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A photograph of a person wearing a light-colored cap and a red shirt, watering a field of tall green corn plants with a silver metal watering can. The background is a clear blue sky. Several large, stylized green and yellow leaf shapes are overlaid on the image.

Uganda Country Report 2020

The African Seed Access Index

By
Edward Mabaya, Michael Waithaka,
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TASAI
The African Seed Access Index

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George Kanyenji
Ruth Ssebuliba
Miriam Kyotalimye

Reviewed by

Nelson Masereka and John Jagwe

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LIST OF ACRONYMS:

ACDP	- Agriculture Cluster Development Project
CIAT	- International Center for Tropical Agriculture
CIMMYT	- International Maize and Wheat Improvement Center
CGIAR	- Consultative Group on International Agricultural Research
COMESA	- Common Market for Eastern and Southern Africa
DUS	- Distinctiveness, Uniformity and Stability
EAC	- East African Community
ICRISAT	- International Crops Research Institute for the Semi-Arid Tropics
IITA	– International Institute of Tropical Agriculture
ISSD	- Integrated Seed Sector Development
MAAIF	- Ministry of Agriculture, Animal Industry and Fisheries
MaRCCI	- Makerere University Regional Centre for Crop Improvement
NAADS	- National Agricultural Advisory Services
NaCRRI	- National Crops Resources Research Institute
NARO	- National Agricultural Research Organization
NaSARRI	- National Semi-Arid Resources Research Institute
NSB	- National Seed Board
NSCS	- National Seed Certification Services
NVRC	- National Variety Release Committee
OPV	– Open Pollinated Variety
OWC	- Operation Wealth Creation
PQIS	- Phytosanitary and Quarantine Inspection Service
PVP	- Plant Variety Protection
QDS	- Quality Declared Seed
UBOS	- Uganda Bureau of Statistics
UNADA	– Uganda National Agro-Input Dealers Association
USTA	– Uganda Seed Trade Association
VCU	- Value for Cultivation and Use
ZARDI	- Zonal Agricultural Research and Development Institute

INTRODUCTION

The increased use of productivity-enhancing technologies, including mechanization, irrigation, fertilizer and improved seed, is critical to improving food and nutritional security across Africa. For field crops, a competitive formal seed sector is key to ensuring the timely availability of high-quality seed of improved, appropriate varieties at affordable prices for smallholder farmers. Improved seed can deliver state-of-the-art technology to farmers, offering including higher yields, disease and pest resistance, climate change adaptation, reduced post-harvest losses, and improved nutrition. To deliver these benefits, the African Seed Access Index (TASAI) seeks to encourage public policymakers and development agencies to create and maintain enabling environments that will accelerate the development of competitive formal seed systems serving smallholder farmers in Africa.

This country report summarizes the key findings of the study conducted by TASAI in 2020 to appraise the structure and economic performance of Uganda's formal seed sector. TASAI studies focus on the four grain and legume crops important to a country's food and nutritional security (the "four focus crops"). In the Uganda 2020 study, these crops are maize, bean, millet, and sorghum. The cultivation of these four crops covers 92% of the country's harvested area (FAOSTAT, 2020)¹.

OVERVIEW OF UGANDA'S FORMAL SEED INDUSTRY

Uganda's seed industry consists of three sectors: the informal, the semi-formal and formal sectors. This Country Report focuses almost exclusively on the formal seed sector.

The informal sector refers to a system in which seed is produced, maintained, and distributed through informal networks. These activities "tend to be decentralized and might revolve around local entrepreneurship, seed banking, community-based seed production, or seed villages" (McGuire & Sperling, 2016). In many cases, farmers keep seed from the harvest and exchange it with neighbors, relatives, and through rural markets. Seed from this system is of variable varietal purity, physical and sanitary quality. In Uganda 85% of the national seed requirement is supplied by the informal sector (The Republic of Uganda, 2015).

The semi-formal sector bridges the gap between the formal and the informal systems. The system usually refers to the Quality Declared Seed system, which is outlined in the 2006 Food and Agriculture Organization (FAO) Plant Production and Protection Paper 185. Within this system in Uganda, local seed businesses (LSBs) multiply seed of improved varieties with minimal quality checks from the National Seed Certification Services (NSCS). This seed class is referred to as Quality Declared Seed (QDS), and it can only be sold within the district where the seed was produced.

The formal sector is a structured and regulated value chain for the production of improved seed varieties. This process involves many actors and institutions, from breeding



1 FAOSTAT <http://www.fao.org/faostat/en/#data/QC>



varieties to the multiplication, processing, and distribution of certified seed. The different stages of improved seed production are regulated by governments, based on approved regulations and standards. The sale of seed from this system takes place through limited distribution channels such as registered seed growers/companies and agro-dealers. This system produces seed of the highest varietal purity, physical and sanitary quality. The government estimates that the utilization of certified seed for the four crops was 59% (maize), 54% (sorghum), 20% (bean), and 13% (millet) (The Republic of Uganda, 2015).

Uganda's National Seed Policy aims to guide, promote, develop and regulate the seed sector in order to ensure the availability of and access to safe and high-quality seed for all stakeholders (The Republic of Uganda, 2018). To achieve this goal, the government supports the gradual transition from the informal sector to the formal sector through the piloting of the QDS seed, agricultural advisory services, and the provision of clean improved seed to farmers (The Republic of Uganda, 2018).

Table 1 lists the main agencies in charge of various aspects of Uganda's formal seed industry. Government agencies/departments include the NSCS and PQIS, NARO (and its institutes NaCCRI and NaSARRI), MaRCCI and NAADS, and NARO Holdings Ltd. The private sector players include local and foreign-owned seed companies led by the Uganda seed Trade Association (USTA) and agro-dealers under the umbrella of the Uganda Agro-Input Dealers Association (UNADA).

Table 1: Key players in Uganda's formal seed sector

ROLE	KEY PLAYERS
Research and breeding	National Crops Resources Research Institute (NaCCRI), National Semi-Arid Resources Research Institute (NaSARRI), Makerere University Regional Centre for Crop Improvement (MaRCCI), Consultative Group on International Agricultural Research (CGIAR) centers, foreign universities
Variety release and regulation	National Seed Certification Services (NSCS), National Variety Release Committee (NVRC)
Seed production and processing	Seed companies (local and foreign owned), private seed laboratories
Education, training, and extension	Seed companies, Uganda Seed Trade Association (USTA), Uganda National Agro-Input Dealers Association (UNADA), Non-Governmental Organizations (NGOs), Department of Agricultural Extension Services
Distribution and sales	Seed companies, agro-dealers, National Agricultural Advisory Services (NAADS)

METHODS

TASAI studies cover 22 indicators divided into 5 categories: **Research and Development, Industry Competitiveness, Seed Policy and Regulations, Institutional Support,** and **Service to Smallholder Farmers** (Table 2). In most TASAI studies, the bulk of the performance data reported come from the year preceding the one in which the study is conducted (“the study year”); this is because often the most recent data available is from the prior year. Accordingly, the data reported in this Country Report pertain primarily to 2019; however, whenever 2020 data are available, they are included in this report.²

Table 2: TASAI Indicators

	Crop-specific	Impact on seed access
A RESEARCH AND DEVELOPMENT		
A1 Adequacy of active breeders	Yes	+
A2 Number of varieties released	Yes	+
A3 Number of varieties with ‘special’ attributes/ features	Yes	+
A4 Availability of basic seed	Yes	+
B INDUSTRY COMPETITIVENESS		
B1 Number of active seed companies/producers	Yes	+
B2 Quantity of seed produced and sold	Yes	+
B3 Number of varieties sold and dropped	Yes	+
B4 Average age of varieties sold	Yes	-
B5 Market concentration	Yes	-
B6 Market share of state-owned seed company	Yes	-
B7 Efficiency of seed import/export processes	Yes	+
C SEED POLICY AND REGULATIONS		
C1 Length and cost of variety release process	Yes	-
C2 Status and implementation of national seed policy framework	No	+/-
C3 Harmonization with regional regulations	No	+
C4 Adequacy of efforts to eradicate counterfeit seed	No	+
C5 Use of government subsidies	No	+/-
D INSTITUTIONAL SUPPORT		
D1 Performance of national seed association	No	+
D2 Adequacy of seed inspection services	No	+
E SERVICE TO SMALLHOLDER FARMERS		
E1 Availability of agricultural extension services for smallholder farmers	No	+
E2 Concentration of agro-dealer network	No	+
E3 Availability of seed in small packages	Yes	+
E4 Seed-to-grain price ratio at planting time	Yes	-

² The list of indicators and recent TASAI data are available at https://tasai.org/wp-content/uploads/TASAI-Appendix_CURRENT.pdf



To assess the progress of Uganda’s formal seed sector, the present Country Report draws comparisons with the findings of the previous TASAI Uganda studies carried out in 2013, 2015 and 2017. In addition, since TASAI has conducted similar studies in 20 other African countries, this report also draws relevant cross-country comparisons. It is important to note that in a few cases we draw comparisons between Uganda and Kenya. We do this because: (i) the two neighboring countries are close trading partners, (ii) they follow the same harmonized seed processes, (iii) in instances where one country has made more progress, this is a useful lesson for the other country, and (iv) for the two countries we have comparable data from four country studies conducted since 2013.





Using TASAI survey tools, data collection focused on three key seed industry players: seed companies, plant breeders, and representatives of government entities active in the country’s seed sector. Of these, seed companies were the study’s primary source of information. For several indicators, TASAI supplements quantitative data with opinion ratings, in which respondents were asked to rate their satisfaction with various aspects of the seed sector in Uganda on a scale of 0-100, with the following brackets: 0-19.99% **extremely poor**, 20-39.99% **poor**, 40-59.99% **fair**, 60-79.99% **good**, and 80-100% **excellent**.

In 2019, there were 42 seed companies on the registry of the National Seed Certification Services (NSCS). Seven of those companies did not meet the criteria for inclusion in the TASAI sample, either because they were not working on the

focus crops for this study (six companies) or because they were an exclusive outlet for one of the seed companies that was itself included in the TASAI survey (one company). The remaining 35 companies were eligible for the study because they were registered to produce and market seed of one or more of the four focus crops - maize, bean, sorghum, and millet - in 2019. Of these 35 seed companies, 24 responded to the survey, detailed in Table 3. The remaining 11 seed companies were not included in the study: one company was inactive in 2019, while the remaining 10 companies declined to respond to the survey. Most of the non-responsive companies were newly-established seed companies which produce low volumes of seed.

In addition to the seed companies, the survey targeted the following government institutions: the National Seed Certification Services (NSCS), the Phytosanitary and Quarantine Inspection Services Division (PQIS), an extension department in the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), and the National Agricultural Advisory Services (NAADS). In addition, the survey targeted the two public agricultural research institutions: the National Agricultural Research Organization (NARO) and the Makerere University Regional Centre for Crop Improvement (MaCCRI). The survey reached several private sector entities, development partners and NGOs. Secondary data was sourced from websites including the Uganda Bureau of Statistics (UBOS) and the MAAIF. Seed industry regulatory documents not available online were obtained in hard copy from the NSCS and/or the government printer.

Table 3. Breakdown of respondents by crop

Crop	Number of seed companies examined for the present study (out of 24 respondents) who:			Total number of seed companies
	Produced	Processed	Sold	
 Maize	19	19	23	23
 Bean	17	17	17	17
 Millet	4	5	5	5
 Sorghum	12	14	14	14
Total	21	21	24	24³

3 The total number of seed companies is lower than the summation of the individual crop totals because most seed companies work on more than one crop.

RESEARCH AND DEVELOPMENT

NUMBER AND ADEQUACY OF ACTIVE BREEDERS

A functioning seed system needs vibrant public and private breeding programs to develop improved varieties that respond to the farmer and consumer needs. The number of active breeders is indicative of the level of investment in research and development.⁴ In addition to tracking the number of breeders working on the four focus crops, the present study also measures the level of satisfaction reported by seed companies with the public breeding programs. The latter offers an indication of the ability of active breeders in public institutions to produce new varieties





In 2019, Uganda had 11 active breeders for the four focus crops – maize, bean, millet, and sorghum. Ten of these breeders were employed in the public sector (Table 4). Out of the 11 breeders, 5 worked on maize and were employed by NARO's two maize breeding programs: the National Crops Resources Research Institute (NaCRRI) and the Buginyanya Zonal Agricultural Research and Development Institute (Bugi ZARDI). Two of the three bean breeders worked in the public sector at NaCRRI, while the third breeder was employed by a private seed company. Uganda had only one millet breeder in 2019, who was employed by the National Semi Arid Resources Research Institute (NaSARRI). Finally, of the three sorghum breeders, one was employed at the Makerere

University Regional Centre for Crop Improvement (MaRCCI), while the other two were employed by NaSARRI.

The sorghum breeding work at MaRCCI's Regional Center of Excellence is funded by the World Bank through the African Centre of Excellence Project. In addition to breeding, the MaRCCI also trains plant breeders. Between 2017 and 2019, the regional center had enrolled 33 PhD students in plant breeding (Edema et al, 2018).

Overall, the number of active breeders has declined from 15 in 2017 (Mabaya et al., 2019) to 11 in 2019. The seed companies rated their satisfaction with the adequacy of breeders as “good” for maize (67%), bean (63%), and sorghum (60%), and as “fair” (47%) for millet. The high level of satisfaction with maize breeders can be attributed to the relatively high number of maize breeders. Despite a relatively high rating for bean and sorghum, some of the companies had complaints about the breeders. For example, some seed companies noted that bean and sorghum breeders had done little to popularize their varieties and did not involve seed companies in the development of new varieties. The ratings for maize and bean have also declined between 2017 and 2019 for maize (from 72% to 67%) and for bean (from 80% to 63%) (Table 4). There has been a slight improvement in the rating of the sorghum breeders, from “fair” (55%) in 2017 to “good” (60%) in 2019. This development can be attributed to the new sorghum breeding program at MaRCCI.

