.

Table 18. Data on promotional activities by QDS groups and companies

PROMOTIONAL ACTIVITY	QDS PRODUCERS (N=10)			SEED COMPANIES (N=6)		
	Everyone	Women	Youth	Everyone	Women	Youth
On-farm demonstrations	8	**2**	0	4	**1**	**1**
Training and extension services	9	0	**1**	6	0	0
Help farmers access markets for their produce	9	0	0	6	0	0
Partner with local farmer groups, cooperatives, or community leaders	8	0	0	0	**4**	**2**
Sell seed at affordable prices	7	0	0	0	**3**	**3**
Package seed in small quantities	6	0	0	6	0	0
Mobile apps/SMS/voice messages to reach farmers	7	0	0	6	0	0
Discounts/incentives for bulk purchases	5	0	**1**	6	0	0
Offer quality guarantee on seed	6	0	0	6	0	0
Brochures, pamphlets, and educational materials	5	0	0	6	0	0
Highlight positive environmental and social impacts of specific varieties	5	0	0	n/a	n/a	n/a
Promote seed varieties suited to local climate, soil, culinary preferences, farming practices	9	0	0	n/a	n/a	n/a
Display quality assurance labels on seed packages	7	0	0	n/a	n/a	n/a
Highlight positive environmental and social impacts of using specific seed varieties	n/a	n/a	n/a	6	0	0
Credit services/flexible payments so target groups can access high-quality seeds	n/a	n/a	n/a	6	0	0
Partner with community members as seed distributors, especially in remote areas	n/a	n/a	n/a	2	1	1

The fact that the strategies are rarely used may not be surprising, as seed producers and companies presumably want to sell to all customers. Nevertheless, respondents in both key informant interviews with QDS group leaders and focus group discussions highlighted that, while promotions might not explicitly target women and youth, they may help seed of improved varieties reach these groups, because QDS producers offer affordable prices, impart knowledge about the benefits of seed of improved varieties use through various means (radio shows, demonstration gardens, and field days), ensure quality (after-sales support), and showcase successful outcomes (peer testimonials). QDS groups also employ women and youth to sort seeds during harvest.

These quotes from FGDs with QDS group members illustrate the group's diverse strategies aimed at engaging women and youth:

"We give seeds to members on credit and after harvest, they repay twice the quantity given and then they remain with the balance of the harvest as theirs."

"We have a system of saving money called seed box where we encourage every member, including youth and women, to save money weekly to facilitate their buying of seeds and other farming activities in the next season."

"We also offer labor in opening their gardens, and they pay later for the labor."

"Advertising and putting a demo of the QDS seeds via the radios so that the young farmers out there can know the benefits of growing and buying seeds from them."

"Offering the seeds at a cheap price so that the youth can buy them."
"Provide a better market for produce and exclusion of middlemen, e.g., sunflower, soybean."

"Like this group of Omutima gwa Ruhira, they most times call women and youth, they train them on the advantages of buying seed of improved varieties, how it gives high yields if taken good care of and how you can benefit from them."

"Wives to group members usually help us in spreading our message to fellow women in the community."
"During post-harvest, we do employ women and youths specially to do sorting of the beans. As they sort the beans, they are learning a lot about our seed of improved varieties and in the end, they want to grow the same seeds."

"When you come to our store for seeds, we double-check them before they are given out and based on our long experience in farming, we give you advice to take good care of your garden until harvesting and marketing."

"When people buy our seed and grow it other community members copy from them especially after seeing how it yields better than the other local varieties. This is how some youths start buying our seeds."

"What the group does to attract outsiders to join or to buy seeds from the group is by putting demonstration plots along the road where they see how the seed of improved varieties are performing exactly and they see and believe that if they leave the traditional variety which is not bringing me anything (returns) and use this one (seed of improved varieties), I will experience change in my life."

Indicator 10: Targeted government subsidies

In 2022/23, two relevant input subsidy programs operated in Uganda - the Nuclear Farmer Partnership Strategy and the Food Security Intervention Initiatives. In the former, participating farmers co-fund/contribute 30% of the cost of the seed or planting materials provided. The budget allocation for gender and equity considerations in FY 2022/23 was 8.5 UGX Billion, about 8% of the NAADS total budget. About 19,413[6] farmers including women, youth, PWDs and the elderly were reached out of an annual target of 74,971 farmers. Table 19 shows the volume of seed/planting material distributed by crop and location.

Table 19. Input distribution by NAADS in FY 2022/23

CROP	VOLUMES		
	Amount	**Unit**	**Geographies**
Cowpeas	30,845	Kgs	Karamoja
Green grams	34,275	Kgs	Karamoja
Hass Avocado	123,792	Seedlings	26 DLGs
Macadamia	30,488	Seedlings	11 DLGs
Maize	200,000	Kgs	Kapeeka, Nakaseke DLG
Small white beans	30,995	Kgs	Karamoja
Soybeans	499,588	Kgs	Acholi and Lango
Sunflower	74,971	Kgs	Acholi, Lango, Nakapiripit, Bulambuli

Source: MFPED, Vote performance report FY 2022/23

6 This figure is not further disaggregated by vulnerable groups.

Indicator 11: Concentration and adequacy of agricultural extension services for smallholder farmers

Extension services play an important role in promoting new agricultural technologies to farmers, including quality seed. Although the gender or age of the extension officer does not necessarily determine the effectiveness of his/her ability to communicate effectively with different gender or age groups, it is reasonable to assume that diversity among extension officers may improve the effectiveness of service delivery overall. In addition, increasing age and gender diversity among extension officers has a value on its own. TASAI country studies collect data on the number of agricultural extension officers, including, if available, the breakdown by gender, as well as satisfaction ratings of the extension services reported by seed companies. Table 20 shows the latest data from Uganda from 2021. The study found that the country had a total of 4,328 extension officers: 3,790 public and 538 private extension agents. Among the public agents, men outnumbered women about 5:1, while the gender ratio among private extension officers is close to equal (53% men and 47% women). Seed companies rated the effectiveness of the extension services at 47%.

Table 20. Data on extension services (Source: TASAI)

QUESTION	2021
Number of public extension officers employed by the government	3,790 (M: 3,183; F: 607)
Number of private extension officers employed by seed companies	538 (M: 287; F: 251)
Total number of extension officers	4,328
Ratio of extension officers to agricultural households	1:1,713
Seed industry satisfaction with extension officers (out of 100%)	47% (2.4)

To complement existing TASAI data, the household survey of the Uganda pilot study asked respondents to rate the quality/effectiveness of the agricultural extension services they received. Specifically, we wanted to see if there were any significant differences between men and women in DHHHs and women in FOAHHs. The question asked respondents to use a 5-point scale to indicate their response, with 1 being 'not effective at all' and 5 being 'highly effective.' Figure 21 presents the results, indicating that all respondent groups rated extension services similarly, with women in DHHHs rating them the lowest (2.5), followed closely by men in DHHHs (2.6). Women in FAOHHs seemed to have the most positive experience with extension services, rating their effectiveness at 2.9. Importantly, the ratings by farmers are reasonably close to the average rating recorded by TASAI among seed companies (2.4). Looking at the different age groups, youth reported a slightly lower opinion rating of extension services than seniors (2.4 vs 2.7).

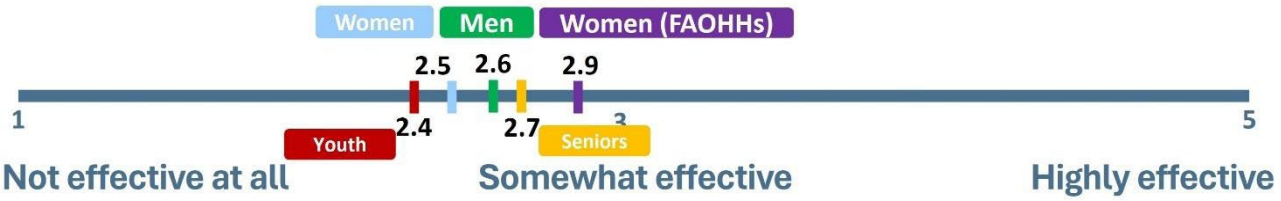


Figure 20. Farmers' ratings of extension services received

As with other indicators, the pilot study looked for an association between extension services and use of quality seed. Figure 21 and Figure 22 present the findings broken down by in-person and virtual extension services. In both cases the data shows that farmers who report using extension services also report significantly higher rates of using improved varieties vs. other varieties. The difference is the biggest for men in DHHHs and seniors, followed by women in FAOHHS, youth, and women in DHHHs. The findings are similar in the case of virtual extension services, although the differences are less pronounced.

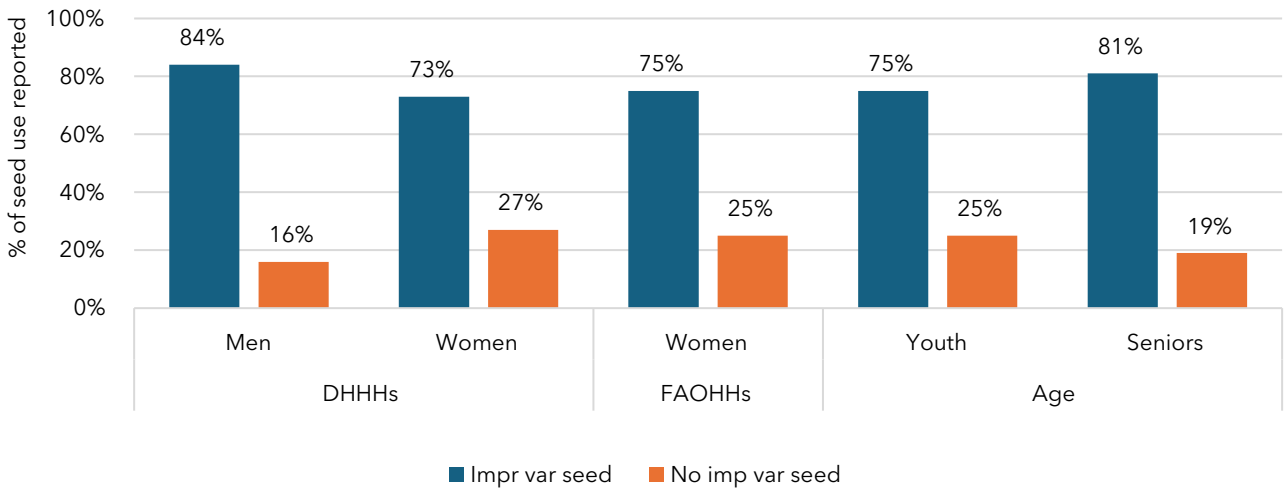


Figure 21. Association between use of extension services (in-person) and use of seed of improved varieties

