Ghana Country Report 2022

The African Seed Access Index

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TASAI
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LIST OF ACRONYMS:

CRI	Crops Research Institute
CSIR	Council for Scientific and Industrial Research
DAES	Directorate of Agricultural Extension Services
DCS	Directorate of Crop Services
DUS	Distinctiveness, Uniformity and Stability
ECOWAS	Economic Community of West African States
GLDB	Grains and Legumes Development Board
GSID	Ghana Seed Inspection Division
IITA	International Institute for Tropical Agriculture
LCIC	Legacy Crop Improvement Centre
MOFA	Ministry of Food and Agriculture
NASTAG	National Seed Trade Association of Ghana
NSC	National Seed Council
NVRRC	National Variety Release and Registration Committee
OPV	Open Pollinated Varieties
PFJ	Planting for Food and Jobs
PPRSD	Plant Protection and Regulatory Services Directorate
SARI	Savanna Agricultural Research Institute
SEEDPAG	Seed Producers Association of Ghana
SRID	Statistics, Research, and Information Directorate
UCC	University of Cape Coast
VCU	Value for Cultivation and Use
WACCI	West Africa Centre for Crop Improvement

INTRODUCTION

The increased use of productivity enhancing technologies, including mechanization, irrigation, fertilizer and improved seed[1], are 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 seeds can deliver state-of-the-art technology to farmers including higher yields, disease and pest resistance, climate change adaptation, reduced post-harvest losses, and improved nutrition. To facilitate the delivery of these benefits to the farmers, The African Seed Access Index (TASAI) conducts seed industry assessments at the national level and uses the findings 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 report summarizes the key findings of the study conducted by TASAI in 2022 to appraise the structure and economic performance of Ghana's formal seed system. TASAI studies focus on the four grain and legume crops important to a country's food and nutritional security (the "four focus crops"). In Ghana, these crops are maize, rice, soya bean, and cowpea. Together these four crops account for 66% of land under cultivation in Ghana (SRID/MOFA 2021; FAOSTA). In addition, the four focus crops are among the six selected food crops under Planting for Food and Jobs (PFJ),[2] the government's subsidy program (MOFA 2019).

Maize is the most important cereal crop and top food security crop in Ghana. It is featured in diets across all the regions in Ghana. The demand for maize is robust, especially because the poultry feed sector has been expanding (Andam et al. 2017). It is also a key ingredient in livestock feeds. It constitutes 50% to 60% of total cereal production in Ghana. A total of 1.2 million ha was dedicated to maize production in 2020 (SRID/MOFA 2021). This makes maize the most important food crop in Ghana.

In 2018, the Ministry of Food and Agriculture (MOFA) estimated that **rice** imports constituted more than 50% of rice consumed in Ghana (MOFA-IFPRI Market Brief 2020). This makes rice a very important cereal crop second only to maize. To reduce imports and save foreign exchange in the past years, the Government of Ghana has implemented several measures to boost local rice production. This includes production and local processing of rice by some foreign companies to meet the standards of imported rice. In 2020, 291,000 ha of land were used for paddy rice production in Ghana (SRID/MOFA 2021).

Soya bean does not feature prominently in the local cuisine of Ghana. Rather, it is an industrial cash crop in the middle and northern regions of Ghana, and it is mainly used to produce poultry feed and livestock feed as well as vegetable oil extraction. Apart from its local consumption, soya bean is also an emerging export crop. Soya bean production is on the increase as a source of income, especially for smallholder farmers. According to the Statistics, Research, and Information Directorate (SRID/MOFA 2021) soya bean production grew by 27% between 2018 and 2020. In 2020, 116,000 ha were under soya bean production.

Cowpea is an important grain legume in Ghana. It is an important source of plant protein, and it is consumed by virtually every household in the country, especially in the northern part of Ghana where the cowpea leaves are also consumed. While cowpea production extends to all regions in Ghana, it is concentrated in the middle and northern parts of the country. Available figures from SRID, MOFA (2021) indicate that cowpea grain production increased from 237,000 MT in 2018 to 254,000 MT in 2019 and 257,000 in 2020. This is supplemented by about 10,000 MT of imports from Burkina Faso, Mali, and Niger. In 2020, cowpea production covered 169,000 ha (SRID/MOFA 2021).

OVERVIEW OF GHANA'S FORMAL SEED INDUSTRY

Like most African countries, Ghana's seed industry consists of two systems: the informal and formal systems (Tetteh et al., 2021). This Country Report focuses almost exclusively on the formal seed system.

The informal system refers to a system where 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 and relatives through rural markets. Seed from this system is of variable varietal purity as well as physical and sanitary quality.[3] Due to a lack of exposure, an inability to purchase seeds, inadequate access to varieties and agro-dealers, and other reasons, most smallholder farmers in Ghana still rely on the informal seed sector. Standards in the informal seed sector are not monitored or controlled by government policies and regulations. Rather, they are guided by indigenous knowledge and local structures. Approximately 80% of the major seeds used in the country are provided by the informal seed sector (National Seed Policy 2013).

1 TASAI uses "improved seed" as the short form of "quality seed of improved varieties".

2 "Planting for Food & Jobs," MOFA, Republic of Ghana, accessed on December 6, 2022, https://mofa.gov.gh/site/programmes/pfj

3 "Seed System Definitions," Agrilinks, USAID, accessed December 6, 2022 https://www.agrilinks.org/post/seed-system-definitions

The formal system refers to a structured and regulated value chain for the production of improved seed varieties. This process involves many actors and institutions that take part in variety breeding as well as the multiplication, processing, and distribution of certified seeds. Different stages of improved seed production are regulated by governments based on approved regulations and standards. In this system, seed is sold through limited distribution channels, such as registered seed growers/companies and agro-dealers. According to the Ghana National Seed Plan, certified seed accounts for 11% of the national seed requirement for maize and 14% of the national seed requirement for rice (Republic of Ghana 2015).