Table 4: Number and adequacy of active breeders in Uganda

Crop	Number of public breeders	Number of private breeders	Total number of breeders		Satisfaction rating (out of 100%)	
	2019	2019	2017	2019	2017	2019
 Maize	5	0	7	5	72%	67%
 Bean	2	1	4	3	80%	63%
 Millet	1	0	2	1	40%	47%
 Sorghum	3	0	2	3 ⁵	55%	60%
Total	10	1	15	11		

extremely poor poor fair good excellent

⁴ TASAI studies define an “active breeder” as a breeder who is currently engaged in breeding/maintaining a variety or a breeder who had either developed and released at least one variety or was developing a variety of the crop of interest at the time of the TASAI study. In Uganda, active breeders are also domiciled in the country.

⁵ The millet breeder is also a sorghum breeder. This is why the total number of breeders is 11 and not 12.



VARIETIES RELEASED IN THE LAST THREE YEARS

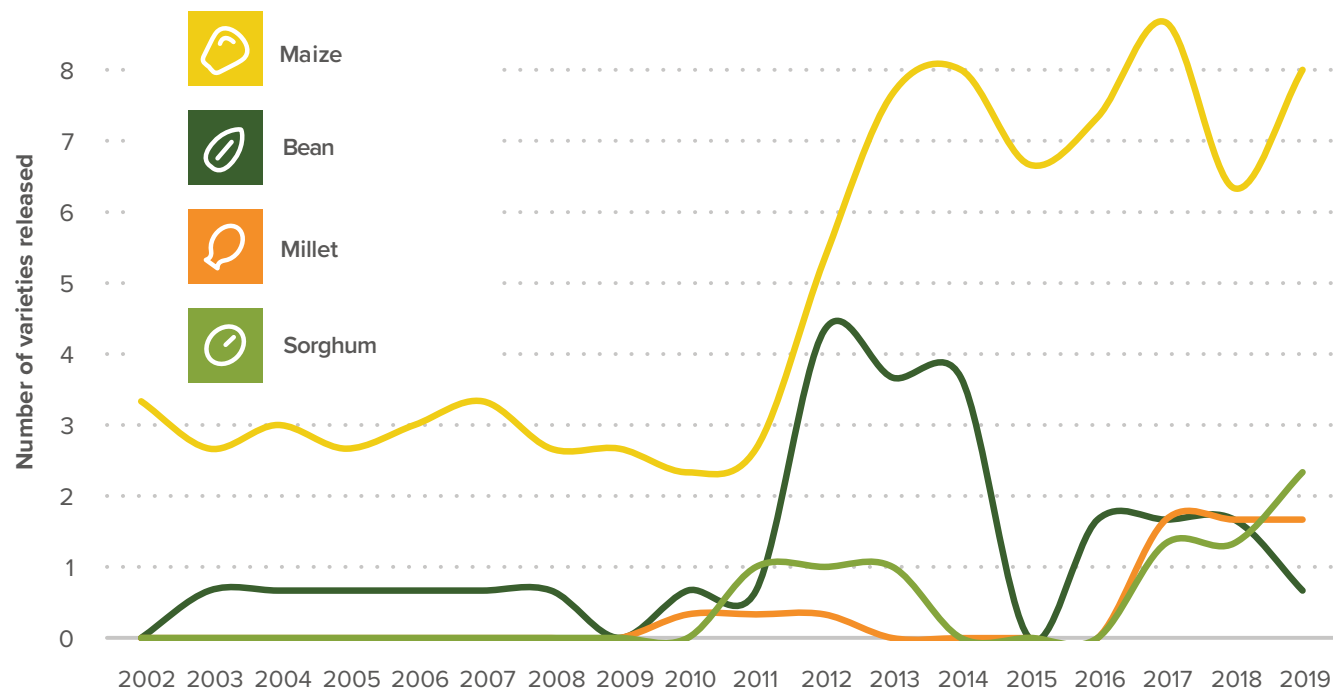
The number of varieties released is a good measure of the performance of the variety development and release system. This indicator (number of varieties released in the last three years) is crop specific, and the greater the number of varieties released in a country, the higher the chances of enhancing smallholders’ access to improved seed. In addition to higher yields, new varieties often carry desired traits such as climate smartness, disease/pest resistance, and nutrition enhancement.

Figure 1 illustrates the 3-year moving averages of crop varieties released between 2000 and 2019. A total of 139 varieties of the four focus crops were released between 2002 and 2019: 99 varieties of maize, 24 varieties of bean, 10 varieties of sorghum and 6 varieties of millet. A total of 38 varieties were released between 2017 and 2019: 24 maize

varieties, 7 sorghum varieties, 5 millet varieties and 2 bean varieties. Maize varieties accounted for over 63% of the total varietal releases of the four focus crops between 2017 and 2019. The high number of maize variety releases is attributed to a strong maize research program, a vibrant private seed sector and strong collaboration with international research institutions, namely the International Maize and Wheat Improvement Center (CIMMYT), Ohio State University and Makerere University for student training.

Uganda is a member of Common Market for East and Southern Africa (COMESA). The country adopted the COMESA seed regulations (COMESA, 2014) in 2018. According to these regulations, once a variety is released in two member states, it qualifies for registration in any member state. In 2019, COMESA seed regulations in Uganda started bearing fruit, when 60% of all the maize varieties listed in the catalogue were released through the COMESA system.

Figure 1: Trend in number of varieties released (3-year moving average)



VARIETIES WITH SPECIAL FEATURES

Varieties may have special characteristics, for instance climate-smart, fast-cooking and nutrition-enhanced, or industry-demanded features. Examples of climate-smart features are drought tolerance, early maturity, or extra early maturity. While acknowledging the increase in biotic stresses (pests, weeds and diseases) due to climate change, TASAI studies narrowly define “climate-smart features” as those that respond to extreme weather events, such as droughts, floods and frost, that affect current farming practices.

Between 2017 and 2019, of the 39 varieties released in Uganda, a total of 27 varieties had special features: 21 varieties were climate smart, 4 were fast-cooking and nutrition enhanced, and 2 varieties had industry-demanded features. Table 5 gives a breakdown of the number of varieties with special features by crop.

Table 5: Number of varieties with special features released

Feature	Description of feature	Number of varieties released (2017-2019)				
		Maize	Bean	Millet	Sorghum	Total
All varieties released		24	3	5	7	39
All varieties released with special features		12	2	2	7	23
Climate-smart features	All climate-smart features	10	2	2	7	21
	Drought tolerant	7	2	1	6	16
	Early / extra-early maturing	3	0	1	1	5
Fast-cooking and nutrition-enhanced features	All fast-cooking and nutrition-enhanced attributes	2	0	0	0	2
	Fast cooking/ sweet tasting	2	0	0	0	2
	Nutrition-enhanced features	0	0	0	0	0
Industry-demanded features	All industry-demanded features	0	0	1	1	2
	Good malting quality	0	0	1	1	2

Note: The total number of varieties with special attributes includes varieties that have more than one “sub-attribute” in the same category. For instance, a variety can be both drought tolerant and early maturing. This variety will appear in the drought tolerance and early maturity rows.

NUMBER OF VARIETIES SOLD IN 2019

An increase in the number of varieties sold in a country often results in an increased choice of varieties available to farmers. The seed companies surveyed sold a total of 40 maize varieties, 16 bean varieties, 5 millet varieties and 10 sorghum varieties to farmers in 2019. Table 6 lists the most popular⁶ varieties of each crop. Longe 5 (sold by 70% of maize seed companies) was the most popular maize variety in 2019, followed by MM3 (sold by 30% of maize seed companies). Longe 5 has wide adaptation (it can grow in diverse agro-ecologies) and is high yielding. MM3 is resistant to maize streak virus and is drought tolerant. Both are open-pollinated varieties (OPVs) and are popular with small and medium seed companies which do not have the capacity to produce hybrids.

⁶ Popularity is based on the number of seed companies selling each variety.









The two most popular bean varieties - NABE 15 and NABE 17 - were sold by 76% and 71% of the bean seed companies, respectively. According to the breeders, the two varieties are popular because of their grain type, growth habits, disease resistance levels and early-maturity traits.

The two most popular millet varieties, Seremi 1 and Seremi 2, were sold by 60% and 40% of seed companies that marketed millet seed, respectively. These two varieties were released

in 1999 and are resistant to blast disease (a widespread millet disease in eastern Africa), are tolerant to lodging and have brown seeds, a feature desired by consumers. The most popular sorghum variety, SESO 3, was sold by 13 out of the 14 surveyed companies (93%) that marketed sorghum in 2019. The breeders noted that the popularity of the variety is attributed to its excellent food quality traits, namely the good taste and brown color.

Table 6: Name and age of popular varieties sold

Crop	Number of varieties sold in 2019	Name of popular variety sold	% of companies selling the variety	Age of variety (years) in 2019	Average age of popular varieties
 Maize	40	Longe 5	70%	19	10
		MM3	30%	9	
		Longe 11H	13%	10	
		Longe 5D	13%	7	
		UH 5051	13%	7	
 Bean	16	NABE 15	76%	9	6
		NABE 17	71%	7	
		NARO Bean 1	53%	3	
 Millet	5	Seremi 1	60%	20	20
		Seremi 2	40%	20	
 Sorghum	10	SESO 3	93%	8	8
		SESO 2	21%	8	

VARIETIES DROPPED OR NO LONGER MAINTAINED

A vibrant seed sector is expected to retire old varieties and discontinue varieties that fail to meet farmer needs as newer and better varieties become available. This indicator tracks any variety dropped (i.e., no longer sold) by at least one seed company in the last three years.⁷ The TASAI study tracks the dropped varieties, and for each dropped variety, we also capture the reason(s) why it was dropped.

During the 2010-2019 period, seed companies dropped 12 maize varieties, 9 bean varieties, and 4 sorghum varieties. No millet variety was dropped over this period. Since some of these varieties were still produced by some companies, they continue to be maintained by the research institutions. Seed companies dropped varieties for several reasons. The major reason for dropping a variety across the three crops was poor performance with regard to agronomic traits such as yield or tolerance to biotic and abiotic stresses, such as diseases and drought. Another reason was that some varieties, for instance the maize variety Longe 7H, were associated with counterfeit seed. Companies could not sell this variety, because farmers suspected all Longe 7H on the market to be counterfeit seed

AVERAGE AGE OF VARIETIES SOLD

In vibrant seed systems, farmers regularly replace old varieties with new ones. In many African countries, old varieties persist, despite the fact that newer varieties often outperform older varieties as they are bred for traits that respond to demands made by farmers, consumers, and industry. A lower average age of varieties signals higher rates of variety turnover. TASAI tracks the average age of varieties by crop.





Table 7 shows the ages of the most popular varieties (and average age by crop) that were sold to farmers in 2019. The age of the variety is calculated based on the year when the variety was released for commercialization. The popularity of the variety is determined by the number of seed growers producing and/or selling that variety.

In 2019, the most popular maize varieties sold - Longe 5 and MM3 - were 19 years and 9 years old, respectively. Seed companies preferred Longe 5 because it is not costly to produce and none of the companies holds exclusive marketing rights to it. Of the 24 maize hybrids released from 2017 to 2019, 17 were owned by individual seed companies, while others were produced by NaCCRI. NaCCRI-owned

⁷ It is important to note that this does not mean the variety is no longer on the market, as other companies may still sell it.

hybrid varieties were sold to companies on an exclusive basis. Other seed companies therefore had no choice but produce the old OPVs, despite the existence of new hybrids.

Table 7. Average age of varieties (all vs. popular varieties)

Crop	Number of varieties sold in 2019	Average age of all varieties sold	Average age of popular varieties ⁸
 Maize	40	8	10
 Bean	16	10	6
 Millet	5	17	20
 Sorghum	10	6	8

There were three popular bean varieties: NABE 15, NABE 17 and NARO Bean 1. The age of bean varieties ranged from 3 years for NARO Bean 1, to 9 years for NABE 15. Seed companies preferred to produce old varieties due to a lack of sufficient quantities of basic seed for the newer varieties. Seed companies retained seed at the end of the season and then multiplied it for sale in subsequent seasons. For example, NaCCRRI no longer maintains basic seed for the variety K132. However, three seed companies sold this variety in 2019.

The two most popular millet varieties, Seremi 1 and 2, were 20 years old. The old age reflects a relatively inactive millet breeding program. In addition, the varieties that were released in 2017 were not promoted due to a lack of resources. The two popular sorghum varieties SESO 3 and SESO 2 were both 8 years old. The average age of all sorghum varieties sold in 2019 was 6 years, a marked improvement from 2017, when the average age was 12 years, and 2015, when it was 14.5 years.

Table 7 shows that younger varieties are more popular only in the case of bean, where the average age of popular varieties was 6 years, while the average age of all bean varieties was 10 years. By contrast, the average age of popular varieties of maize, millet and sorghum was higher than the average age of all varieties available. This indicates that there are difficulties in promoting the adoption of new varieties.

SOURCES AND AVAILABILITY OF FOUNDATION (BASIC) SEED

Seed companies use basic seed to produce certified seed for sale to farmers. In many African countries, limited access to basic seed from public research institutions can limit the ability of seed companies to scale up production. The general process to obtain the desired quantities of basic seed starts with a seed company making a formal request for basic seed at least one season or six months before the seed collection date. A letter addressed to the Director of the Research Institute should provide details of the parental stock, quantity requested and date of collection. On receiving the letter, the Director notifies the breeder, who engages directly with the seed company to further establish the specific details of the order. Seed companies may also submit their seed production plans/schedules and forecasts to the breeder. The seed company is advised on the costs and payment modalities as established in the NARO Financial Management procedures. The seed company and the institute sign a memorandum of understanding detailing the terms and costs of engagement. Seed companies are required to make a down-payment of 30-40% of the value of the seed.