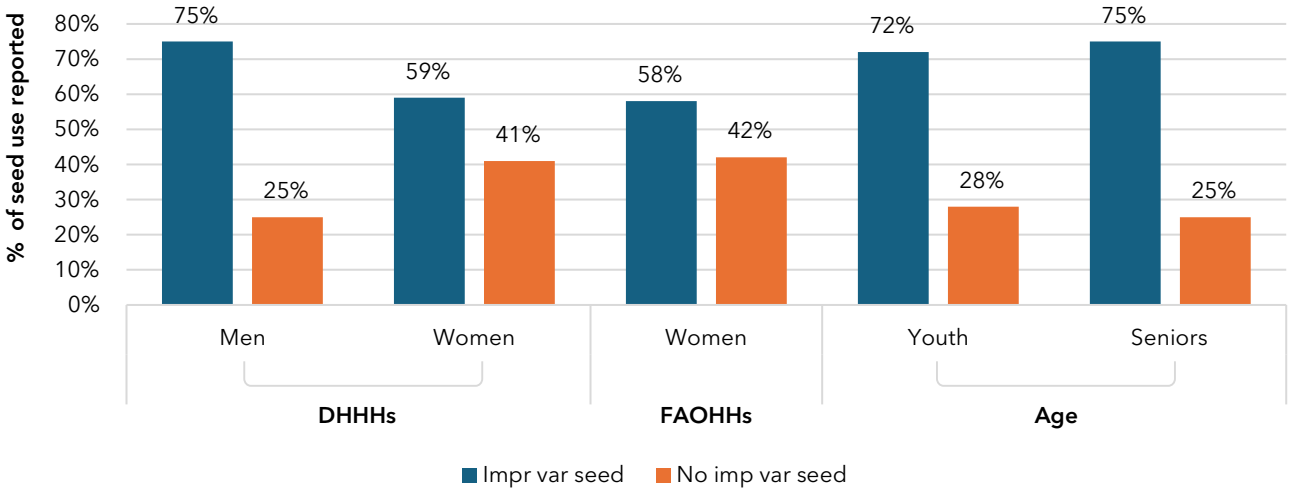


Figure 22. Association between use of extension services (virtual) and use of seed of improved varieties

Indicator 12: Concentration and adequacy of agrodealer network

TASAI studies also collect data on the number of agrodealers in a country and calculate an average satisfaction rating for the participating seed company respondents. These figures for Uganda are presented in Table 21, showing that in 2021, the country had 623 registered agro-dealers, and that seed companies reported an average satisfaction rating of 48% with the agro-dealer network in the country.

Table 21. Agro-dealer data collected by TASAI

INDICATOR	2021
Number of agro-dealers	623
Seed industry satisfaction with agro-dealer network (out of 100%)	48%

The Uganda pilot household survey included several questions about farmers' access to agrodealers. Figure 23 shows that men in DHHHs reported the highest rates of purchases from agrodealers (54%), followed by women in DHHHs (49%). Women in FAOHHs reported the lowest level of access at 42%. In terms of age, 44% of youth reported buying seed from agro-dealers compared to the considerably higher rate of 54% by seniors. The pilot survey did not collect satisfaction ratings.

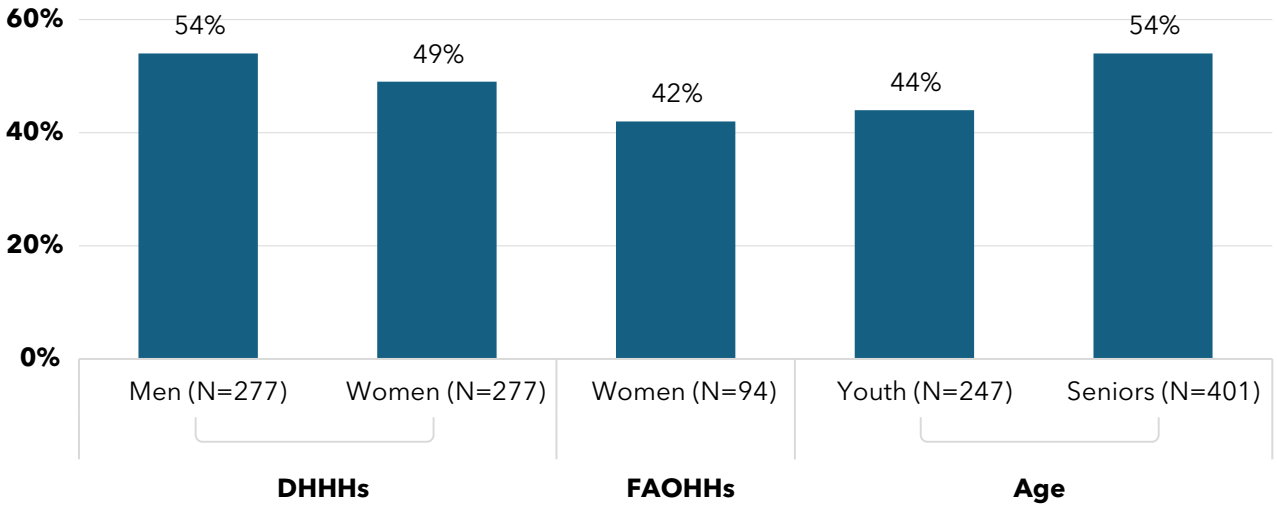


Figure 23. Purchases of seed from agro-dealers by respondent group

When asked how they accessed the agro-dealer shop (Table 27), "transport" and "walking" were the two options reported by nearly everyone. Men reported greater access (68%) to transport than either women in DHHHs and FAOHHs (50% and 59%, respectively). "Home delivery" was reported by hardly any respondent; it may be worth exploring whether this would be a desirable – and viable - avenue to bring the services of agrodealers to customers, especially women, whose time tends to be limited by their household duties. Looking at the data by age, more young people (65%) reported accessing agrodealers by transport vs. walking (35%); conversely, more seniors walked to agrodealers (42%) than used transport (56%).

The survey also inquired about the distance to the nearest agro-dealer; the average distance reported by all three groups was similar, with men reporting an average of 8.3 km and both groups of women reporting an average of 6.9 km. Notably, responses by men and women in the same household had a different average, indicating that they may frequent different agro-dealers, although the survey did not probe this question further. Youth and seniors both reported the same distance – 7.6 km.

Table 35. Access and distance to nearest agrodealer

TRANSPORT AND DISTANCE TO AGRODEALER		MEN (N=277)	DUAL HOUSEHOLDS	WOMEN IN FAOHHS (N=94)	AGE	
			Women (N=277)		YOUTH	Seniors
How did you collect/ receive the seed?	Transport	68%	50%	59%	65%	56%
	Walking (on foot)	32%	46%	41%	35%	42%
	Home delivery	-	2%	-	-	1%
	Other	-	2%	-	-	1%
Distance to nearest agro-dealer (avg km)		8.3	6.9	6.9	7.6	7.6

Indicator 13: Inclusive access through Community Seed Banks

Community Seed Banks (CSBs) serve as hubs for the collection, conservation, multiplication, and dissemination of plant genetic resources within communities. The indicator on community seed banks was added to the proposed indicator list upon the recommendation of seed industry stakeholders in the Nairobi workshop.

This indicator and its nine sub-indicators focus on active engagement by women, youth, and people with disabilities (PWDs)[7] as CSB members or leaders, profiles the type, scope and purpose of the varieties handled by the CSB and assesses the measures for seed quality control. As mentioned in the Methods section, data for this indicator was collected primarily by the Plant Genetic Resource Center, an organization whose mandate is to support the development of community seed banks in the country.

The data collection yielded a rich set of information, which we summarize below. Unfortunately, the methodology was inadvertently flawed in that the farming communities and CSBs surveyed were not located in the same communities, and, as a result, the study has no data on the percentage of community members – disaggregated by gender and age – for whom community seed banks are an important source of seed of improved varieties. The data does show that women make up the majority of CSB members, which, in theory, points to the importance of this source. However, not knowing what percentage of the community the CSBs serve makes it impossible to establish the overall contribution of the CSBs to the seed of improved varieties accessed/used by farmers. It also closed the opportunity to learn more about women's involvement in any business activities that have grown out of the CSB in their communities. This learning will be applied to the finalized plan to assess inclusive access to seed of improved varieties that will be developed based on the pilot studies.

Membership of Community Seed Banks in Uganda

Currently, Uganda has 25 community seed banks coordinated by the Plant Genetic Resources Centre (PGRC) of the National Agricultural Research Organization (NARO). The CSBs have been established by different actors including NARO-PGRC with support from the Alliance of Bioversity International and CIAT, individual farmers, and non-governmental organizations[8].

On aggregate across the seven surveyed CSBs, close to two thirds (63%) of registered members are women, ranging between 40% and 90% (Table 22) per CSB. The reason for the high membership of women is twofold. One, the diverse nature of the seed available at the CSBs provides a wide selection of seed from which the women can choose what is most suitable for the food needs of their households. Two, members access the seed at no financial cost. The only requirement is to return twice as much seed as was borrowed. The ease of access favors rural women farmers who do not have access to large sums of money. The findings confirm that, on aggregate, women are the main beneficiaries of CSBs.

Less than a third (28.3%) of the registered members of the seven surveyed CSBs are youth. By CSB, the percentage of youth members were mostly in the 20-30% range, with two outliers on either end - 8% and 67%. The findings show that CSBs are a relatively important source of seed for youth, although not nearly to the same extent as in the case of women.

The CSB's services may also be accessed by beneficiaries who are not registered members. Accordingly, 4 of the seven CSBs reported that they supplied seed to unregistered members. The number of unregistered beneficiaries ranges between 15 to 2,000. Breakdown by gender and age was not available for this data.

7 This category was added at the recommendation of the PGRC, which conducted the data collection in all but one of the CSBs.
8 PGRC maintains an online database of the community seed banks. (http://www.csb.naro.go.ug/)

Table 22. Members and beneficiaries of the CSBs surveyed

NAME OF CSB	REGISTERED MEMBERS				UNREGISTERED BENEFICIARIES
	Total	% men	% women	% youth	
Don Bosco Seed Bank	10	60%	40%	20%	0
Ongako CSB	30	23%	77%	20%	50
Pur Ber CSB	30	40%	60%	67%	200
Nen anyim CBS	30	60%	40%	33%	15
Nakaseke Community Seed Bank	70	29%	71%	29%	100
Joy and Family Demonstration Farm	62	10%	90%	8%	300
Kiziba Community Seed Bank	73	34%	66%	21%	2000
Average (for 7 CSBs)	**43**	**37%**	**63%**	**28%**	**381**

Types of seed handled by CSBs

Table 23 presents the most commonly available improved and traditional varieties that are either distributed or stored by the CSBs. The improved varieties refer to those that have been developed by research institutions and formally released for commercialization. The CSBs obtained these varieties from the National Agricultural Research Organization (NARO) or Makerere University either when the CSB launched or over the years since then. They have maintained the varieties and supplied them to members and beneficiaries. On the other hand, the traditional varieties stored at the CSB are farmers' own varieties, which have not undergone the formal variety release and registration process.