Table 1 lists the agencies in charge of various aspects of Ghana's formal seed system or seed industry. The Ghana Seed Inspection Division of the Plant Protection and Regulatory Services Directorate (GSID-PPRSD) under MOFA is the government department responsible for regulating the seed industry in Ghana. The Directorate of Crop Services (DCS) is responsible for variety release and registration. The Grains and Legumes Development Board (GLDB) produces and supplies basic seed. The Crops Research Institute (CRI) and the Savanna Agricultural Research Institute (SARI) are both agricultural research institutions with active breeding programs. Other important players are seed growers and agro-input dealers.[4] The National Seed Trade Association of Ghana (NASTAG) brings together players involved in improved seed production and other stakeholders in the seed value chain. The Seed Producers Association of Ghana (SEEDPAG) is a member of NASTAG and brings together seed growers.

Table 1: Role of key players in Ghana's formal seed sector

ROLE	KEY PLAYERS
Research and breeding	The Council for Scientific and Industrial Research-Crops Research Institute (CSIR-CRI), the Council for Scientific and Industrial Research-Savanna Agricultural Research Institute (CSIR-SARI), the West Africa Center for Crop Improvement (WACCI), the University of Cape Coast (UCC) and centers of the Consultative Group on International Agricultural Research.
Variety release and regulation	Directorate of Crop Services (DCS), Plant Protection and Regulatory Services Directorate (PPRSD)
Seed production and processing	Grains and Legumes Development Board (GLDB), National Seed Trade Association of Ghana (NASTAG), Seed Producers Association of Ghana (SEEDPAG)
Education, training, and extension	Directorate of Agricultural Extension Services (DAES), NASTAG and its members
Distribution and sales	Ghana Agricultural Input Dealers Association (GAIDA), Seed companies/growers

4 Ghana's seed law (Plants and Fertilizers Act 2010) requires the registration of seed importers, exporters, growers and dealers (Article 31) (Republic of Ghana 2010). In this report, the term "seed companies" refers to registered seed growers which are also eligible to become members of NASTAG. Seed growers may also register as companies for other purposes (e.g., trade), but this is not a requirement for registration to produce seed.

METHODS

As listed in Table 2, TASAI studies cover 22 indicators divided into five categories: **Research and Development, Industry Competitiveness, Seed Policy and Regulations, Institutional Support,** and **Service to Smallholder Farmers.** In most TASAI studies, the bulk of the performance data reported comes from the year before when the study is conducted ("the study year") because that is when the most recent data are available. Accordingly, the data reported in this Country Report pertain primarily to 2021; however, whenever 2022 data were available, they are included in the report.

Table 2: TASAI Indicators

		Crop-specific	Impact on seed access[a]
A	**RESEARCH AND DEVELOPMENT**		
A1	Adequacy of active breeders	**Yes**	+
A2	Number of varieties released	**Yes**	+
A3	Number of varieties with 'special' 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	**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 and grain prices at planting time	**Yes**	+/-

a A plus/negative sign signals a positive/negative correlation between the indicator and smallholder famers' access to improved seed.

To assess progress in Ghana's seed system, the Country Report draws comparisons with the findings of the 2020 and 2017 TASAI Ghana studies (with performance data primarily from 2019 and 2016, respectively).[5] In addition, since TASAI has conducted similar studies in 21 other African countries, this report also draws relevant cross-country comparisons. More detailed temporal (across previous studies) and cross-sectional (across other African countries) comparisons are now available through an online dashboard available at https://dashboard.tasai.org.

The TASAI research team conducted interviews with various public and private institutions. Interviewees included the CSIR-CRI, CSIR-SARI, the West African Centre for Crop Improvement (WACCI), and the University of Cape Coast (UCC). These entities are responsible for basic research and crop variety development. They also produce early generation seed (EGS). Three directorates under MOFA were interviewed. The first was the PPRSD, which is responsible for seed quality control and certification, plant protection, seed imports and exports. The PPRSD also serves as the secretariat for the National Seed Council (NSC). The second was the DCS which is the secretariat for the National Variety Release and Registration Committee (NVRRC). The third was the Directorate of Agricultural Extension Services (DAES) which is responsible for seed extension and education. In addition, the GLDB was also interviewed, as they are a key supplier of basic seed for seed growers. NASTAG was the main private sector to be interviewed. NASTAG is the umbrella association of the private sector actors in the seed industry in Ghana and is responsible for organizing seed production and marketing as well as any other related issues.

For several indicators, TASAI supplemented quantitative data with self-reported average levels of industry satisfaction on a 0-100 scale, 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 2021, 180 maize seed growers were registered by the Ghana Seed Inspection Division (GSID) of the PPRSD (Table 3). In addition, 93 seed growers were registered to produce rice seed, 88 for soya bean seed, and 17 for cowpea seed. Of these, 80 respondents were interviewed, 63 for maize, 48 for rice, 35 for soya bean, and 21 for cowpea.[6] With the exception of cowpea seed growers who were all interviewed regardless of field size, growers with a minimum field size of 10 ha were selected to be for interviews with the TASAI team. The sample size included all big companies since the total production reported by 80 seed grower respondents from the TASAI study comprised of almost 100% (113% maize, 88% soya bean, and 85% cowpea) of the official level of seed production based on government records. Rice seed production reported by respondents (43% of official record of rice production) was relatively low because very few rice seed growers in the northern region responded.

Growers were enthusiastic in 2020 and a similar response was expected in 2022. While close to 100% of those earmarked in the middle belt and southern part of Ghana were interviewed, the response in northern Ghana, where the bulk of the seed is produced and marketed was disappointing. The main reason for the lack of interest by the seed growers (companies/producers) in northern Ghana was that they had not realized any benefits from the exercises.

5 Since the TASAI sampling methodology has improved over the course of the country studies, the number of years in the temporal comparison may vary for the different indicators.

6 The sum of the number of seed growers by crop exceeds 80 because some seed growers produce more than one crop.

Table 3: Breakdown of respondents by crop (2021)

Crop	Number of registered seed growers (Government data)	Number of registered seed growers surveyed (TASAI data)	% share of seed production from TASAI data vs government data
Maize	180	63	113%
Rice	93	48	43%
Soya bean	88	35	88%
Cowpea	17	21	85%

RESEARCH AND DEVELOPMENT

NUMBER 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.[7] In addition to tracking the number of breeders working on the four focus crops, the study also measures the level of satisfaction reported by seed growers (companies/producers) with the public breeding programs. The latter reflects the ability of active breeders in public institutions to produce new varieties.