Sources of basic seed: Table 8 shows the public and private sources of basic seed for the focus crops in 2019. The main public sources of basic seed for seed companies in Uganda were the two NARO research institutes: NaCCRRI for maize and bean and NaSARRI for sorghum and millet. NARO Holdings Limited (NHL), a commercial but independent arm of NARO established in 2016, constituted a second source of bean basic seed. The sources of basic seed from outside Uganda were the CIMMYT and QualiBasic Seed (QBS) for maize, and some private seed companies, which have subsidiaries in Uganda. All of the above organizations also supplied basic seed in 2017, with the exception of QBS and NHL, which are recent entrants in the industry.





Seed companies' assessment of the availability of basic seed: Seed companies were asked to assess three aspects of the availability of basic seed: the quality of seed received, the timeliness of delivery, and whether they had received the requested quantities. As shown in Table 9, the quality of basic seed was rated "excellent" (84%-85%) for maize, millet and sorghum and "good" for bean. In terms of seed quality, each supplier of basic seed was rated either "excellent" or "good", implying that the suppliers were adhering to required quality standards. With respect to timeliness of delivery, millet and sorghum were rated as "excellent", with a rating of "fair" for maize and bean. These ratings indicate that timeliness of delivery of orders for maize and bean needs to be improved.

⁸ The varieties included in the 'popular varieties' are listed in Table 6.

Table 8. Sources and volume of basic seed (as % of total) (2019)

Source of basic seed	Maize		Bean		Millet		Sorghum	
	Number of transactions	% of total	Number of transactions	% of total	Number of transactions	% of total	Number of transactions	% of total
NARO (NaCCRI and NaSARRI)	12	50%	13	93%	2	100%	6	86%
NARO Holdings Limited	-	-	1	7%	-	-	-	-
CIMMYT	8	33%	-	-	-	-	-	-
QualiBasic Seed	3	12%	-	-	-	-	-	-
Own	1	4%	-	-	-	-	1	14%
Totals	24	100%	14	100%	2	100%	7	100%

Table 9: Seed companies' assessment of availability of basic seed (2019)

Crops		NARO (NaCCRI and NaSARRI)	NHL	CIMMYT	QBS	Own
 Maize (n=24)	Quality *	74%	-	99%	93%	90%
	Quantity **	42%	-	63%	67%	100%
	Timeliness ***	58%	-	88%	33%	100%
 Bean (n=14)	Quality *	75%	80%	-	-	-
	Quantity **	38%	100%	-	-	-
	Timeliness ***	46%	-	-	-	-
 Millet (n=2)	Quality *	85%	-	-	-	-
	Quantity **	100%	-	-	-	-
	Timeliness ***	100%	-	-	-	-
 Sorghum (n=7)	Quality *	82%	-	-	-	100%
	Quantity **	83%	-	-	-	100%
	Timeliness ***	67%	-	-	-	100%

*Quality of basic seed (opinion).

**Quantity of basic seed (% that received quantities requested)

***Timeliness of basic seed (% that received basic seed on time)

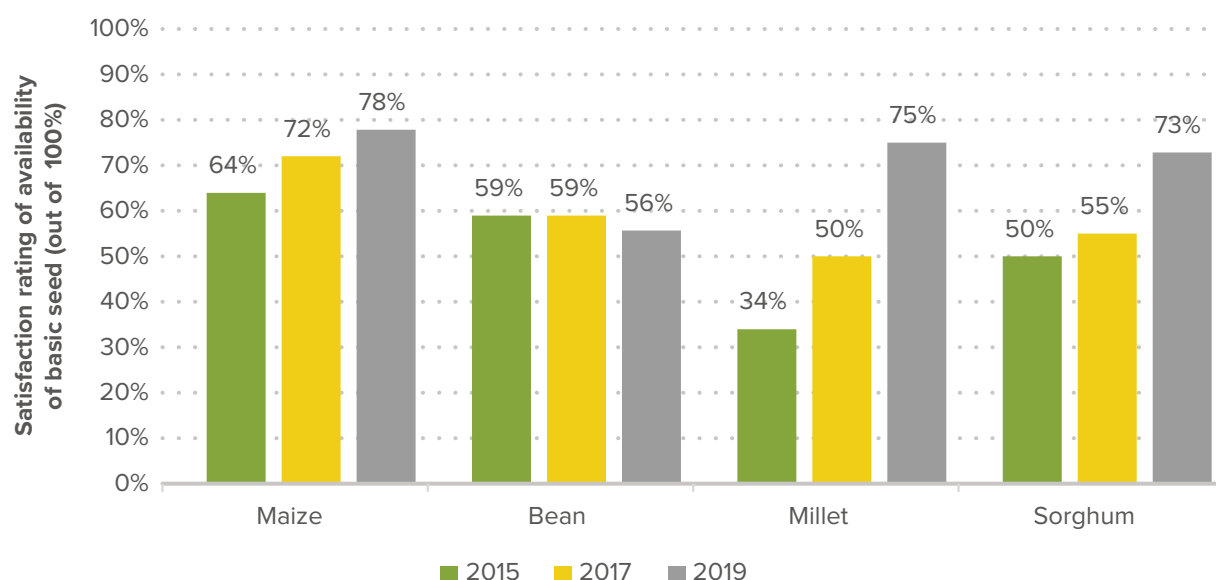
extremely poor **poor** **fair** **good** **excellent**

As shown in Figure 2, seed companies rated the availability of basic seed as “good” for maize (78%), millet (75%) and sorghum (73%), and “fair” for bean (56%).

Figure 2 shows seed companies' overall satisfaction with the availability of basic seed between 2015 and 2019.

Satisfaction ratings have increased overall. Sorghum ratings improved from “fair” in 2015 to “good” in 2019. Maize was rated “good” both years, but the rating increased from 64% in 2015 to 78% in 2019. The ratings for millet showed the most significant increase, from “poor” to “good”. Only the satisfaction with the availability of bean basic seed did not increase, stagnating at “fair”.

Figure 2: Overall satisfaction rating with availability of basic seed



INDUSTRY COMPETITIVENESS

NUMBER OF ACTIVE SEED COMPANIES

Competition breeds excellence: the presence of more active seed companies increases competition and creates incentives for companies to innovate and improve service delivery to farmers. A vibrant seed sector depends on a robust private sector in which seed companies invest in developing, producing, processing, and marketing improved varieties to farmers. This section tracks the number of registered seed companies that produced and marketed seed of one or more of the focus crops.

As outlined in the Methodology section, TASAI interviewed 24 registered seed companies. Table 10 shows the breakdown of active seed companies by crop. Note that the total number of seed companies in Table 11 exceeds 24, as a single company may grow more than one of the four focus crops. The number of active seed companies for all four focus crops has increased over the 2015-2019 period during which three TASAI studies were conducted in Uganda. The highest increase was recorded for companies selling maize, where the number of active seed companies had increased from 12 to 23. The number of companies selling sorghum increased

from 8 to 14, and companies selling bean seed increased from 13 to 17. In contrast, the number of seed companies marketing millet was the same in 2015 and 2019.

The high number of seed companies participating in the maize seed value chain can be attributed to the potential of local and regional seed markets that seed companies seek to tap into. The increase in the number of companies engaged in sorghum seed production has been driven by two factors: the demand for sorghum seed from relief agencies, such as FAO, in South Sudan, and a growing demand for the grain from the brewing industry. The increase in the number of seed companies producing bean seed is due to the growing local and regional demand for bean among consumers. Uganda is a net exporter of bean grain to South Sudan, Kenya, and the Democratic Republic of Congo (CASA, 2020).

The demand for millet seed in Uganda is relatively low, which accounts for the relatively low level of participation of seed companies in the millet seed value chain, compared to other crops. This is due to limited access to improved varieties, but also due to the fact that local landraces still compare favorably with improved cultivars in terms of tillering ability, early maturity, drought tolerance, and the presence of spikes that keep birds away.

GENDER IN MANAGEMENT OF SEED BUSINESSES

TASAI also tracks the number of women in management and ownership positions in seed companies, presented in Table 11. The sector is male dominated: only three (13%) of the surveyed 24 seed companies employed a woman as a top manager, and only four (17%) of the 18 companies where ownership could be disaggregated by gender were owned by women.⁹ Senior management consisted of at least 50% women in only seven (29%) of the 24 seed companies.

Table 10: Active seed companies





Crop	Number of seed companies in		
	2015	2017	2019
 Maize	12	19	23
 Bean	13	17	17
 Millet	5	2	5
 Sorghum	8	12	14
Total	13	20	24

Table 11: Gender in management of seed business (2019)





Gender indicator	Number	%
Women in management positions (n=100)	31	31%
Companies where management consists of at least 50% women (n=24)	7	29%
Companies with female top manager (n=24)	3	13%
Companies with female owner (n=24)	4	17%

PRODUCTION AND SALE OF CERTIFIED SEED

To measure the overall size of a country's seed sector, TASAI tracks the volumes of seed produced and sold for the four focus crops. The data are presented as aggregate quantities (in MT) of seed produced and sold in the data collection year, as reported by active seed companies. Table 12 lists the aggregate quantities of seed produced and sold, as reported by the 24 seed companies in 2019. The quantities produced were 23,165 MT of maize, 4,498 MT of bean, 168 MT of millet, and 10,605 MT of sorghum. These figures were higher than those reported by the National Seed Certification Services (NSCS). For maize, the data collected by TASAI came close to the numbers recorded by NSCS, while for the other three crops, the aggregate production reported by the seed companies was significantly higher than that reflected in the NSCS records. According to seed companies, the main reason behind the difference in these figures is that a significant portion of the seed they produced was not inspected, due to a lack of seed inspectors. Seed companies noted that seed inspectors tended to prioritize the inspection of maize seed production fields over other crops. This is a significant problem, as it indicates that a large portion of seed sold to farmers is not inspected.

⁹ Ownership is not disaggregated by gender if the company is not owned by an individual. This applies for government-owned companies and some multinational companies.

Table 12: Seed production and sales

Crop	Seed production in MT by all seed companies (NSCS data)	Seed production in MT surveyed companies (TASAI data)		Seed sales in MT (TASAI data)	
	2019	2017 (n=20)	2019 (n=24)	2017 (n=20)	2019 (n=24)
 Maize	20,633	21,959	23,165	17,013	18,633
 Bean	1,362	3,794	4,498	2,957	3,971
 Millet	1.5	19	168	12	154
 Sorghum	5,684	2,302	10,605	1,857	8,240

Another reason is that NSCS records are based on the Government's financial year which starts from July and end in June. However, the TASAI data are based the calendar year. Both options count two seasons, but for different years

Table 12 also shows the production and sales of certified seed between 2017 and 2019 based on TASAI and NSCS data. Annual seed production between 2017 and 2019 increased across all four crops. Sorghum production saw the largest increase in absolute values, followed by maize and bean. The increase was large for millet seed production which was below 100 MT in 2017 but jumped to 168 MT in 2019.

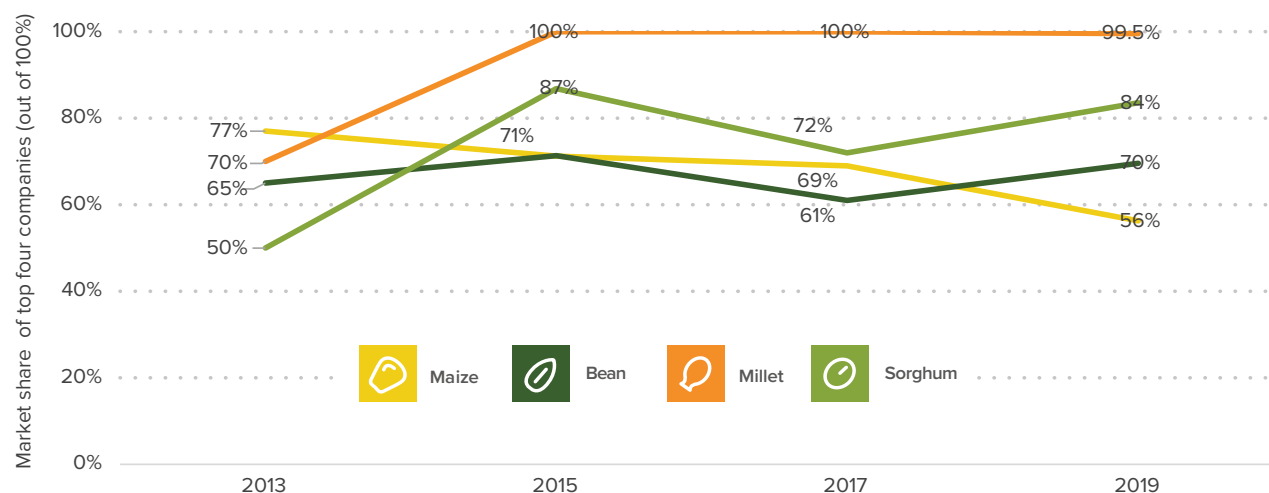
concentration, TASAI uses seed sales data for each crop, as reported by seed producers, to calculate the market share of the four largest firms, also known as four-firm concentration ratio (CR4), and the Herfindahl-Hirschman Index (HHI).¹⁰ In 2019, the market share of the top four companies was 99.5% for millet, 84% for sorghum, 70% for bean, and 56% for maize (Figure 3). The market share of the top four maize seed companies declined from 77% in 2013 to 56% in 2019. This decline may be due to the entry of new and competitive companies into the market over the years, as the number of companies marketing maize seed has increased from 14 in 2013 to 23 in 2019. The market share of the top four millet seed companies was consistently high. This was because of the low number of companies producing and marketing millet seed. The market shares of the top four companies marketing bean and sorghum seed fluctuated over the period.

MARKET CONCENTRATION

Competition among seed producers tends to benefit farmers via lower prices, wider choices, increased innovation, and better customer service. To assess the level of industry market





¹⁰ See below Table 13

Figure 3: Trend in market share of top four seed companies



Turning to the HHI scores, the following values were recorded for the four crops in 2019: 1,248 for maize, 1,471 for bean, 3,473 for millet, and 2,290 for sorghum. The millet seed market was the most concentrated (i.e, least competitive), as only five companies were active in the market, with the top four companies accounting for 99.5% of the market share. The concentration of the sorghum market was “moderate”. The maize and bean seed markets recorded low levels of concentration, making these the most competitive markets among the four crops.