The seven surveyed CSBs distributed seed for a total of six improved varieties for bean, groundnut, maize, and soya bean. These varieties were released between 2000 and 2017 by either the NARO or Makerere Universi-ty9F9. To put these figures into perspective, it is important to note that, during the 2000-2019 period, these two institutions released a total of 88 varieties for the four crops (National Variety List of 2019). Comparing this number to the six varieties distributed by the CSBs indicates that, CSBs (at least the 7 we surveyed), provide only a limited variety of seed of improved varieties for farmers. Further supporting this point is the fact that the CSBs did not handle any improved varieties of banana, cassava, millet, or sesame, even though the NARO released 30 varieties for these four crops during 2000-2019.

The pilot study included interviews with leaders of the CSBs, who provided two reasons for the low uptake of new varieties by CSBs. The most common one was that the traits of the new varieties were not preferred by the CSB members. The second reason, cited by one CSB only, was that the feeling that the CSB lacked sufficient incentive to take up the improved varieties. In this particular case, the CSB maintained two improved varieties of soya bean. It received basic seed from the breeder, along with training for members on seed production and links to buyers for the soya bean produced. In this arrangement, the CSB continued to utilize the improved soya bean varieties. It is important to note, however, that while the arrangement may not have been beneficial for the CSB, it provided access to seed of improved varieties for farmers – though we do not have data on how inclusive this access was.

9 Makerere University only released soya bean varieties, among the 8 crops.

Table 23. Varieties of seed distributed by CSBs

CROP	IMPROVED VARIETIES (2000- 2019)			SEED OF TRADITIONAL VARIETIES	
	Released	Handled by CSB	Varieties	Handled by CSB	Varieties
Banana	11	-	-	3	Entaragaza, Enyeru, Kibuzi
Beans	25	2	NABE 19 (2012), NARO Bean3 (2016)	7	Green, Kabanyarwanda, Kayinja, Nambale, Nambale (short), Ocuc, Yellow
Cassava	11	-	-	2	Odok, Okonyoladak
Groundnut	14	1	Serenut 14R (2011)	1	Pwul Amayido
Maize	41	1	Longe 5 (2000)	4	Alakdyang, Apio, Sirisiri, Yellow maize
Millet	5	-	-	2	Kabatangare, Kal
Simsim	3	-	-	2	Lango kwara, Oturutata
Soya bean	8	2	Maksoy 3 (2010), Maksoy 6 (2017)	-	-
Total	**118**	**6**		**21**	

Quantity of seed distributed through CSBs

Altogether, the seven surveyed CSBs mainly focused on eight crops: banana, bean, cassava, groundnut, maize, millet, simsim, and soya bean. The total volume of seed that was distributed in the last two seasons (that is, Aug 2022-Aug 2023) was 100,561 kg. Of this, 79% (79,354 kg) was seed of improved varieties for only three crops (bean, maize, and soya bean), while the remainder was seed of traditional varieties (Table 24) for banana, cassava, groundnut, and sesame.

Table 24. Volume of seed distributed by CSBs

CROP	SEED OF IMPROVED VARIETIES			SEED OF TRADITIONAL VARIETIES			SEED OF IMPROVED VARIETIES AS A % OF TOTAL SEED DISTRIBUTED
	Quantity distributed10F[2] (Kg)	Quantity in stores (Kg)	Number of varieties	Quantity distributed (Kg)	Quantity in stores (Kg)	Number of varieties	
Banana	-	-	-	623	463	3	-
Beans	10,760	132.25	4	6,105	129	7	63.8
Cassava	-	-	-	7,800	6,122	2	-
Groundnut	-	50	1	90	0.25	1	-
Maize	17,000	3,000	2	122	3	4	99.3
Millets	-	-	-	7,075	310	2	-
Simsim/Sesame	-	-	-	15	1	2	-
Soya bean	51,594	2,570	3	-	-	-	100
Total	**79,354**	**5,752.25**	**10**	**21,830**	**7,028.25**	**21**	

Seed Quality Control by CSBs

"In 2021, the Plant Genetic Resources Centre (PGRC) of the National Agricultural Research Organisation (NARO) produced Standard Operational Procedures to guide the establishment of community seed banks in the country in harmony with national policies" (Vernooy, 2022). The procedures include the following quality control measures:

- **Quality control during seed production:** CSBs regularly train members on seed production and handling. In theory, the CSB management committee should monitor seed in farmers' fields, checking for off-types and ensuring that weeding is done in a timely manner. However, due to a lack of funding, some CSBs are not able to reach all members and beneficiaries at the different stages of seed production.
- **Quality control during seed storage:** All seven CSBs regularly clean their stores and check for pests and

rodents. The seed is checked for moisture content before it is placed in the store.

- **Quality control by government seed inspection officers:** CSBs are required to engage regularly with seed inspectors from the National Seed Certification Service. However, only three of the seven surveyed CSBs reported to have such engagement. Only one reported regular interaction with NSCS seed inspectors, and this was because the CSB works closely with a seed company in the district. Because seed companies are required by law to have their seed inspected and certified, the participating CSB was also involved in the inspection process. Another CSB interacted with NSCS when it was seeking approval to produce and market Quality Declared Seed (QDS).

Table 25 summarizes the quality control activities carried out by the CSBs surveyed and further detail on how successfully they carried them out. As the table shows, while all 7 CSBs have quality control procedures in place, they are only able to execute them to a limited extent. In short, the level of quality control CSBs can provide falls short of what is required in the formal sector. This is particularly relevant to seed of improved varieties, which require specific quality control practices in order to maintain the high quality of the seed.

Table 25. CSB activities related to Seed Quality Control

QUALITY CONTROL ACTIVITIES	NUMBER OF CSBS PRACTICING THESE ACTIVITIES (OUT OF 7)	DETAIL
Related to seed handling by CSB members	7	All CSBs undertake some activities related to seed handling at production level, though not consistently.
Related to seed storage at the CSB	7	All CSBs undertake regular quality control activities at the seed store.
Engagement with government seed quality assurance officers	1	Only one CSB, because of the linkages with a seed company

Accessing quality seed through seed fairs

PGRC, in collaboration with the CSBs and several non-governmental organizations, convenes a seed fair whenever a new CSB has been established. The seed fair is held at the location of the new CSB. Other CSBs and organizations showcase their seed and share it with the newly established CSB, and they also exchange seed among themselves. As such, seed fairs are an important avenue for CSBs to diversify their store of quality seed and accumulate knowledge from other CSBs and organizations.

Table 26 shows the percentage of women, youth and PWDs among the attendees from the CSBs at seed fairs over the last five years. Over the last five years, six of the seven CSBs participated in a total of 5-13 seed fairs each, while one CSB reported having attended only one seed fair during the same period. In five of the six seed CSBs, at least half of the members attending seed fairs were women, and more than one quarter were youth. These figures indicate that women and youth members actively participate in seed fairs, where they can access quality diverse seed and knowledge from other CSBs.

Table 26. Participation in external events like seed fairs

NAME OF COMMUNITY SEED BANK	NUMBER OF SEED FAIRS ATTENDED IN LAST 5 YEARS	DATE OF THE LAST SEED FAIR ATTENDED	PERCENTAGE OF PARTICIPANTS BY GROUP		
			% women	% youth	% PWD
Don Bosco Seed Bank (northern region)	10	Jun-23	57%	57%	0%
Ongako CSB (northern region)	5	Nov-22	50%	50%	0%
Pur Ber CSB (northern region)	10	Sep-23	33%	67%	3%
Nen anyim CBS (northern region)	5	Apr-23	67%	47%	7%
Nakaseke Community Seed Bank (central region)11F[3]	1	Nov-19	MD*	MD	MD
Joy and Family Demonstration Farm (western region)	13	Jun-23	50%	25%	0%
Kiziba Community Seed Bank (western region)	5	Jan-22	50%	0%	0%

*Seed fair took place in 2019; attendee data not available.

Summary: Inclusive access to quality diverse seed through community seed banks

In summary, on the positive side, it is clear that women play a key role in the activities of CSBs, and it stands to reason that, if CSBs gain more prominence as a source of seed of improved varieties, women – and, to a lesser extent, youth - will stand to benefit from that. However, the CSBs visited during the pilot study face several challenges that need to be overcome first, most notably, the small choice of improved varieties offered by CSBs and the related low adoption rate of new improved varieties. Adequate quality control systems to maintain improved varieties are also lacking and clearly affect the quality of seed of improved varieties CSBs can provide. Quality control efforts are also hindered by a lack of engagement with the government's quality assurance systems, which registered, formal seed businesses follow more closely. The literature also underlined that the most successful examples of CSBs coupled their conservation activities with business activities; however, in the most successful cases these businesses essentially became a registered, formal, business (much like a company), following government regulation. (See example of Champion Seed, a Zimbabwean seed company initially part of a CSB, in Vernooy et al., 2022.)

Indicator 14: Inclusive access through seed producer groups (including Quality Declared Seed producer groups and outgrowers for seed companies)

This indicator considers the involvement of women and youth in the production of seed of improved varieties. In Uganda, seed of improved varieties is produced by quality-declared seed (QDS) producer groups and outgrowers who produce seed for seed companies in the formal sector. The section below reviews the information gathered about these groups; in addition, it presents data on women's involvement in the formal seed sector as owners/managers of companies. It is important to note that we do not have data on how many women and youth are served by these producers, and thus cannot make a clear link between the number of producers and the number of users. Nevertheless, tracking the extent of women's involvement in seed businesses has value on its own.

Women and youth in QDS producer groups

QDS producer groups

The QDS groups operating in Uganda grow a range of seed crops, typically spanning one to five crops per group. Regional variations in crop choices are notable; for instance, in western Uganda (surveyed in Isingiro), the focus crops were beans and sweet potatoes, cultivated by three surveyed groups. All three groups grew bean seed, while two out of three focused on propagating sweet potato vines. Contrastingly, in the Northern region, rice seed dominates in Gulu/Nwoya, while groups in Dokolo mostly cultivate sesame and soybeans seeds. Table 27 presents the volumes of seed sold by the QDS producers and seed companies surveyed (the latter by TASAI in 2021).

Table 27. Seed production data (QDS producers and seed companies)

	QDS (QDS PRODUCERS)		CERTIFIED SEEDS (SEED COMPANIES)	
Crop	**Production**	**Sales**	**Production**	**Sales**
	2023	**2023**	**2021***	**2021**
Bean	MD	229**	5,369	4,451
Maize	MD	MD	16,582	19,898

**As per latest TASAI study.*
*** QDS producer group surveys recorded a combined total of 229,398 kg (~229MT) of bean seed sold in 2023; no sales were reported for maize.*

Table 28 shows data from QDS producer groups, showing the types of seed they produced and the breakdown of overall sales by gender and age. The data shows that the QDS producer groups surveyed focused on 7 crops overall, growing primarily QDS, except for rice, where 86% of the seed was certified. In one case (sesame), the group also produced seed for traditional varieties. Of the crops, sales to women ranged from 33% (sweet potato) to 76% (sesame), showing that QDS seed producers had a relatively good reach to female customers. Women purchased the majority of seeds for bean and sesame. The corresponding figures for youth were considerably lower (between 7-55%), although for certain crops like cassava, groundnut, and sesame, the percentage of young customers was relatively high.