In 2021, there were 12 maize (10 public and 2 private), 6 rice (5 public and 1 private), 7 soya bean (all public), and 8 cowpea breeders (all public) active in Ghana (Table 4). Between 2017 and 2021, the number of breeders for the focus crops increased from 26 to 33, most of whom worked in the public sector. The main public institutions with active breeders in 2021 were the CSIR-CRI, the CSIR-SARI, the University of Ghana, Legon, WACCI, and the UCC. The Savanna Agricultural Research Institute (SARI) has the mandate for research and development of the four crops in northern Ghana, while the CRI is responsible for research and development in southern Ghana.

The main challenges reported by the breeders were a lack of equipment for seed production (such as land preparation equipment) and inadequate infrastructure (such as facilities for irrigation, seed processing, and storage). According to the breeders, the challenges stemmed from inadequate government funding. In most cases, the government only provided enough funds to cover breeders' salaries, so breeders had to rely on funding from external donor projects to cover other costs of variety development. Breeders also reported that, since there was no system to forecast the demand for the different categories of Early Generation Seed (EGS), their ability to plan for basic seed production was limited. Another challenge that breeders identified was the lack of a framework to collect royalties for varieties that were sold to seed growers. Although the Ghanaian parliament passed the Plant Variety Protection (PVP) Act in 2020 (GPC 2020), the Ministry of Justice and Attorney General's Department (MoJAGD) was yet to develop the PVP regulations that would provide a framework for breeders to sign licensing agreements with seed growers at the time of data collection. In addition, the breeders reported that farmers did not appreciate improved varieties, especially hybrid maize varieties. Farmers have not been adequately educated on the comparative advantages that hybrids have over local landraces. According to breeders, raising awareness on-farm demonstrations with hybrids will alsoshow farmers the benefits of improved varieties, further stimulating farmer demand.

7 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.

Table 4: Number and adequacy of active breeders in Ghana

Crop	Number of public breeders		Number of private breeders		Total number of breeders			Satisfaction rating (out of 100%)		
	2019	2021	2019	2021	2017	2019	2021	2017	2019	2021
Maize	7	10	3	2	10	10	12	83	73	72
Rice	4	5	0	1	6	4	6	70	52	72
Soya bean	5	7	0	0	5	5	7	80	50	71
Cowpea	5	8	0	0	5	5	8	60	48	71
Total[a]	21	30	3	3	26	24	33			

extremely poor | poor | fair | good | excellent

a In some cases, the same breeder may work on multiple crops, so the total number of breeders may not equal the sum of breeders by crop.

In addition to observing the breeders' point of view about the challenges of the variety development process, the TASAI study also surveyed seed growers. The seed growers' satisfaction with the adequacy of active breeders dropped significantly for the four crops from 2017 to 2019 and increased by 2021. This improvement in growers' satisfaction with breeders in 2021 may be attributed to the increase in the number of newly released varieties of the focus crops (Figure 1). The new varieties have special features (drought tolerance, early/extra early maturity, fast cooking, nutrition enhanced, grits for the brewery industry, etc.).

VARIETIES RELEASED IN THE LAST THREE YEARS

The number of varieties released is a good measure of the functioning of the variety development and release system. In addition to higher yields, new varieties often carry desired traits such as climate smartness, disease/pest resistance, and nutrition-enhancements.

Figure 1 illustrates the 3-year moving averages[8] of crop variety releases between 2002 and 2021. The fluctuating number of variety releases over the 20-year period may be attributed to inconsistent funding for breeding programs and variety releases. Between 2017 and 2018, the NSC detected that some applications submitted by the breeders in the first round of the variety release process were incomplete. These applications were sent back to the respective institutions who then corrected the mistakes and then resubmitted them for further consideration. Due to financial constraints, however, the NSC did not respond to the resubmitted applications. This created a backlog of applications in this time period. As a result, no varieties of the focus crops were released in 2017 and 2018, while 34 varieties were released in 2019 alone.

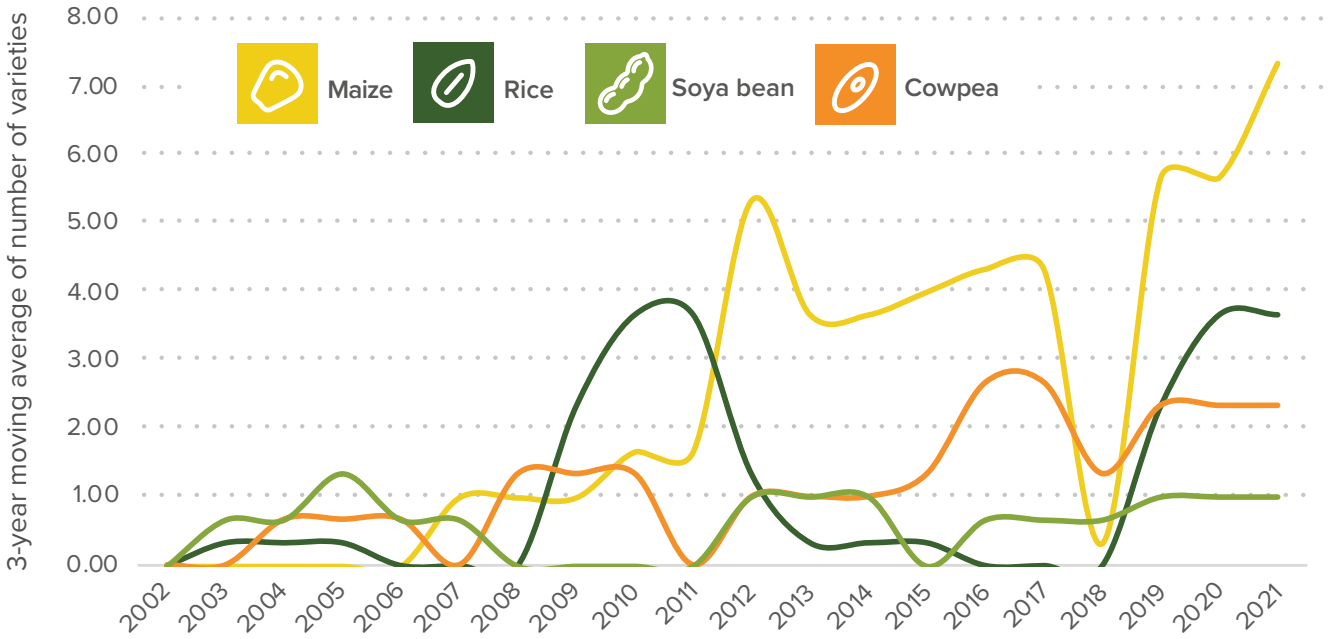
Further, the erratic releases from 2002 to 2018 can be attributed to low demand for basic seed and high variety release process costs. These two factors discouraged breeders from developing new varieties. However, the situation changed after 2017, when, as part of the PFJ program[9], the government began to invest in the production of basic seed and purchased certified seed from seed growers. With the government's intervention, the derived demand for basic seed produced by research institutions increased.