Table 13: Market concentration (HHI and CR4)

Crop	HHI (2016)	HHI (2019)	Market share of top four (%)
 Maize	1,425	1,248	56%
 Bean	1,214	1,471	70%
 Millet	5,139	3,473	99.5%
 Sorghum	1,703	2,290	84%

The HHI is a measure of market concentration and is calculated by squaring the market share of each firm competing in a market, and then adding up the results. It ranges from close to zero for perfect competition to 10,000 for monopoly. The scale for HHI scores, ranges from extremely low to extremely high levels of market concentration: less than 1,000 is **extremely low**, 1,000-1,999 is **low**, 2,000-2,999 is **moderate**, 3,000-3,999 is **high**, and greater than 4,000 is **extremely high**, i.e., monopoly or near monopoly.

MARKET SHARE OF GOVERNMENT PARASTATAL

In some countries, public entities are still active players in the marketing and sale of certified seed. Public seed companies play a critical role in supplying varieties that farmers desire, which private seed companies may consider to be less profitable. They also tend to support multiple national objectives, such as university training and research, in addition to seed production. However, such state-owned companies often benefit from preferential treatment, a less stringent enforcement of regulations, access to competitor information, and indirect production subsidies. Collectively, these privileges can result in unfair competition against purely private seed companies.

In Uganda, the Uganda Prisons Service¹¹ is the only government parastatal involved in the production of certified seed. The Uganda Prisons Service Seed Project is registered with the MAAIF as a seed merchant and produced only maize seed in 2019. Maize seed produced by the project accounted for 2% of the overall market; the bulk of which was sold to agro-dealers and farmers, with 40% of sales to each category.

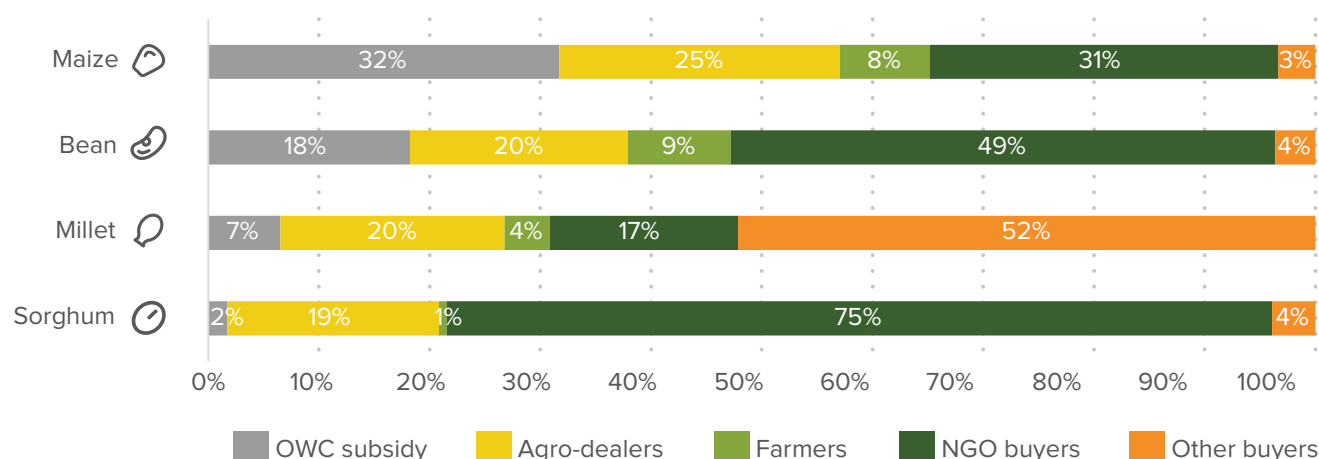
SEED SALES TO DIFFERENT CATEGORIES OF BUYERS

The TASAI study tracked five different categories of seed buyers in 2019: the National Agricultural Advisory Program under the Operational Wealth Creation program (OWC)¹², agro-dealers, NGOs, farmers, and others. NGOs were the main buyers of sorghum seed (75 % of all sales), bean seed (49%) and the second most important buyer of maize seed (31%), as shown in Figure 4. Foreign NGOs which imported sorghum seed into South Sudan are responsible for the high proportion of NGO purchases of sorghum seed. Agro-dealers were also important buyers of seed, accounting for between 19% and 25% of seed sales for all four crops. The NAADS program was the main buyer of maize seed, accounting for 32% of maize seed sales. Most of the millet seed was sold in the open market as millet grain (52%), due to the absence of a market for the seed.

¹¹ The Uganda Prisons Service runs farms which are mandated to train, rehabilitate and reform prisoners by imparting crop production and farming skills. Seed production is a recent addition to the crop production program.

¹² The OWC is a government program aimed at improving incomes of farm households, through a variety of interventions including the distribution of agricultural inputs to farmers.

Figure 4: Seed sales by category of buyers (2019)



SEED IMPORT AND EXPORT PROCESSES

Efficient seed import and export processes extend the seed market beyond national borders. While seed companies benefit from an expanded market, farmers can access a wider range of varieties from across the region.

The length of import process in days is the sum of the number of days needed to obtain import documentation (import permit, phytosanitary certificates and International Orange Certificate¹³, if applicable), and the number of days to clear seed at the border point of entry. It excludes transportation time. In 2019, five seed companies imported a total of 1,111 MT of maize from Kenya and South Africa. Of this, 1,031 MT

came from Kenya, a COMESA country (Table 14). However, only 450 MT of this seed had a COMESA label. This label enables companies to trade in seed that is registered in the COMESA catalogue without having to be subjected to more tests in any of the 21 COMESA Member States. One company imported 20 MT of sorghum seed from Kenya (which did not have a COMESA label). No imports were recorded for bean or millet.

Most of the seed imported into Uganda came from COMESA member countries – 93% of maize and 100% of sorghum. However, only two import transactions, both maize consignments from Kenya, involved the use of the COMESA label.

Table 14: Seed imports

Crop	Number of importing companies in 2019	Main country sources of imports	Main border points of entry	Seed imports (MT)		
				Total	From COMESA countries	From COMESA and w/ COMESA label
Maize	5	Kenya, South Africa	Malaba, Busia	1,111	1,031	450
Bean	0	-	-	0	0	0
Millet	0	-	-	0	-	-
Sorghum	1	Kenya	Malaba	10	10	0

¹³ The International Orange Certificate is issued by a laboratory accredited by the International Seed Testing Association (ISTA) when both sampling from the seed lot and testing of the sample are carried out by the same laboratory.

The length of the export process is calculated as the number of days from the time an export permit is requested to the time when the seed is cleared at the border. In 2019, the volume of seed exports was significantly higher than the volume of seed imports. All exports had COMESA countries as their destination. Nine seed companies exported a total of 5,887 MT of maize seed to South Sudan, Burundi, the DRC and Rwanda (Table 15). Five companies exported a total of 182 MT of bean seed to South Sudan. Seven companies exported 6,401 MT of sorghum seed to South Sudan. No millet seed was exported in 2019.

The data collected by the NSCS comes from the declarations made during the import/export permit application process and may not offer a comprehensive picture of seed trade in the country. Furthermore, the NSCS indicated that exports to some of the countries in the region were not tracked closely for procedural compliance, especially when the countries were in or emerging out of conflict and had no established systems to enable cross-border collaboration between regulators.

In 2019, the length of the export process, reported by seed companies, averaged 11 days, while the import process averaged 17 days. The average import time declined from 48 days in 2013 to 6 days in 2015 and then rose to 17 days in 2019, as shown in Figure 5. The increase in the length of

the import process in 2019 was due to the introduction of a Pre-import Verification of Conformity to standards (PVoC) certificate by the Uganda National Bureau of Standards and the Kenya Bureau of Standards as an additional requirement for seed imports. This requirement affects all seed imports since they are either sourced from Kenya or transit through Kenya to Uganda. Following consultations with relevant ministries in each of the two countries, stakeholders agreed that the new requirement did not have any additional value in terms of quality assurance and was therefore not necessary. It was not only time-consuming but was also an additional financial burden. While this requirement has not been withdrawn in Uganda, it was waived in Kenya in April 2020. The changes in the seed export process and dissatisfaction with the PVoC requirement are reflected by changes in seed companies' satisfaction ratings, which jumped from "fair" to "good" in 2015 and 2017, only to drop to "poor" in 2019.

Seed exporters also complained about the unpredictability of the export requirements. For example, the MAAIF sometimes requested an International Orange Certificate, even when the importing country did not require one. Some seed exporters to South Sudan reported that for some transactions, they were required to physically report to South Sudan in order to access an import permit. On other occasions, the seed exports were taxed, even though a tax-free regime should have prevailed.

Table 15: Seed exports





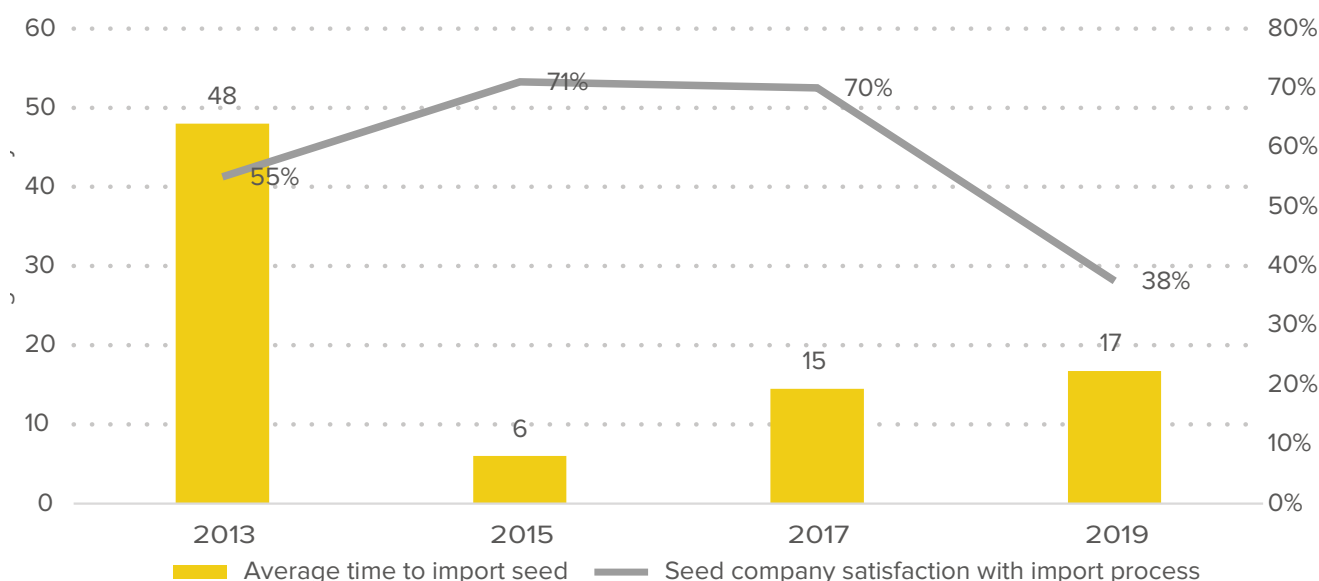
Crop	Number of exporting companies in 2019	Main country destinations of exports	Main border points of exit	Total volume of exports (MT) (all to COMESA countries)	Exports as % of total sales
 Maize	9	South Sudan, Burundi, DRC, Rwanda	Nimule, Elegu, Gisenyi, Mpondwe, Karombo -Bunagana, Katuna	5,888	32%
 Bean	5	South Sudan	Nimule	182	5%
 Millet	0				
 Sorghum	7	South Sudan	Nimule	6,402	78%



Figure 5: Trend in the average length of import processes and seed company satisfaction (2013-2019)



SEED POLICY AND REGULATIONS

LENGTH OF VARIETY RELEASE PROCESS

Plant variety release is the process by which new varieties undergo various tests for yield, Value for Cultivation and Use (VCU), and Distinctness, Uniformity, and Stability (DUS). Varieties that perform satisfactorily in these tests are approved for release by the National Variety Release Committee (NVRC). A vibrant seed sector has a functional variety release system that is well understood by the relevant actors and is followed diligently. Lengthy and/or costly variety release processes can limit the number of released varieties, which can adversely affect farmer choice. The length of the variety release process is calculated from the date the variety is submitted to the variety release committee to the date when the variety is approved for release. The calculation does not include the time the breeder spends developing the variety.

In Uganda, the variety owner/breeder is required to submit an application to the National Seed Board, including data provided on the variety's performance based on advance yield trials and a sample of the seed. The NSCS is responsible for conducting the VCU and DUS tests. However, since the NSCS does not have the capacity to do this, NARO conducts these tests on behalf of the NSCS.

For a new variety that has not been tested elsewhere, VCU tests are run for two seasons and the DUS test is run for one season. It is worth noting that during the evaluations, the DUS/VCU officer is accompanied by at least one breeder, a pathologist and a USTA executive member. The test data is then compiled in a technical report that the NSCS submits to the NVRC for consideration for variety release. The NVRC meets twice a year to deliberate on applications for release.

Approved varieties are published in the official gazette, after which they can be multiplied and marketed as seed in Uganda. The owner/breeder of the variety then applies to have the variety registered in the national variety list and common catalogue and pays the applicable registration fee of UGX 100,000 (US\$ 28). However, the publishing of approved varieties in the official gazette, the updating of the common catalogue and its publication for wider accessibility are infrequent. This means that seed companies and farmers may not be aware of the newly-released varieties.