Table 28. Percentage of seed sold by class, gender, and age group

CROP	SEED CLASS (%)			SALES TO GENDER AND AGE GROUPS (%)		
	Certified	**QDS**	**Traditional**	**Men**	**Women**	**Youth**
Bean	-	55%	-	32%	68%	25%
Cassava	-	100%	-	50%	50%	55%
Groundnut	50%	50%	-	56%	44%	42%
Rice	86%	14%	-	62%	38%	14%
Sesame	-	80%	20%	24%	76%	41%
Soybean	-	100%	-	56%	44%	36%
Sweet Potato	-	75%	-	67%	33%	7%

Number of women and youth members of QDS producer groups

The size of the QDS producer groups surveyed ranged from 24 to 200 individual members, with an average of 55 members (Table 29). Not all members are active; according to the data in Table 29, on average 60% of QDS group members were active seed producers in 2023. Looking at participation by women compared to men, women's participation rates surpass men's by 12-15%, among both active and inactive participants,12F10 signaling that QDS groups are important vehicles for women to engage in seed production. As mentioned above, these figures do not give information on how this may impact the percentage of women farmers who use QDS, if at all, but it is nevertheless a meaningful indicator of women's participation in an economic activity that exposes them – and potentially, other women – to sources of and information on seed of improved varieties of QDS.

Regarding age distribution, youth make up an average of 25% of active members and 30% of inactive members, with membership rates ranging from 0-100%, the latter in a dedicated youth producer group. In terms of geography, the study found that youth in the Acholi sub-region were the least likely to be active in QDS producer groups.

10 Active participants defined as those producing at least one seed crop in a given season.

Table 29. Percentage of women and youth in the registered and active membership of QDS producer groups

QDS PRODUCER GROUP	REGISTERED MEMBERS				ACTIVE MEMBERS			
	Total	Men	Women	Youth	Total	Men	Women	Youth
Aye Medongeca Seed Growers Cooperative Society	200	66%	34%	38%	80	46%	54%	38%
Bedi gen Farmer and Catering Service Ltd.	30	33%	67%	0%	5	20%	80%	0%
Kanywamaizi Farmers and Traders' Cooperative Society Ltd.	45	51%	49%	18%	45	51%	49%	18%
Kyezimbira Catholic Women's Group	36	0%	100%	11%	36	0%	100%	11%
Latyeng Farmers Group	48	38%	63%	48%	30	17%	83%	23%
Ma Icayo Aye Konyi	30	33%	67%	20%	27	33%	67%	22%
Omutima gwa Ruhiira Cooperative Society Ltd.	66	50%	50%	29%	43	53%	47%	12%
Te Olam Okumgoro	45	44%	56%	18%	10	100%	0%	0%
Tic Ryemo Can Youth Group	24	42%	58%	88%	21	48%	52%	100%
Yamalo Faming Group and Catering Service Ltd.	30	67%	33%	27%	30	67%	33%	27%
Average membership	**55**	**42%**	**58%**	**30%**	**33**	**44%**	**57%**	**25%**

Women and youth in the management of QDS groups

The pilot study surveyed 10 QDS producer groups located in northern and western Uganda (Table 30). In each QDS producer group, we collected information on the involvement of women and youth in administrative and/or leadership roles. QDS groups tend to be managed by committees, responsible for the day-to-day running of the group. The committees reported by the QDS producer groups were Executive, Finance, Production, Marketing, and Quality Assurance, although not all groups had all these committees. Among the QDS producer groups interviewed, the size of the committees ranged from 4-8 people. Women's participation in the different QDS producer management groups ranged from 48% to 59%, showing that women are well represented in the management of the QDS groups surveyed. In contrast, the representation of youth was lower. It ranged from 0 to 30%, with an average of 15%, indicating that youth do not have a significant voice in the running of QDS producer groups.

Table 30. Representation of women and youth in the leadership of QDS producer groups

	AVG NUMBER PER QDS PRODUCER GROUP	MEN	WOMEN	YOUTH (AGE 30 OR UNDER)
Management committee members	24	11 (45%)	13 (55%)	4 (15%)

The focus group discussions held with QDS members and leadership revealed no explicit barriers to being selected for a leadership position faced by women and youth. The selection criteria prioritized individual traits such as character, reliability, and leadership potential. The reason cited by some FGD participants for the low rates of youth in leadership positions was that youth tended to sidestep demanding roles due to leisure priorities. Certain roles are seen as more appropriate for women or youth: for example, women often occupy positions like treasurer as they are seen as trustworthy, while youth, perhaps due to fewer domestic responsibilities, are engaged as mobilizers. The support for women and youth in leadership spans both formal (policy-driven) and informal (consensus-based) methods, fostering leadership potential and nurturing it through training, mentorship, and role assignment.

The positive value of the contributions by women and youth in leadership positions were evident in the statements by respondents, highlighting their visionary approaches, effective communication, advocacy, and skillful management. The same sentiments were reflected across the various geographic regions. However, differences between men and women's leadership styles were noted, with women perceived as more transparent and consultative but more hesitant to assume leadership roles or to assert authority.

"Under the supervision of the treasurer, who is a woman, we constructed another store. …She managed to supervise the project to completion." – QDS young men FGD, Isingiro

"The strength of that store came from youthful women. They raised concerns about storing seeds safely, leading to the establishment of the store we have today." - QDS young men FGD, Gulu

"What I see with women is that, when identified to speak up for the group, they do so confidently and eloquently, representing the group's ideas effectively." - QDS senior women FGD, Gulu

"Am pleased with women in their leadership positions; our committee is balanced. There has been no such incidence that men have dominated at any single point in effecting the decision of our group." - QDS senior women FGD, Gulu

"There is equal representation of opinions with respect to both genders in our group." - QDS senior men FGD, Gulu

Number of women and youth outgrowers

In Uganda, a seed outgrower typically refers to a smallholder farmer or an individual contracted by a seed company or organization to produce seeds on their own land or designated plots. Outgrowers play a crucial role in the seed industry by cultivating specific crop varieties to produce high-quality seeds. They follow prescribed cultivation practices, maintain the purity of the seeds, and are inspected through their affiliated seed companies to meet the demand for certified seeds. Outgrower arrangements alleviate the need for seed companies to invest heavily in acquiring extensive land solely for seed production. Instead, they collaborate with farmers who contribute their land and labor, reducing the capital requirement for the company. This shared land usage model allows for hybrid seed production, which necessitates specific isolation distances between different parental lines in greater volumes than would otherwise be produced, improving accessibility. Seed outgrowers hence contribute significantly to the availability of quality seeds for distribution and sale, thereby supporting agricultural productivity and improving crop yields in Uganda on the one hand. This model also creates opportunities for farmers to earn income by producing seeds, a higher value commodity, while supporting the seed industry. Additionally, it strengthens the local agricultural economy by offering an additional source of revenue for smallholder farmers.

Although most seed outgrower businesses are essentially family farm businesses, this indicator tracked the gender of the individual who signs the contract with the seed company. Table 31 shows the engagement of seed companies with outgrowers, showcasing both the extent and diversity of participation. Each seed company engages an average of 1,054 outgrowers, ranging from a minimum of 46 to a maximum of 3,071. Nearly half of the outgrowers are men (47%), averaging around 439 per company, while slightly more than half are women (53%), averaging 615 per company. To accommodate norms around women's engagement in agribusiness, women and youth are mostly engaged through their farmer groups and not as individuals. The involvement of youth stands at 34%, averaging approximately 563 outgrowers per company, yet with a notable range from zero to as high as 1,843.

Table 31. Seed company out-growers by gender and age

OUT-GROWERS	MIN	MAXIMUM	PERCENTAGE	AVERAGE
Total	**46**	**3,071**	**100%**	**1,054**
Men	28	1,228	47%	439
Women	18	1,843	53%	615
Youth	0	1,843	34%	563

This diversity of outgrower engagement reflects a gender-balanced participation and a considerable representation of youth, albeit with significant fluctuations across different companies. The engagement of women and youth in seed production aligns with the broader agricultural inclusivity agenda, enhancing diversity and representation in the seed sector. However, the variability in the number of outgrowers, particularly youth, suggests a potential for further outreach and inclusion efforts, ensuring broader access to seed-related opportunities for young farmers.

Women in the management of seed companies

TASAI studies collect gender disaggregated data about the management and ownership of participating seed companies. Table 32 captures data from the last two rounds of data collection in 2019 and 2021, showing that, overall, the number of women in management and ownership roles is quite low – around 1/3 and 1/5, respectively. On the plus side, women's share in management positions in seed companies has increased to nearly 40% in 2021, marking a 7% increase from 2019, which may be a trend to watch. The number of female company owners has remained the same. Note that breakdown by age is not collected for this indicator.

Table 32. Women in management in seed businesses

GENDER INDICATOR	NUMBER		%	
	2019 (n)	2021 (n)	2019	2021
Women in management positions	31(100)	63 (164)	31%	38%
Seed companies w/ at least one woman in management position	18 (24)	21 (21)	75%	100%
Companies with female top manager	3 (24)	2 (21)	13%	10%
Companies with female owner	4 (24)	2 (12)	17%	17%

Indicator 14 provides information on various types of seed businesses – QDS producer groups, companies, and their outgrowers – and discusses the extent to which women participate in these businesses and the roles they play. The overall conclusion is that women are significant players in these businesses, sometimes even outnumbering men, with the notable exception of seed company ownership or top management. However, it is important to note that these measures are at best a proxy indicator of inclusive access at this point. That said, the fact that membership in agriculture-related organizations showed a strong association with higher rates of use of quality seed among the household survey respondents reinforces the theory of change of this indicator – that increasing participation – especially in leadership roles – by women and youth will likely have an overall beneficial effect on these groups' use of technology, including seed of improved varieties.

Indicator 15: Seed policy indicators

The land policy and legal framework in Uganda demonstrate a commitment to gender equality, recognition of the role of women in society, and the protection of vulnerable groups, including youth and marginalized communities. However, despite the provisions laid out in various instruments such as the Constitution of Uganda (1995), the Uganda National Land Policy (2013), the National Land Use Policy (2006) the Land Act (1998) and its amendments, the Succession Act and its amendment (2022), the Land regulations (2004), and the Registration of Titles Act (2011), gaps remain in land access for women, youth, and other vulnerable groups, particularly in the context of seed production enterprises, which require substantial land to cater for isolation distances.