Between 2019 and 2021, 22 maize varieties, 11 rice varieties, 7 cowpea varieties, and 3 soya bean varieties were released. In 2019, 17 maize varieties, 7 rice varieties, 7 cowpea varieties, and 3 soyabean varieties were released. Four varieties were recommended for release in 2020 by the NVRRC and forwarded for approval by the NSC. These varieties were officially released in 2022 because there was no documentation to support their release in 2021. In 2021, the NVRRC recommended 5 maize varieties for release. These varieties are yet to be approved by the NSC for inclusion in the National Seed Catalogue. However, 2 maize varieties P4226 and P3966W had been released in Nigeria and were approved by the NSC for cultivation in Ghana. The NSC was reconstituted and inaugurated on 9th March 2022. The Intellectual Property office of the CRI has developed a framework for licensing varieties to seed companies. By the end of 2022, CRI had licensed 10 varieties to seed companies: 6 maize varieties, 2 soya bean varieties, and 2 tomato varieties.

8 A 3-year moving average is a statistic that captures the average change in varieties released every three years.

9 "Planting for Food & Jobs," MOFA, Republic of Ghana, accessed on December 6, 2022, https://mofa.gov.gh/site/programmes/pfj

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



VARIETIES WITH SPECIAL FEATURES

Varieties may have special characteristics such as climate-smart, use-related (e.g., fast -cooking or nutrition-enhanced), or industry-demanded features (e.g., suitability for making starch, suitability for livestock feed, high-oil content, etc.) 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. Examples of climate-smart features are drought tolerance, early maturity, or extra-early maturity.

Out of the 43 varieties released between 2019 and 2021, 25 had at least one special feature. Of these, 15 were maize, 3 were rice, and 7 were cowpea varieties (Table 5). Climate smartness was the most prominent special feature. Of the 25 varieties with special features, 17 varieties had climate smart features (9 maize, 1 rice, and 7 cowpea varieties). Moreover, 9 varieties (3 rice and 6 cowpea varieties) were fast-cooking, 2 maize varieties were nutritionally-enhanced, (pro-vitamin A), and 7 maize varieties had industry-demanded features (grits for the breweries). None of the soya bean varieties released had special features.

Table 5: Number of varieties released that have special features (2019 - 2021)

Feature	Description	Number of varieties released				
		Maize	Rice	Cowpea	Soya bean	Total[a]
All varieties released		22	11	3	7	**43**
All varieties released with special features		15	3	0	7	**25**
Climate-smart features	All	9	1	0	7	**17**
	Drought tolerant	4	0	0	7	**11**
	Early / extra-early maturing	7	1	0	7	**15**
Use-related features	All	2	3	0	6	**11**
	Fast-cooking	0	3	0	6	**9**
	Nutrition-enhanced features	2	0	0	0	**2**
Industry-demanded features	All	7	0	0	0	**7**
	Animal feeds	7	0	0	0	**7**
	Grits for the breweries	7	0	0	0	**7**

a The total number of varieties with special features is greater than the 24 varieties mentioned earlier because some varieties have multiple features.

For the past 30 years, the quest for maize varieties with enhanced nutritional varieties has been ongoing. The Obatanpa variety has enhanced levels of lysine and tryptophan. Two maize varieties, CRI-Nkwagye and CRI-Abebe, are enriched with Provitamin A. Both were released in response to market demands. In addition, six maize varieties have been used as animal feeds because they are lower in lignin content, which increases digestibility in livestock. Further, several breweries in Ghana use maize grits to replace some of the imported barley. The breweries prefer maize varieties with dense endosperms. To respond to the demands of the breweries industry, five maize varieties, all excellent for industrial preparation (grits), were released during the 2019 to 2021 period.

Most rice consumers in Ghana prefer varieties with aromatic properties and high amylose content. High amylose content reduces rice's cook time and stickiness. Three rice varieties with aromatic properties and high amylose content were released between 2019 and 2021.

Cowpea, which is adapted to dry areas, is produced mainly in northern Ghana, where changing frequencies and intensities of droughts are making drought tolerance an increasingly important attribute. All 7 cowpea varieties released between 2019 and 2021 had drought tolerant features. In addition, 6 fast cooking cowpea varieties were also released over this period.

NUMBER OF VARIETIES SOLD

An increase in the number of varieties sold in a country often results in an increased choice of varieties available to farmers.

As shown in Table 6, the number of varieties sold for each of the focus crops did not change much from 2019 to 2021. While there was an increase in the number of maize varieties, rice and soya bean varieties sold, there was a reduction in the number of cowpea varieties sold. The commonly sold maize varieties in 2021 were Abontem (12 years), Obatanpa (30 years), Omankwa (12 years), Wang-Dataa (10 years), Sanzal-Sima (10 years), and Opeaburo (9 years). The most commonly sold rice varieties were Agra Rice (9 years) and Gbewaa Rice (13 years), both of which are slender, long grain and have aromatic features. Soya bean varieties commonly sold in 2021 were Favour (3 years), Jenguma (19 years) and Afayak (10 years). Lastly, the commonly sold cowpea varieties were Wang Kae (6 years), Padi Tuya (6 years) and Kirkhouse Benga–1 (6 years). The 3 cowpea varieties are moderately tolerant to drought and resistant to insects, diseases, and striga (a parasitic weed mainly found in the north).