On average, the length of the variety release process ranged from 18 to 33 months. However, private sector breeders (seed companies) reported far longer variety release periods than public sector breeders (Table 16). Public sector breeders reported the average length of the variety release process as 7 months for maize, 9 months for bean and 24 months for both sorghum and millet. Private sector breeders reported the average length of the process as 24 months for bean,

28 months for maize and 39 months for sorghum. No private sector breeders worked with millet. Private breeders are required to complete a season of advance yield trials prior to VCU and DUS testing, as a result of which testing runs over multiple seasons. Public breeders are exempt from advance yield trials, which enables them to submit test results after only one season.

Table 16 shows that private companies were less satisfied with the variety release process than public sector breeders.

The private breeders considered the variety release process for maize to be “good” (60%), while the variety release process for bean and sorghum were considered “poor” (30%) and “very poor” (20%), respectively. Public breeders considered the variety release process to be good (70%) for bean and maize and fair (50%) for sorghum and millet. In 2017, seed companies’ overall rating of the variety release process was “good” (75%), which was notably higher than the rating in 2019.

Table 16: Average length of variety release and seed companies’ satisfaction ratings





Crop	Average length of variety release (in months)			Satisfaction ratings (out of 100)		
	Public breeders	Seed companies	Overall	Public breeders	Seed companies	Overall
 Maize	7	28	18	70%	60%	64%
 Bean	9	24	19	70%	30%	50%
 Millet	24	-	24	50%	-	50%
 Sorghum	24	39	33	50%	20%	35%
Average	12	29	20	64%	48%	57%

COST OF VARIETY RELEASE PROCESS

In well-functioning seed systems, the costs of releasing a variety should not be so high as to disincentivize variety releases altogether. The official VCU test costs UGX 800,000 (US\$ 222), while the DUS test costs UGX 350,000 (US\$ 98), based on the current seed regulations (GoU, 2017). However, in practice, the costs are higher. They are set following negotiations between the applicant and the responsible entities at NARO. For instance, the private sector reported an average cost of US\$ 3,732 for DUS tests for maize, US\$ 10,000 for bean, and US\$ 1,111 for sorghum, compared to the published cost of roughly US\$ 100, as shown in Table 17.

For public breeders, the study only obtained VCU costs for maize. Although the costs should not vary by crop, the costs of releasing a maize variety are relatively lower than for other crops for both the private and public sector. This may be due to greater economies of scale since more applications are made for the release of maize varieties than for any other crop. The breeders also opined that charges by the maize program are fairer than those for other breeding programs. It is worth noting, however, that private sector estimates should be viewed with caution, since there were just a few releases by the private sector between 2017-19. In addition, in one of the four cases, a seed company was not willing to disclose the costs incurred.

Table 17: Costs of variety release

Crop	Average costs incurred by seed companies (in US\$)				Average costs incurred by public breeders (in US\$)			
	DUS	VCU	Other	Total	DUS	VCU	Other	Total
 Maize (n=4)	3,732	1,233	157	5,122	323	683	1,029	1,607
 Bean (n=1)	10,000	10,000	- ¹⁴	20,000	3,500	-	2,000	5,500
 Millet (n=1)	-	-	-	-	5,000	-	-	5,000
 Sorghum (n=1)	1,111	19,667	3,453	24,231	5,000	-	-	5,000

STATUS AND IMPLEMENTATION OF NATIONAL SEED POLICY FRAMEWORK

Well-functioning formal seed sectors have effective coordinating institutions that work well together, following rules and procedures stipulated in clearly defined and regularly updated legal instruments. The National Seed Policy was approved in 2018 (The Republic of Uganda, 2018). Its implementation is guided by the National Seed Strategy (MAAIF, 2018) and the Seeds and Plants Act (The Republic of Uganda, 2007). However, the national seed regulations are yet to be fully harmonized with the COMESA Seed Trade Harmonization Regulations (COMESA, 2014). The other gap is the lack of regulations for the Plant Variety Protection Act, 2014 (The Republic of Uganda, 2014).

The Directorate of Crop Resources is responsible for the implementation of the National Seed Policy. According to the Seeds and Plant Act of 2006, the implementation of the national seed law and regulations is the responsibility of the NSCS. The National Seed Board, which oversees the implementation of the regulations, was inaugurated in November 2019. However, by the end of 2020, it had held only one meeting due to the limitations posed by the COVID-19 pandemic. The NVRC comprises 12 specialists representing fields relevant to variety evaluation, registration and release, and meets twice a year.

Uganda has a National Variety Catalogue which is updated internally each time the NVRC approves the release of a new variety and the Board authorizes its listing. However, the Catalogue is not updated frequently, and is not publicly available either online or in hard copy. At the time of the study, the NSCS indicated that all the catalogues needed to be approved by the Solicitor General before they could be sent to the government printer.

The Uganda National Seed Policy of 2018 provides for the transformation of the NSCS into the Uganda Plant Health and Inspectorate Agency (UPHIA). This semi-autonomous agency is expected to improve efficiency of service delivery and will be responsible for all phytosanitary services, seed regulatory services, and agricultural and plant-related chemical regulatory services.

QUALITY AND ENFORCEMENT OF SEED REGULATIONS

Seed regulations give structure to the formal seed sector. The TASAI study assesses stakeholder perspectives on various aspects of seed regulations, including whether they are supportive to the growth of the seed sector, the role stakeholders play in their design and implementation, stakeholders' awareness of the laws and regulations, the presence of an enforcement agency, the costs of regulation, and the effectiveness of punitive measures.

¹⁴ Empty cells indicated that respondents did not provide a cost estimate on the particular type of cost.

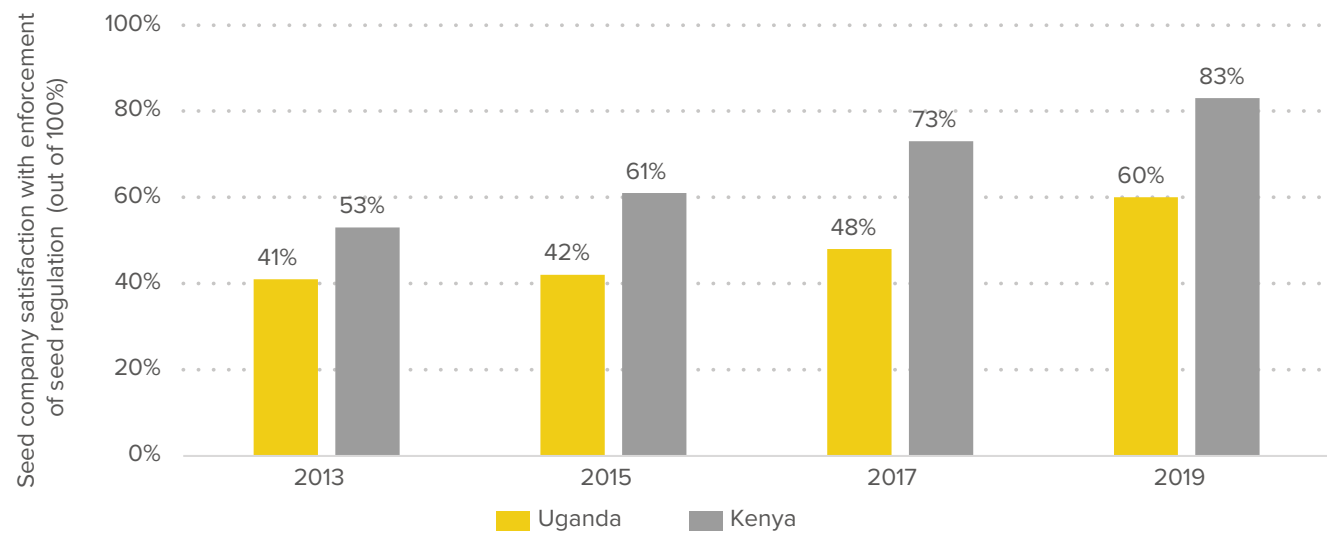


Implementation of COMESA Seed Trade Harmonization Regulations: The COMESA Regulations touch on three elements: the variety release system, the seed certification system, and phytosanitary measures. The COMESA Regulations provide guidelines for the registration of varieties in the COMESA Variety Catalogue for: new varieties that have not been registered and released in any COMESA country; a variety that was registered and released in one COMESA country prior to the launch of the COMESA Variety Catalogue in 2015; and varieties that were registered and released in at least two COMESA countries prior to launch of the COMESA Variety Catalogue in 2015. The Uganda Seed and Plant Regulations of 2017 (MAAIF, 2017) are not fully harmonized with the COMESA regulations. However, the COMESA regulations are currently being applied. Between 2017 and 2019, 9 maize

The Uganda Plant Protection and Health Regulations (MAAIF, 2020) require a plant import/export permit, a phytosanitary certificate for exports, and a re-export phytosanitary certificate for re-exports. Prior to issuing import permits, phytosanitary inspectors conduct pest risk analysis and may recommend testing or treatment of a consignment under their supervision.

Status of East African Community (EAC) Seed Bill and regulations: The EAC Harmonized Seed and Plant Variety Bill was developed and referred to the Sectoral Council of Legal and Judicial Affairs by the 38th Council of Ministers in May 2019. The Bill is currently awaiting consideration by the Council of Ministers, which will then transmit it to the East

Figure 6: Seed company satisfaction with enforcement of seed regulations



varieties (out of 15 varieties released that year) were released through the COMESA variety release system.

Uganda's seed certification system is closely aligned with the COMESA seed certification system with regards to the field and laboratory certification standards, seed labelling, the issuing of certificates, and seed classification.

Uganda's sanitary and phytosanitary measures for seed are guided by the Plant Protection and Health Act of 2015 (The Republic of Uganda, 2015). Uganda's quarantine pest list has not been harmonized with the corresponding COMESA list.

The COMESA Seed Trade Harmonization Regulations require three types of documentation to accompany imports and exports of seed within and from the region: a seed testing certificate, a plant import/export permit, a phytosanitary certificate for exports, and a re-export phytosanitary certificate for re-exports. When the conditions prescribed in these documents are not met, importing countries may issue a non-compliance notification.

African Legislative Assembly (EALA). However, civil society organizations have petitioned the EALA to reexamine the bill to ensure that farmers' rights have been incorporated adequately.

Seed companies' satisfaction with government enforcement of seed regulations was "good" (60%). Most seed companies felt that while the seed regulatory framework was very clear, its implementation was not robust enough because its enforcement did not provide adequate checks and balances. Figure 6 shows the seed companies' satisfaction with the enforcement of seed regulations in Kenya and Uganda from 2013 to 2019. The satisfaction for Ugandan seed companies has slightly increased over the four years. In comparison, Kenyan seed companies' satisfaction has increased considerably over the same period. The main difference between the two countries is that over this period, the Kenyan government has passed two important regulations for the seed industry. More importantly, the Kenyan government has implemented these regulations through actions like enforcing seed standards, introducing authorized seed inspectors and strictly enforcing measures to curb the spread of counterfeit seed.

EFFORTS TO ERADICATE COUNTERFEIT SEED

Counterfeit seed (also known as fake seed) threatens the seed sector in two important ways. First, it reduces farmers' confidence in certified seed due to cases in which farmers unknowingly plant inferior quality grain labeled as certified seed. Second, it threatens the success of efforts to increase the adoption of improved varieties because farmers are not sure of which seed is genuine. TASAI tracks the number of cases of counterfeit seed reported by seed companies and the government in the data collection year. In addition, seed companies report their level of satisfaction with government efforts to eliminate counterfeit seed.

Seed companies interviewed by TASAI for the 2019 study reported 48 cases of counterfeit seed. This stands in sharp contrast to the official number of 3 cases. According to the NSCS, the official count includes only cases reported directly to the government. The formal process requires that a written complaint be submitted to the Permanent Secretary of the MAAIF, who forwards it to the Director of Crop Resources, who in turn hands it over to the Commissioner of the Department of Crop Inspection and Certification, who then hands it over to the Assistant Commissioner/Head of NSCS for investigation. The lengthy procedure required to report cases is likely to be a disincentive for reporting minor cases. The three official cases of counterfeit seed were all related to seed supplied to the government's NAADS program. The chief administrative officers in the affected districts made formal written complaints to the MAAIF.

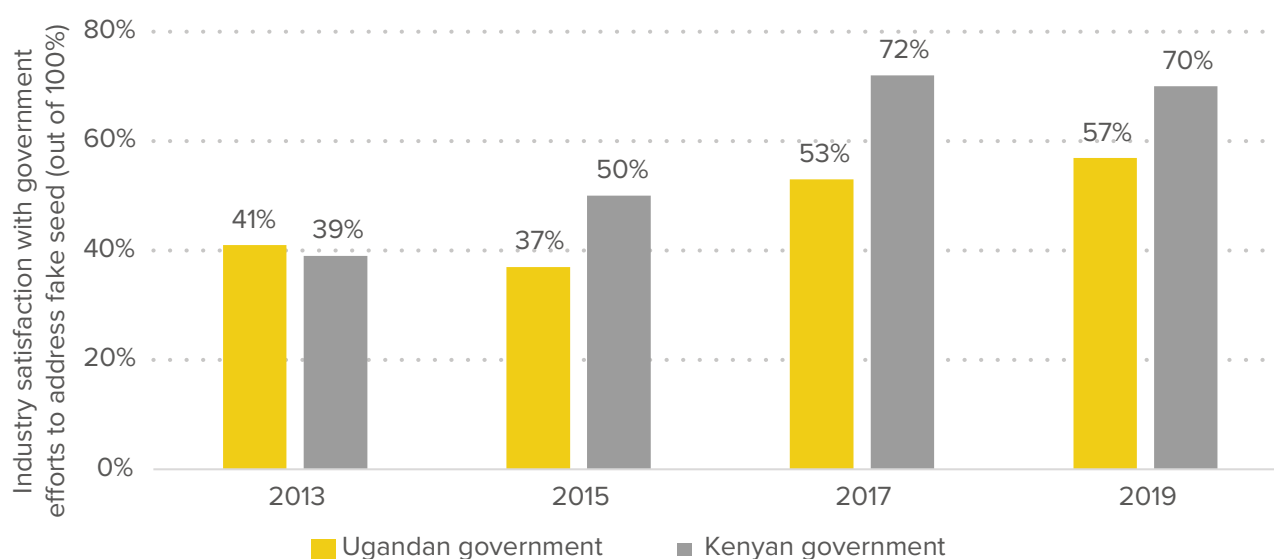
Between 2013 and 2019, seed companies' satisfaction with government efforts to address the challenge of counterfeit seed in Uganda has been consistently rated "fair", as shown in Figure 7. The low ratings are partly due to the NSCS not having adequate staff and logistical capacity to comprehensively address the problem of counterfeit

seed. According to the NSCS, there is limited data on the key sources of counterfeit seed to inform priority response actions. Seed companies indicated that the main sources of fake seed were agro-dealers, and fellow seed companies which package grain as seed. Finally, NGOs, in particular the FAO, were blamed for not providing suppliers with sufficient lead time to multiply high-quality seed for relief efforts. This opened loopholes from procurement through to distribution that unscrupulous dealers took advantage of.