Key policy statements and observations

The constitution emphasizes gender balance, fair representation of marginalized groups, and the recognition of women's significant role in society. Affirmative action measures are highlighted to address historical imbalances. Further, the national land policy recognizes that customary land tenure discriminates against women. The policy hence has explicit strategies to protect the land rights of women and children. Proposed amendments aim to address discriminatory cultural practices, ensure equal succession and inheritance rights, and create joint ownership provisions for family land. Despite legal provisions ensuring spousal co-ownership and inheritance rights, implementation remains ineffective, perpetuating land grabbing and unequal rights. Challenges persist

in providing land tenure security for women farmers, impacting their access and ownership rights, especially in agricultural activities. Amendments to the Succession Act (2022) have bridged the gap in the law, addressing unequal distribution, ensuring fair succession, and protecting the rights of divorced or separated spouses, particularly women. The law also provides for the representation of women and marginalized groups in decision-making structures related to land use, recognizing their importance in the planning and utilization of land resources. However, the following challenges remain:

- Despite legal provisions, customary practices often override statutory law, denying women and vulnerable groups equal access and rights to land.
- While legal frameworks exist, effective implementation and enforcement mechanisms are lacking, leading to continued discrimination in land access and ownership.
- Deep-rooted cultural norms and traditions perpetuate discrimination, hindering equal land rights for women and vulnerable groups.

Overall, Uganda's land policy and laws showcase a commitment to gender equality and the protection of vulnerable groups' land rights. However, there's a substantial gap between these policies and their effective implementation. Addressing cultural barriers, enhancing implementation mechanisms, and enforcing legal provisions are crucial to ensuring equal access to land for seed production enterprises by women, youth, and marginalized groups in Uganda.

Indicator 16: Women and youth's influence/input in participatory breeding approaches

This indicator sought to understand whether current breeding programs consider gender and age-related preferences when deciding the specific varieties or traits to focus on. To answer these questions, we surveyed 13 crop breeding programs across three organizations: NARO (bean, cassava, groundnut, maize, rice, sesame, soybean, sweet potato, sorghum, and millet), CIP (sweet potato), and Makerere University (cowpeas and soybeans).

Breeders told us that, in general, all crop breeding programs operate on the principles of participatory breeding. However, some stages of the breeding process engage farmers more than others due to the complexity of the activity involved, availability of funding, and maturity of the breeding program. The enrollment criteria varies by activity; see Appendix 5 for a detailed list. Table 33 shows the list of activities and rates of participation by farmers. On-farm trials have the highest farmer participation, with 85% involvement, reflecting a substantial contribution by farmers to the testing of new varieties. However, youth are notably underrepresented, with only 16% of the participants under the age of 30. Determining breeding goals and conducting demonstration trials also see considerable farmer involvement, showing a balanced participation between men and women, with a slightly higher engagement of women in these stages. Demonstration trials also showcase a relatively higher involvement of youth compared to other stages, at 24%.

In contrast, activities like making initial crosses, which marks the inception of the breeding process, no longer involve farmers. Additionally, stages like conducting multi-location evaluations, screening germplasm, and selecting among progeny show the lowest farmer engagement, with percentages as low as 8%. Although the overall engagement by farmers is low, women do make up the majority of participants in some areas, with 60% involvement in conducting multi-location evaluations and 58% in screening the germplasm. In contrast, men are more engaged in activities like seed production and distribution, where they represent 60% of the participating farmers.

The analysis indicates a distinct gender imbalance in certain stages, especially in roles like seed production and distribution, where men dominate participation. Conversely, activities such as screening germplasm and conducting multi-location evaluations showcase higher female involvement. Although these stages are breeder-led, farmers may be asked for their input, which would indicate that women's voices are also heard given their high levels of participation. The underrepresentation of youth across various stages raises concerns about their involvement in crucial aspects of crop breeding, which could impact the inclusivity and diversity of per-

spectives in developing new varieties. When asked about the low levels of involvement by youth, many breeders interviewed felt that youth lacked interest in agriculture, or that they did not have the necessary resources, especially land, needed to participate in the activities. Addressing these disparities in participation could lead to more inclusive breeding programs, benefiting from diverse insights and experiences of farmers across genders and age groups. Additionally, creating opportunities for youth involvement in earlier stages of the breeding process could foster innovation and sustainability in agricultural practices.

Table 33. Farmers' participation in the breeding process by gender and age

ACTIVITY	TOTAL	% MEN	% WOMEN	% YOUTH
On-farm trials	85%	55%	45%	16%
Determining the breeding goals including farmers needs and priorities	77%	48%	52%	13%
Demonstration trials to promote the varieties	77%	56%	44%	24%
Collection of germplasm/accessions from farmers	38%	52%	48%	17%
Seed production and distribution (new variety release, customer targeting and demand analysis)	38%	60%	40%	24%
Evaluating on-station trials (testing experimental varieties)	31%	52%	48%	16%
Training on breeding techniques and practices	23%	53%	47%	32%
Screening the germplasm	15%	43%	58%	20%
Selection among progeny	15%	48%	53%	20%
Conducting multi-location evaluations	8%	40%	60%	20%
Making initial crosses	0%	0%	0%	0%

Traits important to farmers (breeders' opinion)

The survey asked breeders to identify traits that, in the breeders' opinion, were the most important to farmers. Farmers were also asked this question, allowing the study to compare the two sources of information. The breeders interviewed were shown a list of variety traits and asked to indicate which of the traits are valued by men, women, and youth. The same trait may have been favored by more than one group. Table 34 summarizes the responses: the higher the percentage listed, the more breeders felt that the particular trait was important to the group.

Table 34. Trait preferences by gender and age (breeders' opinion)

TRAITS	MEN	WOMEN	YOUTH
Ability to produce fodder	8%		
Appearance	38%		23%
Color	15%		23%
Culinary traits	8%	77%	23%
Disease and pest resistance in the field	31%	38%	31%
Drought tolerance	31%	31%	31%
Early maturity	46%	69%	69%
Easy to process/cook	15%	38%	31%
Easy to store	23%	23%	23%
High income potential	69%		15%
High yield	85%		15%
Nutritional content	8%	38%	15%
Taste/Aroma	8%		
Tillering ability	15%		15%
Mealiness - at least 60% flour recovery	8%	8%	
High oil content		8%	
Non-shattering		8%	
Good for intercropping with maize		8%	
Shape		8%	
Amenable to mechanization			15%

Extracted from the above, the top 5 traits for men, women, and youth are listed in Table 35 below.

Table 35. Top 5 traits by gender and age (breeders' opinion)

	MEN	WOMEN	YOUTH
1	High yield	Culinary traits	Early maturity
2	High income potential	Early maturity	Disease and pest resistance in the field (tie)
3	Early maturity	Disease and pest resistance in the field (tie)	Drought tolerance (tie)
4	Appearance	Easy to process/cook (tie)	Easy to process/cook (tie)
5	Disease and pest resistance in the field and Drought tolerance (tie)	Nutritional content (tie)	Appearance, Color, Culinary traits, easy to store (all tied)

Traits important to farmers (farmers' opinion)

To triangulate the information collected from breeders and to see if there were any differences by gender or age, farmers were also asked to rank a list of common variety traits in order of importance to them. Table 36 shows the results for beans, highlighting the top 5 traits for the three different groups in orange. Overall, the traits valued by farmers do not seem to be impacted much by gender or age. Namely, three of the top five traits are valued by all groups – these are early maturity, high income potential, and high yield. In addition, drought tolerance made it into the top five for men and women in DHHHs but not for women in FAOHHs, while "disease and pest resistance in the field" was among the top 5 for men only. Perhaps not surprisingly, use-related traits ("easy to process/cook", and "taste/aroma") made it in the top five traits for women only but were seen as lower priority than yield and income potential.

Table 36. Trait preference for bean, disaggregated by gender and age (top 5 traits)

TRAITS (BEAN)	DUAL HOUSEHOLDS		WOMEN IN FAOHHS	AGE	
	Men	Women		Youth	Seniors
Ability to produce fodder	0%	-	1%	-	0%
Affordable price of seed	5%	2%	5%	5%	3%
Appearance	1%	1%	3%	1%	2%
Disease and pest resistance in field	11%	7%	5%	9%	8%
Drought tolerance	11%	12%	5%	14%	9%
Early maturity	16%	14%	13%	15%	15%
Easy to process/cook	5%	5%	8%	5%	6%
Easy to store	1%	2%	2%	2%	1%
High income potential	18%	19%	20%	17%	20%
High yield	15%	19%	19%	17%	17%
Nutritional content	5%	4%	4%	3%	5%
Only option available	2%	2%	4%	3%	2%
Taste/Aroma	9%	12%	12%	10%	11%
Tillering ability	0%	0%	1%	-	0%

When looking at the traits valued for maize varieties, the picture is even more uniform, as the top 5 varieties reported by men and women in dual-headed households and women in FAOHHs are the same – disease and pest resistance, drought tolerance, early maturity, and high yield (Table 37). The fifth shared 'trait' is not a trait per se, but rather the fact that the variety purchased was the only one available, indicating that about 10% of farmers did not have a choice of variety when purchasing seed. Finally, two traits were only listed by men in the top 5 reasons for buying the particular variety – affordability of seed and high-income potential. But, again, the overall conclusion is that the three groups did not differ significantly in the variety traits they based their purchase decisions on.

Table 37. Trait preference for maize, disaggregated by gender and age

TRAITS (MAIZE)	DUAL HOUSEHOLDS		WOMEN IN FAOHHS	AGE	
	Men	Women		Youth	Seniors
Ability to produce fodder	0%	2%	-	1%	1%
Affordable price of seed	9%	5%	8%	7%	7%
Appearance	1%	3%	2%	2%	2%
Disease and pest resistance in field	13%	9%	13%	12%	11%
Drought tolerance	15%	12%	13%	15%	13%
Early maturity	15%	15%	14%	15%	15%
Easy to process/cook	1%	4%	2%	2%	3%
Easy to store	2%	1%	2%	2%	2%
High income potential	9%	7%	7%	9%	8%
High yield	20%	20%	16%	19%	20%
Nutritional content	2%	3%	2%	2%	3%
Only option available	9%	10%	12%	10%	9%
Taste/Aroma	3%	7%	8%	5%	6%
Tillering ability	-	2%	-	1%	1%

Comparison of breeders and farmers' trait preferences

Having looked at traits valued by farmers as listed by breeders and farmers, it may be interesting to compare these two lists. In Table 38 we first present the list of traits valued by men and women, highlighting the top 5 for each group. The data shows that four out of the top 5 traits were the same for both groups, and even the order of importance was quite similar.

Table 38. Top 5 traits listed for maize and bean combined, disaggregated by gender and age[11]

MAIZE AND BEAN COMBINED			
Traits	Men	Women	Youth
Ability to produce fodder	0%	1%	1%
Affordable price of seed	7%	5%	6%
Appearance	1%	2%	2%
Disease and pest resistance in the field	12%	9%	10%
Drought tolerance	13%	11%	14%
Early maturity	16%	14%	15%
Easy to process/cook	3%	5%	4%
Easy to store	1%	2%	2%
High income potential	14%	13%	13%
High yield	18%	19%	18%
Nutritional content	3%	3%	2%
Only option available	5%	7%	6%
Taste/Aroma	6%	10%	7%
Tillering ability	0%	1%	1%

11 In order to make the household data comparable to breeder data, we are presenting averages for maize and bean – the two focus crops – and we have also averaged the results obtained by the two women's groups, as breeders only disaggregated their responses by gender and age.