Table 6: Number, name, and age of commonly sold varieties

Crop	Number of varieties sold		Name of commonly sold variety	Age of variety in years (2021)	Average age of commonly sold varieties (2021) (all varieties sold)
	2019	2021			
Maize	22	25	Abontem	12	14(7)
			Obatanpa	30	
			Omankwa	12	
			Wang-Dataa	10	
			Sanzal Sima	10	
			Opeaburo	9	
Rice	4	5	AGRA Rice	9	11(8)
			Gbewaa Rice	13	
Soya bean	4	5	Favour	3	11(11)
			Jenguma	19	
			Afayak	10	
Cowpea	7	5	Wang Kae	6	6(8)
			Padi Tuya	6	
			Kirkhouse Benga-1	6	

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 foundation seed from public research institutions tends to constrict seed companies' ability to scale up production. The process to obtain basic seed generally starts when a grower applies to the research institution that produces or supplies the basic seed. The application specifies the crop, variety, and quantity needed. The research institution invoices the grower for the basic seed, and upon payment, the grower receives the seed.

Table 7 shows the number of basic seed transactions for each source organization. Most seed growers obtained basic seed from public institutions: the GLDB, the CSIR-CRI, and the CSIR-SARI. The government supports these public institutions under the PFJ program to produce and provide all early-generation seed. This explains their high scores. In addition, seed growers obtained basic seed from the International Institute for Tropical Agriculture (IITA), the Legacy Crop Improvement Centre (LCIC), and other seed growers. A few seed growers relied on their own sources. In addition, the GSID licensed 9 seed companies to produce basic seed.

Seed growers were asked to assess each source organization on three aspects related to the availability of basic seed: the quality of basic seed received, whether they received the quantity of basic seed that they requested, and the timeliness of delivery of the seed (Table 8).

Table 7: Sources of basic seed by crop, number of transactions, and percentage of total transactions (2021)

Source of basic seed	Maize		Rice		Soya bean		Cowpea	
	Number of transactions	% of total	Number of transactions	% of total	Number of transactions	% of total	Number of transactions	% of total
CRI	17	19	7	20	0	0	4	20
GLDB	30	34	4	11	1	3	1	5
IITA	1	1	0	0	0	0	0	0
LCIC	6	7	0	0	0	0	0	0
SARI	20	22	19	54	30	86	15	75
Other seed companies	13	15	4	11	4	11	0	0
Own	2	2	1	3	0	0	0	0
Totals	**89**	**100%**	**35**	**100%**	**35**	**100%**	**20**	**100%**

Table 8: Satisfaction rating of the quality, quantity, and timeliness of basic seed received by source organization (2021)

Crops		CRI	GLDB	IITA	LCIC	SARI	Other seed companies	Own
Maize (n=87)	Quality	91	85	90	86	79	74	90
	Quantity	86	86	90	94	78	91	85
	Timeliness	90	92	100	86	77	88	95
Rice (n=51)	Quality	87	85	N/A	N/A	84	79	90
	Quantity	84	75	N/A	N/A	84	90	90
	Timeliness	85	85	N/A	N/A	82	90	100
Soya bean (n=35)	Quality	N/A[a]	80	N/A	N/A	84	85	N/A
	Quantity	N/A	100	N/A	N/A	80	93	N/A
	Timeliness	N/A	100	N/A	N/A	85	93	N/A
Cowpea (n=20)	Quality	80	100	N/A	N/A	83	N/A	N/A
	Quantity	85	80	N/A	N/A	79	N/A	N/A
	Timeliness[b]	88	90	N/A	N/A	87	N/A	N/A

extremely poor | poor | fair | good | excellent

a "N/A" means that the information requested does not apply to the source organization.

b Quality, quantity and timeliness of basic seed are all opinion ratings and reflect how satisfied seed companies were with these attributes for the basic seed that they received.

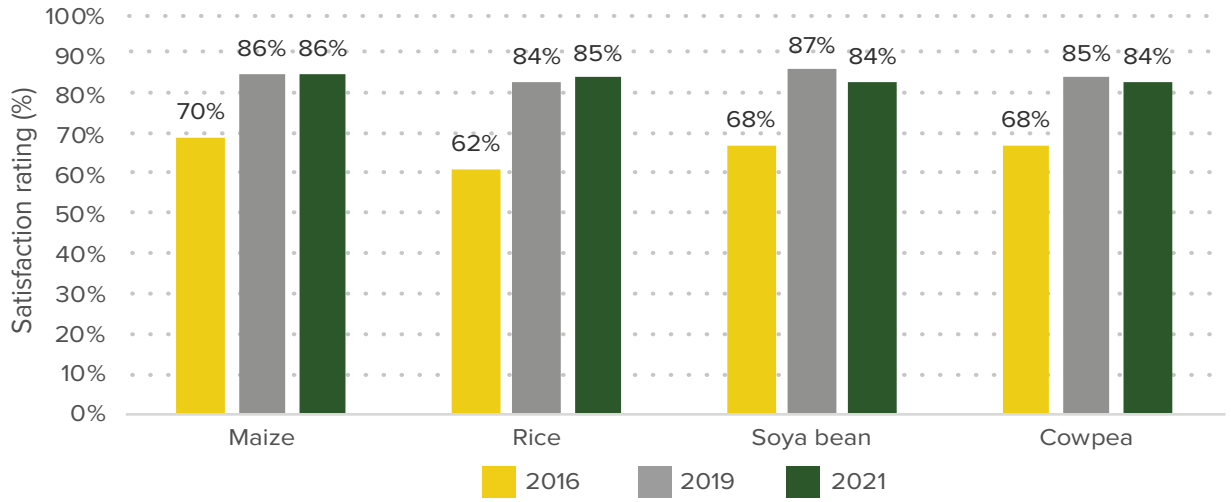
Quality of basic seed received: The ratings assigned to quality of basic seed ranged from "good" to "excellent." Soya bean and cowpea from the CRI, GLDB, SARI and "other seed growers" were rated "excellent". Maize and rice seed from most sources were rated "excellent". Maize from SARI and rice from "other seed growers" were rated "good".