In contrast, seed companies' satisfaction in Kenya significantly increased between 2013 and 2017 and has maintained a high level, given that the two countries had the same rating in 2013. The positive change is mainly attributed to two government interventions: first, the strengthening of seed inspection services through the introduction of authorized seed inspectors in 2017, and second, the introduction of seed security labels, also in 2017, which are affixed to certified seed packets

The government and the private sector have both instituted multiple measures to address fake seed. The MAAIF has set up a clear legal framework for the seed industry, and has worked to raise farmers' awareness of seed quality issues by publishing and distributing easy-to-read versions of seed regulatory documents. The MAAIF's agricultural police undertake routine checks and impound counterfeit seed. In addition, talks are underway with the Directorate of Public Prosecution to strengthen the MAAIF agricultural police's capacity to prosecute offenders. Furthermore, the government, working through the NSCS, is upgrading to an electronic seed inspectorate management system that will handle traceability and tracking and enable digitization of the tamper-proof seed labels. The initiative, called the Seed Tracking and Traceability System (STTS), has been deployed in the second season (season B) of 2021, which started in September. The private sector, through USTA, is a partner in the electronic management system initiative.

Figure 7: Rating of government measures to address counterfeit seed



USE OF GOVERNMENT SUBSIDIES

Seed subsidies are often intended as a short or medium-term measure to encourage farmers to adopt improved crop varieties. The design and execution of subsidy programs, in terms of the scale, targeting, distribution arrangements, and payment systems, may contribute to the development of the seed market in positive ways, but may also be disruptive to market forces.

Uganda's farm input subsidy program, Operation Wealth Creation (OWC ¹⁵), started as a pilot in the 2014/15 financial year and was rolled out across the country in 2015/16. In 2019, the program distributed a total of 3,315 MT of maize seed to 663,073 maize-growing households, and 294 MT of bean seed to 24,470 farming households.¹⁶ The OWC is managed by the National Agricultural Advisory Services (NAADS). OWC interventions on seed target selected major food security crops, notably maize and bean, and to some extent sorghum for the Karamoja and Teso sub-regions. The interventions also target all categories of farming households, though inclusion is limited by the quantity of seed available.

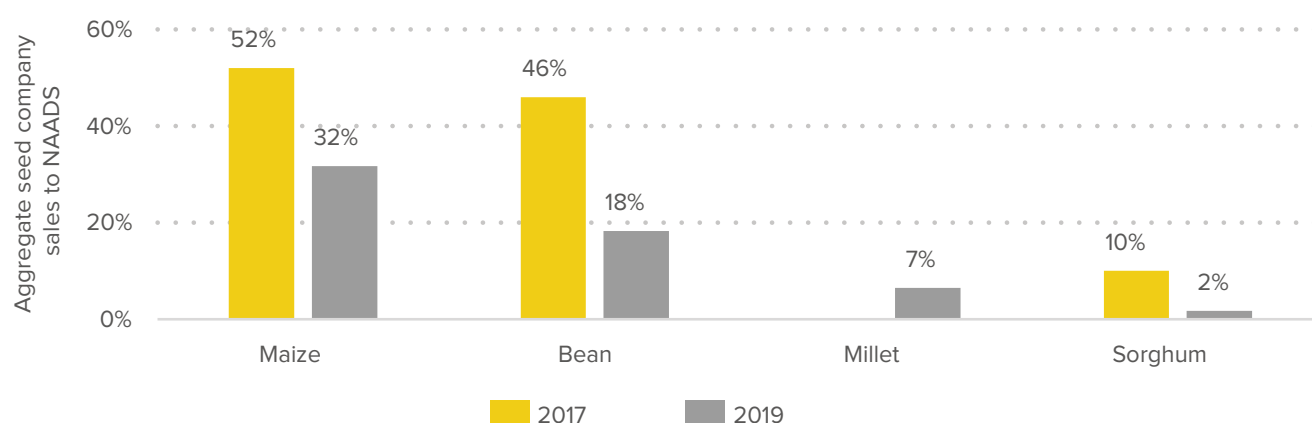
Priority crops are selected in consultation with the District Local Governments (DLGs), which submit suggestions for crop selections based on farmers' priorities with regard to household food or income security. The NAADS secretariat makes the final crop selections based on the strategic benefit to the country's food security, i.e., they give preference to crops that are used widely in the country.

Seed dealers are invited to submit supply bids using an open and competitive process following the Public Procurement and Disposal of Public Assets Authority (PPDA) regulations/principles (MOFP, 2014). Eligibility to compete is guided by compliance with clearly defined administrative, commercial, technical and financial procurement criteria. To be eligible for participation, a company must be registered and licensed to trade in seed by the MAAIF's Department of Crops Inspection and Certification. The process also requires an assessment of the technical specifications governing seed quality.

Contracted suppliers deliver the seed to relevant DLGs for administrative and technical clearance. Seed is distributed to the target beneficiary farmers in the parishes within earmarked sub-counties. The distribution is carried out by OWC officers with the help of government technicians, who assess quality, and politicians, who provide oversight. The NAADS has a framework for monitoring and evaluating food security interventions under the OWC.

Figure 8 shows the aggregate seed company sales to the NAADS input subsidy program in 2017 and 2019. On aggregate, seed company sales have declined from 2017 to 2019 for three crops – maize, bean and sorghum. Millet was not one of the crops under OWC input program in 2017 but is included in 2019. The reason for the decline is seed company dissatisfaction with some aspects of the program's implementation, which are explained below.

Figure 8: Aggregate seed company sales to NAADS



¹⁵ The OWC program aims to raise household incomes and contribute to wealth creation by transforming subsistence farmers into commercial farmers <http://owc.go.ug/background.php>

¹⁶ The total number of target households is based on the volume of seed required for half an acre per household. For maize, this is equivalent to 5 kg. In 2019, the price at which companies bid to supply bean was significantly lower (by the time the companies supplied seed) than the market price because of drought-induced scarcity. Consequently, the bean seed that was procured was inadequate and was given to Members of Parliament to distribute to their constituents. Sorghum is usually supplied to the Karamoja region and some districts of Northern Uganda, but delayed communication of district needs led to a reallocation of resources. Millet seed was not included among the 2019 priority crops for distribution.



Seed companies expressed a low opinion of the implementation of NAADS, as shown in Table 18. Seed companies' ratings on openness and transparency and predictability of the procurement process were "very poor", at 23% and 24%, respectively. The efficiency of payments was rated "poor" (35%). Companies felt that there was no guarantee that the bidder with the best service/product would get the contract. In addition, seed companies complained that they did not receive sufficient

advance notice and information about the procurement program to inform their production plans. Furthermore, seed companies reported that the NAADS payment process did not guarantee 100% on-time payments. Importantly, seed companies' satisfaction with the implementation of the NAADS program has decreased since 2017, pointing to growing problems with the program's implementation.

Table 18: Seed companies' satisfaction ratings of the government subsidy program

Opinion indicator (satisfaction rating)	Rating (out of 100%)	
	2017	2019
Openness and transparency of the seed procurement process	59%	35%
Predictability of the seed procurement process	36%	23%
Efficiency of payment process	48%	24%

INSTITUTIONAL SUPPORT

QUALITY OF THE NATIONAL SEED TRADE ASSOCIATION

Well-functioning national seed trade associations play a key role in representing the interests of the industry and engaging with the government. The membership of the national seed associations includes seed companies and some agro-dealers.

The Uganda Seed Trade Association (USTA) is a member-based association for seed merchants in Uganda. USTA was incorporated on 16th August 1999, with a vision of "enhancing the availability of quality assured seed through building, coordinating, and spearheading the development of the seed industry in Uganda." The association has ordinary and associate members. Ordinary members are seed companies involved in the production/processing and/or marketing of seed of a wide range of crops. Some members also sell agro-inputs and farm equipment. Associate members are mainly agro-input dealers and seed service providers such as those involved in seed testing or laboratory analysis.

USTA is a member of the Africa Seed Trade Association (AFSTA) and the International Seed Federation (ISF). In 2019, USTA's membership comprised 33 of the 44 registered active seed companies in Uganda and 3 associate members (not involved in seed production but offering seed services such as laboratory testing and agro inputs/seed distribution). Out of the 24 seed companies that participated in the TASAI survey, 21 were ordinary USTA members.

USTA is governed by a seven-member executive committee that comprises: a chairperson, vice-chairperson, general secretary, treasurer and three committee members. They serve three-year terms and are voted into office during the annual general meeting. Currently, two positions of the Executive Committee are held by women: the treasurer and one committee member. The low participation of women in the current executive is largely structural, emanating from the overall low participation of women as managers/owners of seed companies. The USTA secretariat has two employees, an executive secretary (male) and an accountant (female). The major challenges that the secretariat faced in 2019 were slow responses by members when the secretariat requested information, delays in members' payments of membership dues, and insufficient staffing.

Figure 9: Seed companies' satisfaction with USTA

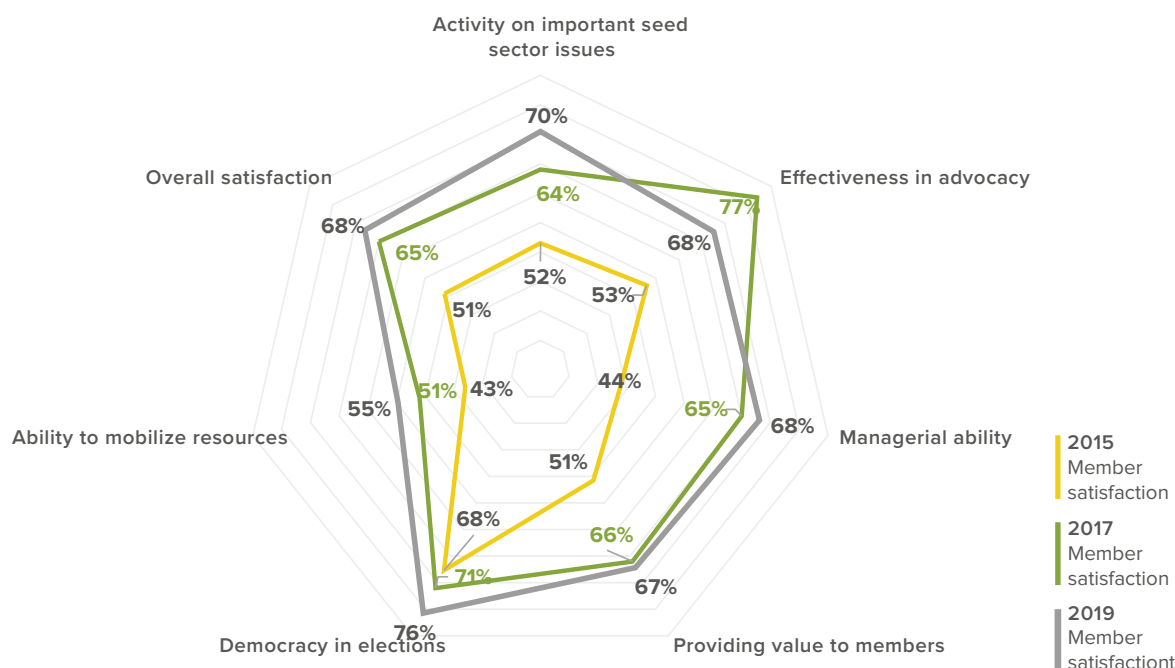


Figure 10 shows the performance rating of USTA by its members across seven dimensions in 2015, 2017, and 2019. Members' overall rating of USTA was "good" (68%). Members rated "democracy in elections" highest at 76% ("good") and USTA's "ability to mobilize resources" lowest at 55% ("fair").

Looking at the 2015-2019 period, members' overall satisfaction with USTA has been steadily increasing from "fair" at 51% in 2015 to "good" at 68% in 2019. For all the areas of service delivery, with the exception of "effectiveness in advocacy", there has been a steady rise in the rating over the 2015, 2017 and 2019 TASAI studies. This increase is a clear evidence that the organization is steadily growing stronger and becoming more effective in most of its tasks.

The TASAI study asked USTA members to identify priority issues the seed trade association should focus on. The following were identified as key priorities:

- **Advocacy in support of the seed industry:** USTA should play a leading role in lobbying the government to ensure that there is a level playing field in the seed sector. The general issues of concern include the need to fully enforce the seed laws, rules and regulations, fully implement the COMESA harmonized seed regulations and review tax policies. Some of the specific issues include.
 - The local seed businesses (LSBs) that produce QDS do not pay taxes. Further, the QDS is sold beyond the borders of local communities with no restrictions, in contravention to the National Seed Policy (2018) and the draft Seeds and Plant (QDS) regulations of 2019 (MAAIF, 2019).
 - Seed companies compete on unfavorable terms with government entities. For example, Uganda Prisons produces, processes and sells seed using public

resources and does not pay taxes. Seed companies feel that they should also benefit from tax exemptions.