Table 39 puts the data from breeders and farmers side-by-side, showing that breeders accurately 'guessed' four out of the top 5 traits listed by men; however, they only got 2 out of the top 5 traits listed by women, and 3 out of 5 traits listed by youth. Put differently, breeders seemed to understand men's trait preference better than those of women or youth. Related, breeders assumed that women placed a higher priority on cooking-related attributes than they did – at least the women interviewed for this study.

Table 39. Comparing top 5 traits, as listed by breeders and farmers

	BREEDERS	FARMERS	BREEDERS	FARMERS	BREEDERS	FARMERS
	Men		Women		Youth	
1	High yield	High Yield	Culinary traits	High Yield	Early maturity	High yield
2	High income potential	Early maturity	Early maturity	Early maturity	Disease and pest resistance in the field	Early maturity
3	Early maturity	High income potential	Disease and pest resistance in the field (tie)	High income potential	Drought tolerance	Drought tolerance
4	Appearance	Drought tolerance	Easy to process/cook (tie)	Drought tolerance	Easy to process/cook	High income potential
5	Disease and pest resistance in the field and Drought tolerance (tie)	Disease and pest resistance	Nutritional content (tie)	Taste/Aroma	Appearance, Color, Culinary traits, easy to store (all tied)	Disease and pest resistance in the field

Variety and trait preferences among seed producers

Focus group participants in QDS producer groups were also asked to provide information on how the group decided which varieties to focus on. Respondents indicated that the group selected the varieties together, usually following market surveys among their customers or advanced yield trials in collaboration with breeders. Some focus group respondents reported that trait preferences were influenced by gender and age, with men favoring market-preferred crops, youth opting for early maturing ones, and women balancing market demands with dietary preferences. In contrast, others emphasized that features like high yield or early maturation are preferred by farmers regardless of gender. The following quotations illustrate these points, although it is notable that the same variety may be prized for multiple different traits – for example, a variety may be early-maturity and also have good taste.

The importance of early maturity:
"There are different factors that we consider when choosing a certain variety, for instance, varieties like NAROBEAN 1, 2, 3, and 6, which mature quickly, are cultivated in seasons with expected short rains."
"… women often grow varieties which mature early, like NABE 15."

The role of agronomic factors:
"People may choose a variety according to how their soils are, but we all grow the same varieties."

How joint decision-making influences trait selection:
"We make the decisions together [with the spouse]. For example, we can say that we have planted in this plot three times, if we bring NAROBEAN 1 again, it might not give us good yields and we decide to bring NAROBEAN 6 which might work better depending on the history of the plot."

On men's preference for higher market price:
"Men also prefer varieties … like yellow beans (NAROBEAN 3) and Nambale short and long due to their higher market prices."
On the value of high yield and quality by both men and women:
"Generally, in the group, our main crops are groundnuts 14R, Rice Namche 1, and Namche 5. …Men purchase more of rice variety Namche 1 and groundnuts 14R. … Men favor these varieties for their quality, high yields, and potential for higher incomes. They also find Serenut 14R appealing for its taste, high yields, and ease of threshing."

"Namche 1 is preferred by women due to its vigorous growth and simple harvesting, unlike Namche 5, which requires specialized harvesting equipment."

On the importance of cooking-related traits for women:
"Women favor NAROBEAN 6 for its sweetness, affectionately calling it 'komba orusaniya' or 'lick the plate.' They also appreciate NABE15 for its quick cooking time."

"CARITAS cassava variety is preferred by women for its non-watery consistency when boiled."
"… women prefer varieties that are easy to cook and have a good taste or aroma."

Traits preferred by youth: end to prioritize traits like early maturity, high yield, and higher-priced varieties in the market:
"… men and youth opt for bean varieties like yellow (NAROBEAN 3) and nambale short due to their higher market prices."

Indicator 17: Varieties with special features commercialized

Indicator 16 focuses on varieties released; however, a crucial next step to get the seed into farmers' fields is commercialization. TASAI studies have shown that, in many countries, a significant portion of the varieties released are not commercialized, leaving farmers relying on old varieties. Seed companies often cite that farmers insist on using tried-and-tested varieties as a reason not to commercialize new varieties. Adopting a new variety comes with a level of risk that many smallholder farmers cannot take, but this also means that they miss out on newer, and potentially better, varieties. Research and development investment is not realized either. In short, tracking how many – and which – newly released varieties make it to market is important. For this study, we have compared the list of desired traits shared by farmers with traits of the varieties commercialized during the 10-year period 2010-2019 to see whether those varieties seem to be responding to farmers' preferences.

Table 40. Comparison of trait preferences by farmers and varieties on the market with those traits

TRAITS (BEAN)	TOP 5 TRAITS LISTED BY:			NO OF VARIETIES W/ TRAIT	% OF ALL VARIETIES RELEASED (2010-2019)
	Men	**Women**	**Youth**		
Disease and pest resistance in the field	X			11	46%
Drought tolerance	X	X	X	15	63%
Early maturity	X	X	X	6	25%
Easy to process/cook		X		8	33%
High income potential	X	X	X	7	29%
High yield	X	X	X	8	33%
Taste/Aroma		X	X	-	-

TRAITS (MAIZE)	TOP 5 TRAITS LISTED BY:			NO OF VARIETIES W/ TRAIT	% OF ALL VARIETIES RELEASED (2010-2019)
	Men	**Women**	**Youth**		
Disease and pest resistance in the field	X	X	X	24	34%
Drought tolerance	X	X	X	24	34%
Early maturity	X	X	X	7	10%
High income potential	X			-	-
High yield	X	X	X	13	19%

Table 40 above shows that the traits listed by farmers appear in a third or fewer of the varieties on the market. The only exception is "drought tolerance" in maize, which was a priority trait for all men, women, and youth, and is featured in 63% of varieties on the market.

CONCLUSIONS

Summary of findings

Table 41 below summarizes the main findings for the indicators reviewed above, including some lessons learned for future pilot studies.

Table 41. Summary of findings by indicator

INDICATORS	RESULTS
Farmer-level indicators	
Use of seed of improved varieties	Differences by gender or age are relatively small for all crops combined; however, over 10% difference by gender, especially for maize; over 40% difference by age for bean, justifying disaggregation by gender and age.
Purchases of seed of improved varieties	Differences by gender or age are relatively small for all crops combined; however, over 10% difference by gender and age for both bean and maize. Notably, bean seed purchases by women in FAOHHs exceeded those by men, though the situation is reversed for maize. Though gender and age differences are notable, overall, relatively few farmers purchase seeds of improved varieties.
Availability of seed in small packages	Overall, farmers purchase more packaged maize seed than bean seed. The majority of farmers, regardless of gender or age, purchase packages that weigh less than 10kg, with somewhat more purchasing the smallest package size (2 kg or less) than packages weighing between 2 and 10 kgs. Although there are some differences by gender and age, over 90% of all groups reported that they were able to buy the package size they needed, which indicates that no group is being disadvantaged by the package sizes available. As such, this question may not be too relevant to inclusive access by gender and age; it is relevant to inclusive access for smallholder farmers overall.
Affordability (Price)	Twenty percent of women in FAOHHs and 19% of seniors reported that they were not able to purchase the quantity of seed they needed/wanted, and, in all these cases, the reason given was 'high price.' The same number of men and women in DHHHs was lower at 13%. Considering that this question was only asked of those who purchased at least some seed, which ranged from 43% to 52% for the various groups, it raises the question of how many of those who did not purchase seed did so for reasons of price. This is something we can address in a future pilot study.
Exposure to "model/lead" farmer	Results showed modest differences by gender (less than 10%) among the different groups; differences by age were minimal (3-4%). When asked how much the exposure to a model farmers influenced their decision to plant seed of improved varieties, the responses indicated moderate influence. While this indicates that model farmers are reasonably beneficial, they were rated lower in importance than "word-of-mouth" from people known to the farmer, such as neighbors or friends.
Link to buyer	All groups reported using the same buyers – contract farming and various produce bulking centers – although while more men and women in DHHHs favored contract farming, more women in FAOHHs reported using independent rural agents for produce bulking. Similarly, while more younger people preferred produce bulking, more seniors were partial to contract farming. Link to buyers was associated with higher rates of use of quality seeds.
Input in household decision-making related to agricultural production	Arguably, this is one of the most important questions in the survey in terms of studying differences by gender. The data showed that the majority of households decide jointly on the varieties to plant, although the rates were higher for maize than bean. We also looked into whether we could see any clear association between joint decision-making and use of seed of improved varieties; the results showed a clear association between the two variables: that is, those who used improved varieties also reported higher rates of making decisions jointly.

INDICATORS	RESULTS
Access to/ownership of assets related to agricultural productivity	The survey asked respondents to indicate what agriculture-related assets they had access to. The analysis looked at the assets that showed the most disparate figures by gender and age. By gender, the biggest differences were reported for land (owned solely or jointly), transport owned by family, hired labor, seed of improved varieties, and extension services. By age, the most notable differences were reported for land (sole or joint ownership), non-mechanized equipment, fertilizer – organic, and seed of improved varieties. Based on the size of the differences, gender, age, and household type are associated with different rates of access to agriculture-related assets. Related to this analysis, the study also looked at the association between average landholding size (owned and/or leased) and use of seed of improved varieties – testing the hypothesis that those with more land also use more seed of improved varieties. The data bore this out for all groups except for women in FAOHHs, where the portion of those using seed of improved varieties was slightly higher (57% vs. 55%) for women with below average landholding size.
Membership in agriculture-related community groups	We tracked membership in cooperatives and SACCOs. Overall, more women reported membership in either group; however, more men were in leadership positions. For youth and seniors, while more seniors reported membership, a higher percentage of youth reported holding leadership positions.
Service to smallholder farmers	
Targeted seed promotion by companies/producers	This indicator gathered information on various marketing strategies used by seed businesses to see if any of them targeted women or youth in particular. The results showed that, by and large, seed businesses were targeting farmers overall, and trying to collect gender- and age-disaggregated data did not make much sense here.
Targeted government subsidies	The study looked at two subsidy programs active in Uganda in 2022-2023, both of which had special consideration for gender. The study did collect data on the crops distributed and the number of beneficiaries, but the data does not tell us how much of the need was covered.
Concentration and adequacy of agricultural extension services for smallholder farmers	Drawing on data from the 2021 TASAI study, we found that Uganda had 3,790 public extension service agents and 538 private ones. While men outnumbered women 5 to 1 among the public agents, among the private ones, the ration was nearly 1 to 1. Further, TASAI recorded seed companies' satisfaction ratings with extension services; the rating was 47%. The pilot survey asked farmers to also rate extension services, and the results were somewhat higher, though still only mediocre, ranging from 50-58%. Importantly, the study looked at the association between use of extension services and of seed of improved varieties, and across the board, those who reported using extension services also had higher rates of seed of improved varieties use.
Concentration and adequacy of network of sources of seed	The survey asked farmers whether they purchased seed from agro-dealers; on average, approximately half of farmers reported doing so, with a smaller percentage reported by women in FAOHHs (42%), and the highest rates reported by men in DHHHs (54%). By age, 54% of seniors reported accessing seed from agro-dealers compared to 44% of youth. The most common methods of access were transport or walking, with more men having access to transport than women, and more youth than seniors. The average distance to the nearest agrodealer was around 7.5 km for the various groups.
Seed policy indicators	Overall, Uganda's land policy and laws showcase a commitment to gender equality and the protection of vulnerable groups' land rights. However, there's a substantial gap between these policies and their effective implementation. Addressing cultural barriers, enhancing implementation mechanisms, and enforcing legal provisions are crucial to ensuring equal access to land for seed production enterprises by women, youth, and marginalized groups in Uganda.