Quantity of basic seed received: The ratings for the quantity of basic seed received also ranged from "good" to "excellent". Maize seed from most sources was rated "excellent," except from SARI, which was rated "good". Rice seed from all sources was rated "excellent," except from the GLDB, which was rated "good". Cowpea and soya bean seed from the GLDB were rated "excellent".

Timeliness of delivery of basic seed: The ratings for the timeliness of delivery ranged from "good" to "excellent". The timeliness for maize seed was rated "excellent" for all sources except SARI which was rated "good". The timeliness for rice, cowpea and soya bean seed was rated "excellent" for all sources.

Availability of basic seed: Figure 2 illustrates seed growers' satisfaction rating of the availability of basic seed in 2016, 2019, and 2021. Availability of basic seed is calculated as the average of the ratings of the three aspects mentioned above. In 2021, the satisfaction ratings for all four crops were "excellent" at over 80%. In 2019, the rating was also "excellent" for all crops; the ratings recorded in 2021, while still excellent, were slightly lower for maize, soya bean, and cowpea. The ratings in 2021 and 2020 are a major improvement over the "good" ratings observed in 2016. This is also evident by the fact that seed growers did not report any challenges with the availability of basic seed in 2021.

Figure 2: Overall satisfaction rating of availability of basic seed



INDUSTRY COMPETITIVENESS

NUMBER OF ACTIVE SEED COMPANIES

Competition breeds excellence: the presence of more active seed companies[10] increases competition and creates incentives for companies to innovate and improve. A vibrant seed sector depends on robust seed companies which invest in developing, producing, processing, and marketing improved varieties to farmers. This section tracks the number of registered seed growers (companies) that produced and marketed seed of one or more of the focus crops.

The number of seed companies[11] that produced and marketed maize, rice, and soya bean crops approximately doubled between 2019 and 2021 (Table 9). The increase may be attributed to the fact that the government's seed subsidy program – the PFJ program – helped increase the demand for certified seed for maize and rice. The number of cowpea seed companies increased slightly from 2019 to 2021.

Table 9: Breakdown of active seed companies

Crop	Number of active seed companies (2016)	Number of active seed companies (2019)	Number of active seed companies (2021)
Maize	17	29	47
Rice	7	19	41
Soya bean	5	15	32
Cowpea	9	13	19

GENDER IN MANAGEMENT OF SEED COMPANIES

TASAI also tracks the number of women in management and ownership positions in seed companies. The main positions held by women in management include Chief Executive Officer/ Managing Director, Manager, Secretary, and Finance Officer/ Accountant. Out of the 256 individuals in the various management positions across all seed companies in 2021, 60 (23%) of them were women (Table 10). Despite the increase in the number of women in management positions from 21 in 2019 to 60 in 2021, their proportion relative to men remained the same. In 2021, the number of companies with at least one woman in a management position was 38 (62%). This was an increase from 45% in 2019 despite the decrease in the sample size. In 2021, 11 (18%) companies had a woman top manager while in 2019, only one company had a woman as the top manager (3%). Finally, while five companies (8%) were owned by a woman in 2021, only 1 company (3%) was woman-owned in 2019.

10 TASAI defines an "active seed company" as a company that produces and/or markets seed of one or more of the four focus crops in the TASAI study year.

11 Seed companies are seed growers that are also registered as companies by the Registrar General's office.

Table 10: Gender in management of seed businesses

Gender indicator	Number (n)		%	
	2019	2021	2019	2021
Women in management positions	21 (92)	60 (256)	23%	23%
Companies with at least one woman in a management position	42 (94)	38 (61)	45%	62%
Companies with a woman top manager	1 (31)	11 (61)	3%	18%
Companies with a woman owner	1 (31)	5 (61)	3%	8%

PRODUCTION AND SALE OF CERTIFIED SEED

To measure the overall size of a country's seed sector, TASAI tracks the volumes of certified seed produced and sold for the four focus crops. The data are presented as aggregate quantities in metric tons (MT) of certified seed sold in the data collection year, as reported by active seed companies. Note that TASAI data on seed production and sales in 2019 and 2021 were sourced from the 80 seed growers who were interviewed for this study. On the other hand, government data on seed production covered all seed growers in Ghana who produced seed in 2019 and 2021.

Table 11 contains TASAI and government data on certified seed production and sales by crop in 2019 and 2021. According to TASAI data, seed production volumes across all four focus crops increased. Specifically, seed production increased 39% for maize, 12% for rice, 76% for soya, and 26% for cowpea between 2019 and 2021. Based on government data, seed production saw a significant drop for maize and soya bean within the same time period. According to the PPRSD (2021), the drop in maize seed production resulted from seed grower's shift from open pollinated varieties (OPVs) to hybrids, due to the increasing demand for maize hybrids from farmers and a focus on maize hybrids under the PfJ program. Most hybrids are imported, while a small volume are produced locally. Many OPV maize producers shifted to rice and cowpea seed production. Furthermore, several seed producers had not been paid for the seed they supplied to PFJ since 2019. The worst affected by non-payment under PFJ were the maize seed producers who supplied the bulk of seed to the program. The reduction in soya bean production may be attributed to underreporting by the seed growers. In 2021, the Ghanaian government placed a temporary ban on the exportation of soya bean. According to the DCS, seed producers indicated that several metric tons of soya bean seed had been sold to merchants from neighboring countries before the export ban was announced. Additional quantities were smuggled across the borders even during the export ban. Producers did not officially account for these sales, so they were left undocumented.

The Head of the Ghana Seed Inspection Division of PPRSD stated that the figures provided by the PPRSD on maize seed production were the actual volumes of certified seed obtained in 2021. On the other hand, TASAI data was obtained from the 80 seed growers who were interviewed for the study.