- USTA should lobby for seed companies to be part of the technical team that defines the scope and processes for the disbursement of financing for the agricultural sector.
- **Provide forecasts for seed demand:** USTA is expected to offer services that directly benefit members such as support in capacity building, member sensitization on seed industry issues, and market information on seed demand forecasts to guide the industry on how much to produce. The other services are to lobby for transparency in public seed procurement, and to ensure the participation of seed companies in the variety release process.
- **Increase scope for seed marketing:** USTA members expect the association to undertake activities aimed at promoting their businesses through exhibitions, marketing USTA members' varieties/products and increasing the visibility of members through adverts in print and social media.
- **Develop a system for self-regulation:** To improve the quality of seed it offers on the market, USTA should spearhead the development of an internal quality assurance system. This will be a self-regulatory system, where USTA would be expected to cross-check seed quality, for example through random audits. Through this process, USTA should be able to take samples of seed and send them to an independent laboratory for testing. Further, USTA should work with the NSCS to revive the training of seed companies' staff as seed inspectors.
- **Enforce USTA's code of conduct:** To strengthen the association, members stressed the need for the registration of new USTA members, the enforcement of adherence to the code of conduct, and the enhancement of members' managerial ability.



ADEQUACY OF SEED INSPECTORS

Seed inspection services ensure that certified commercial seed meets regulatory quality standards. Providing adequate inspection services requires sufficient numbers of well-resourced inspectors. TASAI studies track the number of inspectors and other information pertinent to their effectiveness, such as the availability of resources and the use of (new) digital tools. In Uganda, seed inspection is the mandate of the NSCS.

In 2019, the NSCS had 19 seed inspectors (15 men and 4 women). However, five of these had been deployed to conduct phytosanitary inspections at the airport and were not available for field and laboratory certification services, effectively reducing the number of inspectors to 14. Although this number is more than double the number recorded in 2017, both the NSCS and the Phytosanitary and Quarantine Inspection Services Division agreed that 14 inspectors are still insufficient to meet Uganda's current needs. Yet another gap is that the inspection capacity is further limited by a lack of adequate financial resources, equipment and infrastructure needed to effectively deploy inspectors to the field, provide technical training, and to equip the border posts with the necessary quarantine facilities. A promising development is that in 2021, an additional 24 seed inspectors were available by MAAIF and deployed for field inspections. This was an increase from the 14 seed inspectors in 2019. An additional 80 inspectors are employed at the border points as phytosanitary inspectors, by the Phytosanitary and Quarantine Inspection Services Division (PQISD). NSCS acknowledges that the number of seed inspectors is still insufficient to meet Uganda's current needs.

Yet another gap is that the inspection capacity is further limited by a lack of adequate financial resources, equipment and infrastructure needed to effectively deploy inspectors to the field, provide technical training, and to equip the border posts with the necessary quarantine facilities.

To address the challenge of a low number of seed inspectors, NSCS has trained and accredited 100 agricultural extension

officers, from the major seed-producing districts. These officers were appointed through their respective Local Government Authorities and assist the NSCS seed inspectors to conduct field inspections. In addition, NSCS is in the process of recruiting more seed inspectors in 2021. According to the Senior Agricultural Inspector heading the NSCS, once these new recruits are deployed, the number of seed inspectors, coupled with adequate facilities and resources, is expected to be sufficient.

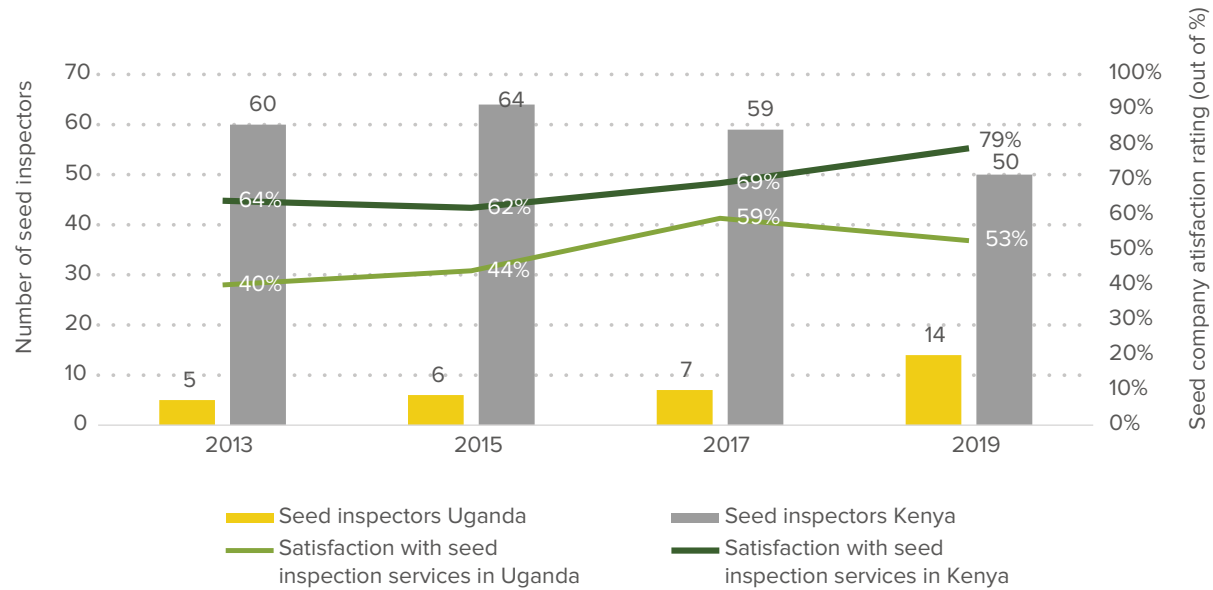
While the number of inspectors in Uganda has grown between 2013 and 2021, it is still low. This means that, overall, seed inspection services are inadequate, which is reflected in the "fair" satisfaction ratings reported by companies during this period ranging from 40 in 2013 to 59% in 2017, dropping to 53% in 2019 (Figure 12). In contrast, Uganda's next-door neighbor Kenya¹⁷ has reported consistently higher levels of satisfaction with seed inspection services over the same period. In fact, a 10-point increase was recorded between 2017 and 2019, which is partly attributed to the fact that Kenya introduced private seed inspection in 2017. This change has resulted in a more efficient process for seed companies, even though the overall number of inspectors had actually decreased.

The main complaint from the seed companies in Uganda is that due to financial and logistical constraints (for example, a lack of vehicles), inspectors are not able to carry out mandatory inspections in the crop fields and at the retail and distribution levels. As a result, not all the fields declared in the planting returns are inspected. The initiative of authorizing private-sector participation as a way of closing the capacity gap in Uganda's public seed inspection services collapsed in 2018 (Mabaya et al., 2019). A recent initiative by the NSCS, with support from AGRA, is setting up a system for the training and accreditation of para-inspectors to complement the work of the government seed inspectors. Such an approach has been successfully applied in Malawi in 2016 (Mabaya et al., 2021)

17 The comparison here are absolute and do not take into account the differences in the sizes of the seed sectors in the two countries.



Figure 12: Trend in number of, and satisfaction with seed inspectors in Uganda and Kenya



SERVICE TO SMALLHOLDER FARMERS

ADEQUACY OF EXTENSION SERVICES

Well-functioning agricultural extension services are critical to the successful adoption of improved seed by smallholder farmers. TASAI tracks the average number of agricultural households served by one extension officer. The lower this ratio, the better access farmers have to expert information and advice on how to access and use improved seed and other relevant agricultural technologies. This indicator tracks the number of extension officers by sector (public and private) and gender; it is not crop-specific.

Agricultural extension in Uganda is subject to the MAAIF Directorate of Agricultural Extension. With an estimated 7,413,883 farming households (UBOS, 2020), the 4,110 government agricultural extension workers (3,469 men and 641 women) translate to a ratio of one agricultural extension officer to more than 1,800 farming households in 2019 (Table 19). In 2019, the MAAIF published guidelines for the registration and accreditation of all agricultural extension agents in the country. The aim of this process is to establish a high-quality, well-coordinated and harmonized pluralistic agricultural extension delivery system (MAAIF, n.d.). The guidelines target all extension officers, including public, private and NGO-based extension officers. The MAAIF is currently raising awareness of the guidelines while concurrently registering extension officers. This effort is still in its infancy.

Seed companies reported that they were not satisfied with the adequacy of government agricultural extension services which they rated as “fair” (47%). Seed companies have consistently rated their satisfaction as “fair” at 49% in 2013 (TASAI, 2015), 45% in 2015 (Mabaya et al., 2016) and 59% in 2017 (Mabaya et al., 2019). The low rating given by seed companies reflects the inability of extension officers to perform their duties due to inadequate resources such as transportation.

In 2019, seed companies reported that they were dissatisfied with government agricultural extension services. This was because access to extension services was limited and unpredictable due to the low number of officers. Furthermore, not all extension officers are knowledgeable enough on the different crop varieties to adequately advise farmers. To close these gaps in public extension services, most seed companies employ their own extension officers. In 2019, 21 of the 24 seed companies (88%) employed extension officers and 19 of these companies (79%) employed at least one woman as an extension worker. In total, seed companies employed 162 extension workers (Table 19) of whom 108 were men (67%) and 54 are women (33%).

Despite the low rating given by seed companies, there are several positive improvements in the Directorate of Agricultural Extension that have the potential to improve the provision of extension services country-wide. The MAAIF is implementing a mechanism where field extension officers will assess pre-season demand for agricultural inputs, including improved seed. This mechanism will be part of the

Agriculture Cluster Development Program (ACDP). Under the program, the extension officers first assess farmer demand for improved inputs and then link those farmers to agro-dealers who have been trained and accredited to provide

inputs to farmers through an e-voucher system.¹⁸ In addition, the MAAIF has procured 120 vehicles and 1,100 motorcycles to be used by extension officers

Table 19: Number and rating of agricultural extension services

Indicator	2019
Number of public extension officers	4,110 (3469 men and 641 women)
Number of private extension officers employed by seed companies	162 (108 men and 54 women)
Total public and private extension workers	4,272
Ratio of public extension officers to agricultural households	1:1,800
Satisfaction with government extension services (out of 100%)	47%

CONCENTRATION OF THE AGRO-DEALER NETWORK

Agro-dealers play a key role in Africa's seed distribution systems, connecting seed companies to individual farmers, especially in hard-to-reach rural areas. They are often the main point of sale for certified seed. A higher concentration of agro-dealers means that smallholder farmers have greater access to improved seed. This indicator tracks the number of agro-dealers and, where possible, this is disaggregated between registered and non-registered agro-dealers.

In 2019, 725 agro-dealers were registered by the MAAIF (Table 20). With 7,413,883 agricultural households in Uganda, this translates into a very low ratio of one registered agro-dealer to more than 10,000 households. The number of agro-dealers in 2017 was 2,500. At the time, the MAAIF did not have formal processes for registering and monitoring agro-dealers, so this number is a government estimate. By 2019, the MAAIF had instituted a system to register all agro-dealers (the process is outlined below). Both MAAIF and seed companies recognize that most of the agro-dealers who are

operational and working with the seed companies, are not yet formally registered.

To register with the MAAIF, agro-dealers apply to the Agricultural Chemical Control Board following the guidelines in the Seed and Plant Regulations of 2017. The applicants are assessed on their knowledge of agro-inputs. If their qualifications are not sufficient, they undergo tailored training, currently conducted by Makerere University. Seed storage facilities at the proposed premises are also assessed on appropriateness. A major challenge cited by the NSCS is that many agro-dealers do not have the facilities needed to maintain seed quality.

Of the 24 seed companies surveyed, 23 engaged agro-dealers. On average, each seed company worked with 141 agro-dealers, with the number per company ranging between 2 and 500. Seed companies indicated that they limited the number of agro-dealers they dealt with as a strategy to reduce counterfeit seed, since smaller numbers of agro-dealers are easier to monitor and track. Twenty-one seed companies reported offering training to agro-dealers, while 15 offered agro-dealer training that promotes better services to women farmers. Seed companies rated their satisfaction with the agro-dealer network as "fair" (56%).

Table 20: Number and rating of agro-dealer network

Indicator	2017	2019
Number of registered agro-dealers	2,500	725
Seed company satisfaction with agro-dealer networks	61%	56%
Interpretation of satisfaction	Good	Fair

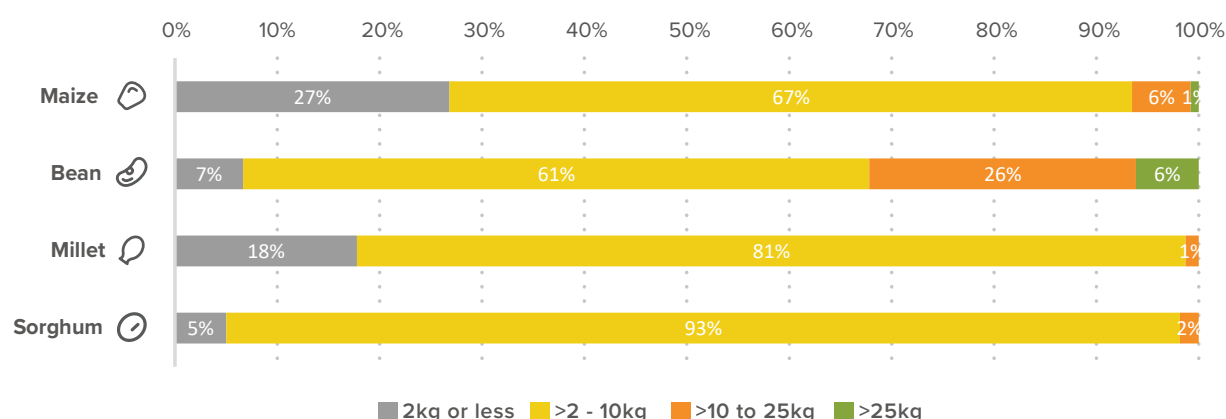
¹⁸ <https://agriculture.go.ug/launch-of-the-e-voucher-system-of-the-agriculture-cluster-development-project/>

AVAILABILITY OF SEED IN SMALL PACKAGES

Because most farmers in Sub-Saharan Africa operate on a small scale, making seed available in small, more affordable packages is a good way to increase adoption rates of certified seed. TASAI tracks the percentage of seed sold in different package sizes, i.e., 2 kg or less, 2-10 kg, 10-25 kg, and above 25 kg.