INDICATORS	RESULTS
Inclusive access through Community Seed Banks	Uganda has a number of community seed banks and given the connection with the Plant Genetic Resource Center that actively supports CSBs, the pilot included a 'mini' study of CSBs. This provided us with a detailed picture of their operations, achievements, and challenges, which, to date, shows that CSBs are a limited source of seed of improved varieties mostly due to a lack of technical know-how and resources required to maintain seed of improved varieties properly. Another problem we faced was that the communities where we surveyed CSBs and where we conducted the household surveys were different; this only came to light during the report writing process. As such, a key piece of information is missing from the study – the percentage of farmers who source seed from CSBs. This question should be corrected in any future pilot studies.
Inclusive access through quality-declared seed (QDS) producer groups	The data under this indicator considered the following: i) the number of women and youth in QDS producer groups, the number of women and youth in the management of such groups, and women in management/leadership positions in registered seed companies. While overall, women are well represented among seed producer groups (though much less in company leadership), this indicator does not provide further insight into how women's involvement in seed production may impact women farmers' access to seed of improved varieties.
Research and Development	
Vulnerable Group's [VG]'s influence/input in participatory breeding approaches	The study included surveys and interviews with breeders about the input of women and youth in participatory breeding activities. The results showed some differences by gender and age in terms of the tasks most commonly assumed by farmers, for example, women were more likely to conduct multi-local evaluations, while men were more engaged in seed production and distribution. In terms of age, seniors were more involved than youth. The study also looked at trait preferences by gender and age as reported by breeders and farmers themselves; here we found that breeders seemed to have a more accurate understanding of trait preferences by men than by women and youth.
Varieties with special features commercialized	The last indicator considers the varieties on the market, accessible to farmers, and looks at whether the traits of these varieties meet the needs (preferences) of the farmers reported under Indicator 16. The traits preferred by farmers are included among the varieties on the market; however, with the exception of drought tolerance, they appear in at most a third of the varieties commercialized.

Lessons learned for any subsequent pilot study

- Deploy a pre-mobilization team to allow for prior sensitization of targeted villages and households and assigning of household IDs and mobilizers on time. This also ensures that men would be more likely to be at home if notifications are made early.
- Use an app for data collection that enables skip patterns and easy editing prior to submission
- Avail more time to the pre-test especially the conversion factors
- The FGD checklists should be availed on time
- Test and ensure the gadget used for recording FGDs delivers high audio quality
- Refreshments should be availed equitably among household respondents and FGD participants since they are all from the same villages. This demoralized the non-FGD participants.
- Include the respondent's mobile number in the survey. Sometimes a call back was needed to correct a missed entry during the editing prior to submission.
- Respondent groups must overlap – households, CSBs, and seed producers surveyed.

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APPENDICES

Appendix 1. List and description of indicators

	INDICATOR	INDICATOR - DETAILED EXPLANATION	THEORY OF CHANGE
1	Women's participation in Community Seed Banks	Indicators tracks quantitative and qualitative information about women's participation in Community Seed Banks, the roles they play, and the quality/type of seed they can access through Community Seed Banks.	Community Seed Banks (CBSs) are vehicles for collection, conservation and distribution of quality seed in communities. Information about women's participation in seed banks provides useful information and a relatively good measure of their access to seed.
2	Women as seed producers	This indicator tracks women's participation in seed production in multiple categories: (i) women members of seed cooperatives/ associations; (ii) women outgrowers for seed companies (in countries where only outgrowers do not market seed), (iii) women individual seed producers who also market their own seed; (iv) women heads/ owners of seed companies.	1. Women participating in any industry will lead to industry being more responsive to women's needs; 2. Greater involvement in seed production by women results in increased access to seed for women.
3	Women's influence/input in participatory breeding approaches	Indicator assesses extent to which women's participation/ preferences influence the outcome of Participatory Varietal Selection (PVS) and/ or Participatory Plant Breeding carried out by research institutions in charge of plant breeding in the country.	Participatory Varietal Selection (PVS) and/or Participatory Plant Breeding that considers needs of target groups will lead to the development of more varieties demanded by target group.
4	Availability of seed in small packages	Because [the target groups] mostly represent small-scale farmers, making seed available in small, more affordable packages is a good way to increase adoption rates among smallholder farmers.	Given that women make up a higher proportion of low-income farmers, seed sold in small packages enables them to buy high quality seed in smaller amounts, thus improving access and adoption rates.
5	Affordability (Price)	The indicator tracks the average price of seed at the time of planting.	The price of seed is a key determinant for its uptake by farmers. Given that women make up a higher proportion of low-income farmers, ensuring that high quality planting material is sold at a price that is affordable by target group will contribute to increased access.
6	Varieties with special features commercialized	Indicator tracks varieties commercialized with features that are more relevant to women, such as features related to food preparation, enhanced nutrition, etc.	As more varieties with relevant special features are released and commercialized, become more available, target groups' access will increase.
7	Targeted seed promotion by companies/producers	Indicator tracks seed company efforts to promote their varieties to target groups.	When companies expressly promote products to target groups, it will contribute to increased awareness of said product by target groups.
8	Targeted government subsidies	Indicator tracks relevant aspects of government subsidy programs, including participation by/ benefit for target groups.	Seed subsidies encourage farmers to adopt improved crop varieties. Indicator would track the extent to which the program targets different user groups
9	Concentration and adequacy of agricultural extension services for smallholder farmers	Indicator tracks the ratio of agricultural extension officers to agriculture households in country.	Well-functioning agricultural extension services are critical to the successful adoption of improved seeds by smallholder farmers.
10	Concentration of agro-dealer network	Indicator measures concentration of agro-dealer network as measured by number of registered agro-dealers, the ratio of agrodealers to agricultural households, and the average number of agro-dealers each seed company works with.	Agro-dealers play a key role in closing the last mile in Africa's seed distribution systems and are often the main point of sale for certified seed.
INDICATORS ADDED AFTER WORKSHOP			

1	Seed policy indicators	Assessment of various policies related to the seed sector as to whether they mention/promote inclusive access to seeds	Promoting inclusive access to quality seed on paper will, over time, increase inclusive access to quality seed in communities.
2	Input in household decision-making related to purchase and use of improved seed.	Assessment of gender/age dynamics in decision making about use and purchase of improved varieties.	Joint decision-making is a sign of a more egalitarian (inclusive) household, where women/ youth, etc. have more decision-making power and say in what varieties to plant/purchase.
3	Input in household decision-making regarding financial decisions related to purchase and use of improved seed.	This indicator was not carried further, as it overlaps a great deal with the previous indicator.	
4	Access to/ownership of assets related to purchase and use of improved seed.	Assessment of what agricultural assets women/ youth, etc. have access to, and whether their access is greater/less/equal to that of other household members.	Greater access to agricultural assets also includes greater access to seed of improved varieties.
5	Membership and Leadership in agriculture-related community groups	Assessment of level of participation in groups such as cooperatives, SACCOs, and other similar organizations; also includes data on percentage of members who held leadership roles.	Assumption is that members and leaders in agriculture-related community groups are more likely to use improved varieties. If data supports this assumption, a useful strategy to increase inclusive access may be to encourage membership in such groups by the target population - women, youth, etc.
6	Link to buyer	Assessment of percentage of farmers who had access to buyers of various types for their seed.	Assumption is that access to buyers increases the chance of farmer using quality seeds, either because they will learn about them and/or because they are more likely to be able to afford them. If data supports assumption, promoting links to buyers may be a good strategy to increase inclusive access by target populations - women, youth, etc.
7	Exposure to "model/lead" farmer	Assessment of whether model farmers impact the likelihood that farmer may use improved varieties.	Assumption is that access to model farmer increases the chance of farmer using quality seeds, because the model farmer provides a source of information that is easy for the farmer to follow/trust. If data supports assumption, promoting model farmers may be a good strategy to increase inclusive access by target populations - women, youth, etc.

Appendix 2. List of seed companies in Uganda

SEED COMPANY	TARGETED FOR SURVEY	INTERVIEW METHOD
1. Brac Social Enterprise (Uganda) Ltd	No	-
2. Busoga Seed Solutions Ltd.	No	-
3. CAII (Centre for Agricultural Inputs International)	No	-
4. CEDO (Community Enterprise Development Organisation) Seeds	No	-
5. Crown Seeds Ltd	Yes	Phone
6. Daylight Agro-Tech Ltd	Yes	Phone
7. Equator Seeds Limited	Yes	Phone
8. Faith Agro Inputs Ltd	Yes	Phone
9. FICA Seeds Ltd	Yes	No response
10. Green Firm Africa Ltd.	No	-
11. Grow More Seeds and Chemicals Ltd	Yes	No response
12. Masindi Seed Company Ltd	No	-
13. Miika Albertine Seeds Co. Ltd.	No	-
14. NASECO (1996) Ltd.	Yes	Online
15. Otis Garden Seed Ltd	No	-
16. Pearl Seeds Ltd	Yes	Phone
17. Rhino Seeds Africa Ltd.	No	-
18. Savana Seeds Ltd	Yes	No response
19. SeedCo Limited	Yes	No response
20. Simba Seeds Ltd	No	-
21. SIMLAW Seeds Ltd.	No	-
22. Supa Seeds Africa Limited	No	-
23. Syova Seed (U Ltd	No	-
24. Uganda Prisons Service	No	-