Table 11: Seed production and sales

Crop	Seed production in MT (TASAI data)		Seed production in MT (Government data)		Seed sales in MT (TASAI data)	
	2019	2021	2019	2021	2019	2021
Maize	4,527	6,272	10,831	5,546.9	5,550	5,282
Rice	4,937	5,551	8,354	12,917.9	4,445	2,934
Soya bean	1,141	2,012	5,252	2,280.3	967	1,380
Cowpea	255	321	176	375.3	218	185

Table 11 also shows the volume of seed sold in 2019 and 2021. Maize, rice, and cowpea sales declined while soya bean sales increased. According to the DCS, these changes can be attributed to the increasing prices of fertilizers. Apart from cowpea whose seed sales dropped marginally in MT, the drop in seed sales for maize and rice was more pronounced. As a result of COVID-19 and Russian-Ukraine war, fertilizer prices increased and the cost of production for maize and rice escalated.

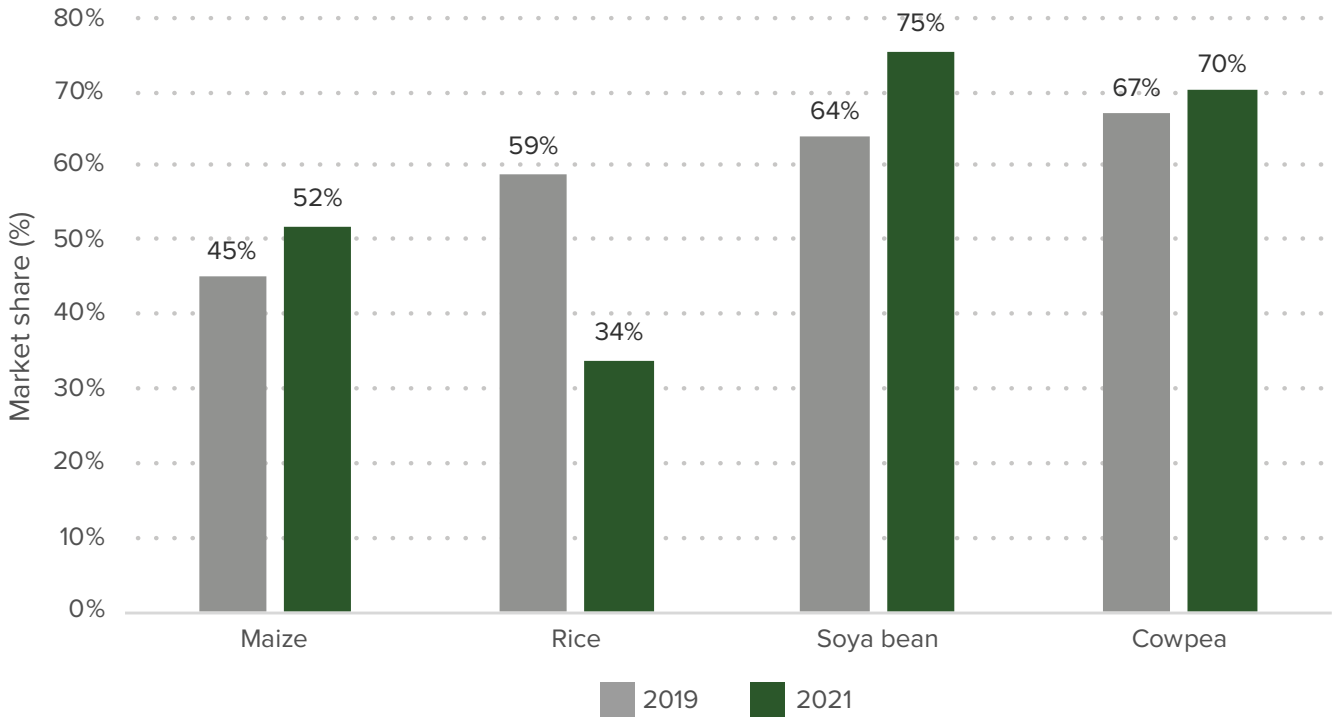
Following these events, farmers shifted their attention towards producing more soya bean seed production and therefore bought more seeds to plant in the subsequent seasons. This is evident in 2022 where a lot of maize farms have been cultivated with soya bean. Realizing the delay in payment of seed supplied to PFJ in the previous year, some seed growers decided not to sell seed to PFJ. They did, however, sell their 2021 maize, rice, and cowpea seed stocks to agro-dealers, NGOs, and other buyers resulting in the slow sales. It may be noted that the figures in Table 11 were obtained during the field survey by researchers. During the time of data collection, the planting season in the north was about four months away and most farmers would not have bought seed for planting and several seed producers had unsold stocks. This might have accounted for the decline in seed sales. However, these stocks would have been sold at the beginning of the planting season. It is anticipated that by the end of the third quarter during which farmers in the middle and southern sectors would have completed planting for the minor season, stock levels would have reduced or perhaps depleted. The country's seed stocks will be known from the PPRSD's report at the end of the last quarter of 2022. Soya bean sales however, increased from 967 MT in 2019 to 1,380 MT in 2021. This might be due to sales of soya bean to merchants from neighboring countries (available external market).

MARKET SHARE OF TOP SEED COMPANIES

Seed company competition benefits farmers via lower prices, wider choices, increased innovation, and better customer service. To assess the level of industry market concentration, TASAI uses seed sales data for each crop, as reported by seed companies, to calculate the market share of the four largest firms, also known as the four-firm concentration ratio (CR4), as well as the Herfindahl-Hirschman Index (HHI) in 2019 and 2021.

Figure 3 shows the CR4 scores for each focus crop in 2019 and 2021. In 2021, the top four seed companies (seed growers) accounted for 52%, 70%, and 75% of the maize, cowpea, and soya bean seed market, respectively. When looking at the rice market alone, seed growers' market share reduced by approximately 42% from 2016 to 2021. As explained in the methods section, we did not reach the targeted number of rice growers. This could explain the observed decline.