As indicated in Figure 11, in 2019, much of the seed was sold in package sizes ranging from 2-10 kg: 93% of sorghum seed, 81% of millet seed, 67% of maize seed, and 61% of bean seed. To an extent, the package size was determined by buyers. For example, according to the NAADS guidelines for the OWC program, farmers are supposed to receive a minimum of 5 kg of maize seed per household, suitable for half an acre of grain production. The NAADS accounted for 32% of maize seed sales in 2019. In addition, for sorghum, package size is determined by the specifications given by institutional buyers such as NGOs (relief agencies) in the export market. In 2019, 75% of sorghum seed was sold to NGOs.

Figure 13: Percentage of seed sold in different package sizes (2019)



SEED-TO-GRAIN PRICE RATIO

The seed-to-grain price ratio at the time of planting is a good measure of the affordability of improved seed. This data point is important as many smallholder farmers end up making a choice between purchasing seed from the formal sector or planting grain. The greater the price difference between the two, the less likely it is that resource-poor farmers will purchase certified seed. This indicator tracks the ratio of the retail price of seed (at the agro-dealer level) vis-à-vis the market price of grain at the time of planting.

Table 21 lists the seed-to-grain price ratios at planting time as follows: 4.3:1 for hybrid maize, 3.7:1 for sorghum, 2.4:1 for millet, 2.0:1 for maize OPV and 1.7:1 for bean. Note, however, that the retail prices for seed are based on subsidized prices under the NAADS program. The ratios indicate that the price of bean seed is relatively low and close to the price of grain. The prices of OPV maize, millet, sorghum, and hybrid maize seed are two to four times the price of grain. The ratio for hybrid maize is higher than that of OPV, because of the high costs associated with the production and processing of hybrid maize varieties.

Compared to the 2017 study, the seed-to-grain price ratio has declined for hybrid and OPV maize and increased for sorghum, bean and millet.

Table 21: Seed-to-grain price ratios

Crop	Prices in 2019 (US\$/kg)		Seed-to-grain price ratio	
	Average retail seed price with subsidy (US\$/kg)	Average grain price in April 2019 (US\$/kg)	Seed/grain price ratio (2017)	Seed/grain price ratio (2019)
Maize (hybrid)	1.63	0.38	6.0:1	4.3:1
Maize (OPV)	0.76	0.38	3.0:1	2.0:1
Bean	1.29	0.77	1.2:1	1.7:1
Millet	1.11	0.46	2.1:1	2.4:1
Sorghum	0.97	0.26	1.2:1	3.7:1



CONCLUSION

In a 2019 article, Ariga et al. describe five stages of seed sector growth in Sub-Saharan Africa, ranging from nascent to mature. Assigning a country to a category is not always straightforward, because parts of the seed sector may be ahead, while others may lag behind a particular stage. As shown in the TASAI study, this is the case in Uganda; however, overall, the 2020 snapshot of the country's formal seed sector most closely resembles the growth stage of development, characterized by well-established private companies that are supported by strong breeding programs, a policy environment that is supportive of private-sector participation, a highly competitive market with multinational and local seed companies producing a wide range of high-quality seed, and a strong agro-dealer network serving seed companies. The 2020 TASAI Uganda study has revealed several positive aspects of the seed industry, most of which are the result of recent improvements and programs initiated by the government. However, the industry still faces some constraints that can stifle growth.

Under the **research and development category**, the TASAI study found that most maize varieties listed in the national catalogue were released through the COMESA system. The release of regionally adaptable varieties increases farmers' access to improved seed and saves on lengthy variety development processes. The main sources of basic seed for the four crops in 2019 were NARO institutes and the CIMMYT for maize. Two recent entrants in basic seed production - QBS and NARO Holdings Limited - also supplied some maize and bean basic seed. The continued diversification of the supply of basic seed is healthy for Uganda's seed sector.

Over the years most breeding programs have depended on financial support from collaborative projects. It is because of such initiatives that the maize breeding program has accounted for most of the varieties released since 2017. There is a need to strengthen public breeding programs across the other three crops so that they can continue to develop varieties for food and nutritional security crops, such as millet, that are not attractive to the private sector.

Twenty-seven out of 38 varieties released during the data collection period have at least one special feature. New features mostly respond to the challenge of climate change, with 21 of the 27 varieties having climate-smart features. The other most common features are drought tolerance and early maturity. Although less prominent than climate-smart features, TASAI also recorded new varieties with features related to use (sweet-tasting, fast-cooking) and nutrition (free from tannins).

Under the **industry competitiveness category**, Uganda has seen growth in the number of active seed companies participating in the maize, bean, and sorghum seed value chains. As a result, the maize seed market has become competitive and does not have any dominant players. However, the bean and sorghum seed markets continue to be dominated by a few large players. To increase their competitiveness, the government should reverse the increase in the length of the import process from 6 days in 2015 to 17 days in 2019. The introduction of the Pre-import Verification of Conformity to Standards certificate by the Uganda and Kenya bureaus of standards in 2019 added extra costs and the loss of a planting season, due to the significant delays at the border, as a

result of which seed does not arrive in time for planting. New policies should be predictable, communicated early and given ample time for discussion with stakeholders before they are implemented.

The **seed policy environment** in Uganda is mostly supportive of private sector growth and the basic policy instruments are in place. There is clear coordination and regulatory oversight of the seed industry. Uganda's seed certification system is closely aligned to the COMESA seed certification system with regards to field and laboratory certification standards, seed labelling and issuance of certificates and seed classification. Uganda's National Variety Catalogue is not regularly updated and is not publicly available, which means that the information is not accessible to interested seed companies and farmers. Variety release and registration can be speeded up with regular meetings of the committee, the standardization of test costs, and the digitization of processes. To further increase confidence in the quality of seed produced and sold in Uganda the government should expedite the accreditation of the seed testing laboratory by the International Seed Testing Association (ISTA).

To avoid market distortions, voucher systems should be adopted to enable farmers to exercise choice in selecting seed supplied by government or NGOs. Lessons from the e-voucher system being implemented in selected districts under the Agriculture Cluster Development Project (ACDP) can be good starting points. The OWC seed subsidy program led by the NAADS needs improvements in the transparency and predictability of seed procurement and in the efficiency of payments.

On **institutional support**, the overall satisfaction with the performance of USTA has improved slightly from 61% in 2013 to 68% in 2019. This shows that the association is still serving its members effectively. The timely payment of membership dues will allow the secretariat to improve on its otherwise satisfactory performance.

Despite the increase in the number of seed inspectors from 7 in 2017 to 24 in 2021, inspection services in Uganda are still weak. The prospects of the NSCS and USTA operationalizing the training and authorization of private para-inspectors will reduce the burden on public seed inspection services. To make further gains, the capacity of seed inspectors needs to be supported with adequate funding for effective field inspections. Finally, the expected transformation of the NSCS into the Uganda Plant Health and Inspectorate Agency (UPHIA), will improve the efficiency of the regulation of the seed sector.

The support **services provided to smallholders** in Uganda are inadequate, as shown by the low numbers of agricultural extension agents. While there has been some improvement in the number of extension workers employed in the public service since 2017, the average number of farming households served by each extension office is still very high. In addition, the ratio of registered agro-dealers to agricultural households is very low, indicating that farmers might experience challenges in accessing farm inputs. The MAAIF is linking farmers to accredited agro-dealers through extension officers in 57 districts, under the ACDP. This is a step in the right direction.

REFERENCES

- Ariga, J., Mabaya, E., Waithaka, M., Wanzala-Mlobela, M. 2019. "Can improved agricultural technologies spur a green revolution in Africa? A multicountry analysis of seed and fertilizer delivery systems." *Agricultural Economics*. 50: 63–74.
- CASA 2020. Beans Sector Strategy – Uganda CASA Uganda Country Team. Commercial Agriculture for Smallholders and Agribusiness. Department for International Development (DFID).
- COMESA. 2014. COMESA Seed Trade Harmonization Regulations, 2014.
- Edema, R., Gibson, P., Ongom, P., Dramadri, I. 2018. Makerere University Regional Centre for Crop Improvement. Eastern and Southern Africa Higher Education Centres of Excellence Project.
- GoU (Government of Uganda). 2017. The Seeds and Plant Regulations, 2017. Statutory Instrument 2017 No. 14.
- GoU (Government of Uganda). 2020. The Seeds and Plant (Quality Declared Seed) Regulations, 2020. Statutory Instrument No. 5.
- Mabaya, E., Kachule, R., Waithaka, M., Tihanyi, K., Magambo, G., Mugoya, M. 2021. Malawi Country Report. The African Seed Access Index.
- Mabaya, E., Mugoya, M., Mubangizi, E., Ibyisintabyo, C. 2019. Uganda Brief 2018 - The African Seed Access Index.
- Mabaya, E., Mubangizi, E., Ibyisintabyo, C. 2016. Uganda Brief 2016 - The African Seed Access Index.
- MAAIF (Ministry of Agriculture, Animal Industries and Fisheries). 2020. The Plant Protection and Health (Import and Export) Regulations. Statutory Instrument 2020 No. 4.
- MAAIF (Ministry of Agriculture, Animal Industries and Fisheries). 2019. Process of Registration and Accreditation of AEAS Providers.
- MAAIF (Ministry of Agriculture, Animal Industries and Fisheries). 2018. National seed strategy 2018/19 – 2022/23.
- MAAIF (Ministry of Agriculture, Animal Industries and Fisheries). n.d. Maize Training Manual for Extension workers in Uganda. <https://www.agriculture.go.ug/wp-content/uploads/2019/09/Maize-training-manual-for-extension-workers-in-Uganda.pdf>
- MAAIF (Ministry of Agriculture, Animal Industries and Fisheries). n.d. Bean Training Manual for Extension workers in Uganda. <https://www.agriculture.go.ug/wp-content/uploads/2019/09/Bean-training-manual-for-extension-workers-in-Uganda.pdf>

ABOUT TASAI



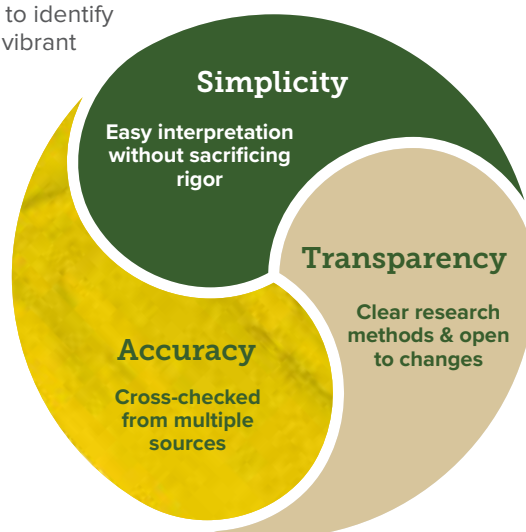
PILLARS OF COMPETITIVE SEED SECTORS

The African Seed Access Index (TASAI) is a seed industry research initiative that is coordinated by the nonprofit organization TASAI Inc. TASAI's goal is to encourage African governments and other seed industry players to create and maintain enabling environments that will accelerate the development of a vibrant private sector-led seed system serving smallholder farmers. It is this enabling environment that TASAI seeks to measure, track and compare across African countries.

To assess the status of the seed industry value chain, TASAI employs 22 indicators grouped into five categories: Research and Development, Industry Competitiveness, Policy and Regulations, Institutional Support and Service to Smallholder Farmers

By the end of 2021, TASAI studies will have been completed in 20 African countries: Burkina Faso, Burundi, the Democratic Republic of Congo, Ethiopia, Ghana, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Tanzania, Uganda, Zambia, and Zimbabwe. In each country, TASAI works closely with local seed industry actors, government and international development agencies to share the TASAI findings and to identify the next steps for creating a vibrant national seed sector

TASAI's work has been supported by various development organizations including the Alliance for a Green Revolution in Africa (AGRA), the African Development Bank, the Bill and Melinda Gates Foundation, UKAID, ELAN-RDC, and Kenya Markets Trust, among others. Several of these agencies use TASAI data to inform their seed-sector related activities.



TASAI PRINCIPLES

REFERENCES (cont)

- MOFPED (Ministry of Finance, Planning and Economic Development). 2014. The Public Procurement and Disposal of Public Assets Regulations. Statutory Instruments 2014 No. 6. https://www.ppda.go.ug/download/regulations/regulations/central_government_regulations/2014/PPDA-Regs-2014.pdf
- TASAI (The African Seed Access Index). 2015. Uganda Policy Brief. The African Seed Access Index
- The Republic of Uganda. 2018. The National Seed Policy. <https://www.agriculture.go.ug/wp-content/uploads/2019/05/Ministry-of-Agriculture-Animal-Industry-and-Fisheries-National-Seed-Policy.pdf>
- The Republic of Uganda. 2007. The Seeds and Plant Act 2006.
- The Republic of Uganda. 2015. The Plant Protection and Health Act, 2015.
- The Republic of Uganda. 2015. Uganda National Seed Strategy 2014/15-2019-20 Final Draft Validated by Stakeholders.
- The Republic of Uganda. 2014. The Plant Variety Protection Act 2014.
- Uganda Bureau of Statistics [UBOS]. 2020. Uganda Annual Agricultural Survey 2018. <https://www.ubos.org/annual-agricultural-survey-2018-report>

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For a comparison of TASAI Indicators across different countries, please visit:
<http://tasai.org/wp-content/uploads/TASAI-Appendix-CURRENT.pdf>

READ TASAI REPORTS ONLINE:
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