Appendix 3. List of breeders for target crops

NAME	TYPE OF INSTITUTION	INSTITUTE	CROP(S)	INTERVIEW METHOD
1. Dr. Godfrey Asea	national agricultural research system (NARS)	NARO - NaCRRI	Maize	In person
2. Dr. Emmanuel Mbeyagala	national agricultural research system (NARS)	NARO - NaSAARI	Pigeon Pea, Cowpea, Mung Bean	No response
3. Dr. Jimmy Lamo	national agricultural research system (NARS)	NARO - NaCRRI	Rice	Online
4. Dr. Gabriel Ddamulira	national agricultural research system (NARS)	NARO - NaCRRI	Vegetables/ Tomato	No response
5. Dr. David Kalule Okello	national agricultural research system (NARS)	NARO - NaSAARI	Groundnut	Online
6. Dr. Isaac Dramadri	Academic institutions	Makerere U. - MaRCCI	Cowpeas	Phone
7. Dr. William Esuma, Dr. Paula Arigaba	national agricultural research system (NARS)	NARO - NaCRRI	Cassava	Phone
8. Dr. Gorretie Ssemakula Nankinga	national agricultural research system (NARS)	NARO - NaCRRI	Sweet Potato	Online
9. Dr. Stanley T. Nkalubo	national agricultural research system (NARS)	NARO - NaCRRI	Bean	Phone
10. Dr. Frank Kagoda	national agricultural research system (NARS)	NARO - ZARDI	EA Highland Maize	Phone
11. Dr. Bernard Yada	national agricultural research system (NARS)	NARO - NaCRRI	Sweet Potato	Online
12. Dr. Moses Kiryowa	national agricultural research system (NARS)	NARO - NaCRRI	Horticulture	Online
13. Prof. Phinehas Tukamuhabwa	Academic institution	Makerere University	Soybean	In person
14. Dr. Adikini Scovia	national agricultural research system (NARS)	NARO - NaSAARI	Sorghum/Millet	Phone
15. Prof. Elizabeth Balyejusa Kizito	Academic institution	Uganda Christian University	Vegetables	No response
16. Dr. Walter O Anyanga	national agricultural research system (NARS)	NARO - NaSAARI	Sim-Sim (Sesame)	Phone
17. Dr. Robin Tendo Ssali	CGIAR	CIP	Sweet Potato	Phone
18. Dr. Bridgette Uwimana	CGIAR	IITA	Cassava	No response
19. Dr. Mukankusi Claire	CGIAR	Alliance of Bioversity Int'l and CIAT	Common beans	No response

Appendix 4. Survey tools and Conversation Factors

Links to survey tools on Alchemer.com

Breeders' survey: https://survey.alchemer.com/s3/7538499/SE-UGA-pilot-ST-Breeders
Community Seed Bank survey: https://survey.alchemer.com/s3/7530476/Survey-Instrument-for-Community-Seed-Bank-Uganda-
Household survey: https://survey.alchemer.com/s3/7523192/SE-UGA-pilot-ST-household
QDS Producers: https://survey.alchemer.com/s3/7540649/SE-UGA-pilot-ST-Quality-Declared-Seed-Producer-Groups

FGD checklist:

FOCUS GROUP DISCUSSIONS: CHECKLIST FOR FARMER GROUPS

BACKGROUND INFORMATION

Questionnaire code: (FGD_FGS-01, FGD_FGS-02, ….)	
Date of interview (Use format DD-MM-YYYY)	
Name of facilitator:	
Name of audio sound recorder, photos and note taker	

Region	Options: Northern, Western
Sub-region	Options: Acholi, Langi, Ankole
District	Options: To be shared
Sub-county	Options: To be shared
Village	Options: To be shared

RESPONDENT PROFILE

#	Names	Sex	Age	Size of land holding (acres)	Most important crops grown for the market only	Most important crops grown for food only	Most important crops grown for both food and the market	Crops for which they bought improved seed in either of the last two seasons
1								
2								
3								
4								
5								
6								
7								
8								

1. Varietal trait preferences by gender and age

Brainstorm and agree on the [CROP] to discuss

a. Which are the main varieties of [CROP] which farmers grow in this community, both traditional and improved? Why?
b. Which three most important attributes do [men], [women], [youth] consider when evaluating and selecting [CROP] varieties to [grow for home consumption] [grow for the market] [buy for consumption]?
c. What proportion of [men], [women], [youth] farmers currently grow improved [CROP] varieties in this community?
d. How do farmers perceive improved [CROP] varieties?
e. How do consumers perceive improved [CROP] varieties?
f. Would men and women farmers be willing to try out improved [CROP] varieties? (Options: Yes/No) Explain why?

g. Would men and women consumers be willing to try out improved [CROP] varieties? (Options: Yes/No) Explain why?
h. If you are willing to try the new varieties, which three most important attributes do you consider when evaluating and selecting improved [CROP] varieties to [grow for home consumption] [grow for the market] [buy for consumption]?
i. How much would you be willing to pay for such a variety per Kg?
j. Which factors are facilitating the adoption/use of improved [CROP] varieties in this community?
k. Which factors/ challenges could be limiting use of improved [CROP] varieties in this community? How can these be addressed?
l. Describe any social norms associated with seed in this community?

2. Women and Youth's Involvement in Participatory Variety Selection and Plant Breeding: (Explain in lay man terms what you mean by breeding)
a. How often have women and youth in this community been invited to participate in variety selection or plant breeding processes? (e.g., never, rarely, occasionally, always)? What type of woman is usually invited to participate?
b. What roles do women and youth typically play in these processes?
c. Do you feel that the improved seed varieties currently available in your community have the traits important to women and youth? Can you provide examples?

3. Seed Purchase Decisions: (would need to explain in lay terms what is meant by certified seed e.g. seed from the company)
a. What types of seeds did you purchase last season? (certified, QDS, traditional, grain from the market)
b. What factors influenced your decision to purchase a particular type of seed?
c. How would you rate the quality of seeds you purchased by crop and type?

4. Seed Package Size and Affordability:
a. Do you find the seed package sizes available in the market appropriate for your needs?
b. How do affordability considerations affect your seed purchase decisions?
c. Are there any specific challenges women and youth face in affording seeds? What opportunities are there in this community to make good seed more accessible?

5. Willingness to Pay for Quality Seeds:
a. Would you be willing to pay more for seeds that have all the desired varietal traits and are of high quality?
b. What factors would influence your willingness to pay for quality seeds?

6. Seed Promotion Strategies:
a. Which strategies are seed sellers using to encourage women and youth to buy seed in this community? In your opinion, which seed promotion strategies have been effective, and why?
b. Can you share any experiences or examples of such successful seed promotion efforts in this community?

7. Government Programs Supplying Seed:
a. Are women and youth deliberately targeted by government programs supplying seed in your area?
b. What is your opinion on the proportion of women and youth who benefit from these programs?

8. Extension Services and Digital Outreach:
a. Which type of extension service do you receive and from whom? How would you rate the quality and accessibility of extension services you receive?
b. Do you regularly use any digital extension services, and if so, which types? (***Use prompts***)

9. Access to Agro-Dealers/Seed Sellers:

a. How far do you typically need to travel to reach the nearest shop that sells seeds? How about other sources of seed in the community?
b. Are there any challenges or barriers you face in accessing seeds and agricultural inputs?
c. (if they obtain seed from seed seller/ shop that sells seed) How do you obtain the seed from these shops? Do you collect it yourselves? Do you send a boda boda?

10. Women's Involvement in Decision-Making:

a. In your household, how much input do women have in decisions related to seed use? Which decisions regarding seed do men make, which ones do women make?
b. To what extent do farmers in this community seek credit in order to buy improved seed? What are the typical sources for this type of credit? Which decisions regarding this type of credit do men make, which ones do women make? How does women's participation vary with the source of credit?

11. Women's Access to Assets:

a. Do women have access to or own assets (land, tools, equipment) that are important for agricultural production?
b. Are there any challenges or disparities in asset ownership among women and men?

12. Community Leadership and Group Membership:

a. How actively do women and youth participate in leadership roles within this community?
b. Which kinds of groups are present in this community? How are women and youth represented in the agriculture-related community groups in particular?

13. Buyer Linkages:

a. Do you have any connections or linkages to buyers for your agricultural produce? Please describe these linkages if any
b. How does this influence your decisions regarding improved seed purchases?

14. Exposure to Model/Lead Farmers:

a. Have you had opportunities to interact with model or lead farmers in your community? Please describe the nature of these interactions
b. How have these interactions influenced your decisions regarding seed purchases?

Conversion factors

CROP	UNIT	CONVERSION TO KG
Sweet potato vines (Northern Uganda)	1 bundle	9kg
Sweet potato vines (Western Uganda)	1 bag	30kg
Cassava stems	1 bag	45kg
Groundnut in shell for seed	1 bag	42kg
Grains	3 cups	1kg
Grains	1 basin	16kg
Ware potato	1 bag	125kg
Ware potato	1 basin	21kg

Appendix 5. Criteria for enrollment in participatory breeding programs

The criteria for farmers to enroll in a participatory breeding program shares some commonalities across programs. The criteria are presented below by stage:

- On-farm trials and demonstration plots:
  - Based in the target product environment or chosen sites.
  - Ability and willingness to host and invest own time and resources towards managing the on-farm trials/ demonstration plots to completion.
  - Has available land to which they hold inalienable rights as an individual or as part of a group, ranging from 0.125 to 0.5 acres for trial allocation. Preference is for plots that are easily accessible to allow for participatory variety evaluations, field days to promote the variety, etc.
  - Belongs to a group with a history of working with the breeding program or for new environments, a registered group referenced by an extension worker who is also available to collaborate with the breeding teams. Group members vouch for their reliability and are willing to nominate them to the role.
  - Famer is knowledgeable about the crop (minimum of 4 years of experience for rice), commands the ability to communicate in English/local language aspects relevant to the breeding process e.g. production constraints, trait preferences, market demands, genotype distinction capability using morphological descriptors.
  - Besides this criteria, it is worth noting that the maize and cassava programs (NARO) and the sweet potato program (CIP) have also embraced the use of Triadic Comparisons of Technologies (tricot), an approach that enables breeders to engage many farmers in testing crop varieties and other technologies. Each farmer tests three advanced lines. Breeders recruit dedicated farmers, distribute the lines, define and execute the trials, and compile and analyze data with the support of a digital platform (www.climmob.net). The farmer recruitment process is rooted in evidence and allows for the inclusion of groups that would otherwise not participate, including the less educated, women, youth, the disabled, the near landless, and widowed individuals, etc.
- Trained sensory evaluation panels:
  - Some of the programs, e.g. the cassava breeding program (NARO NACCRI) has a trained sensory evaluation panel. The panel members are selected from the public based on their consistency in providing reliable evaluations.
- Product profile development meetings:
  - Opinion leader or title holder within farmer-based organizations with perceived capacity to represent the views of farmers.

Appendix 6. Participants at Indicator Review workshop

NAME OF PARTICIPANT	INSTITUTION	COUNTRY	E-MAIL ADDRESS
Stephen Baguma	African Women in Agricultural Research and Development (AWARD)	Kenya	S.Baguma@cifor-icraf.org
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(Footnotes)

1 Exchange rate used: UGX3800=1USD

2 A useful measure of the role/impact of CSBs would be to compare the seeds distributed to other sources of seed – such as certified seed, QDS, etc., available to farmers. TASAI studies collect production and sales data from seed companies, which shows much larger volumes than the volumes cited for CSBs - nearly 20K MT for maize and 4,500 MT for beans, compared to 10 and 17 MT reported by CSBs. However, our study did not interview all CSBs, and thus we cannot make the comparison, but it is safe to say that the volumes of improved seeds distributed through CSBs are relatively small compared to other sources.

3 Information was not available for Nakaseke Community Seed Bank.

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