Figure 3: Market share for the four focus crops (CR4)



In 2021, the HHI market concentration measure was "extremely low" (865), similar to the 883 in 2019 (Table 12). This indicates that, among the seed growers that were surveyed, the maize seed market was more competitive, i.e., no single grower or small number of growers dominated the market. The decrease in the level of market concentration for rice seed was more pronounced. In 2021, the HHI for rice was "extremely low" at 518 compared to the "low" HHI level (1,264) observed in 2019. As explained in the methods section, the TASAI team did not reach the targeted number of rice growers, and this may explain the trends over this period. Soya bean's level of market concentration was "moderate" at 2,005 which was a decrease from "low" level at 1,094 in 2019. This indicates that, recently, the soya bean seed market has become more concentrated with a few growers dominating the market. This is further supported by the reduction in the number of varieties sold from 7 to 5 as discussed earlier. In the case of cowpea seed, the level of market concentration steadily became more competitive. In 2021, the HHI scores remained "low" at 1,524 though it was a decline from 1,824 in 2019. These scores are consistent with the general increase in the number of active seed growers as presented earlier in Table 9. The number of seed growers increased for maize, rice, and cowpea seed. Since none of the seed growers for these crops in the TASAI study was dominant, the seed markets for these three crops were competitive.

Table 12: Market concentration (HHI)[a]

Crop	HHI (2019)	HHI (2021)
Maize	883	865
Rice	1,264	518
Soya bean	1,094	2,005
Cowpea	1,824	1,524

a 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 average, 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 (state-owned) entities are still active players in the marketing and sale of certified seed. Public seed companies are expected to play a critical role in meeting farmer demand for varieties that private seed companies deem less profitable. In addition to seed production, public companies may support other national objectives, such as university training and research. However, these state-owned companies may benefit from preferential treatment, less stringent enforcement of regulations, greater access to competitor information, and indirect production subsidies. Collectively, public seed companies tend to receive unfair advantages that are not necessarily awarded to purely private seed companies.

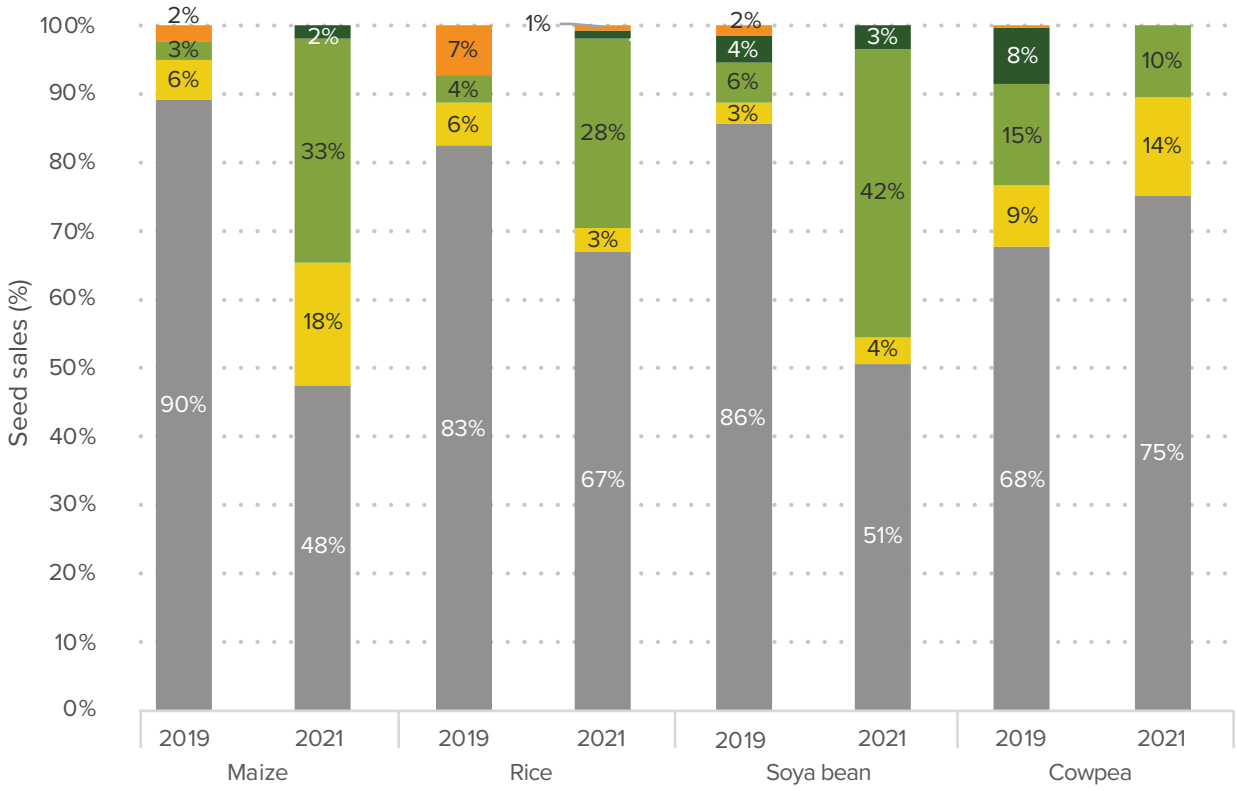
In Ghana, no public entities were involved in producing and marketing of certified seed. Certified seed production and marketing were typically carried out by private seed companies/producers.

SEED SALES TO DIFFERENT CATEGORIES OF BUYERS

The TASAI study tracked five different categories of seed buyers in Ghana in 2021: agro-dealers under the PFJ program; agro-dealers not under the PFJ program; farmers; NGOs; and other buyers.

Figure 4 illustrates seed sales through each category of buyers. Despite the decline in maize, rice, and soya bean sales through the PFJ program from 2019 to 2021, agro-dealers under the PFJ program remained the top buyers of seed for all crops in that time period. For maize, rice, and soya bean crops, the decline in sales through PFJ was followed by an increase in direct sales to farmers. In 2021, 48% of maize seed was sold through PFJ, a decline from 90% in 2019. This reduction can be attributed to the government's increased focus on hybrid maize varieties (which are typically imported into Ghana from elsewhere) as opposed to OPVs which are typically produced by the country's seed growers). The decline for rice may be explained by the fact that we did not reach the targeted number of rice growers. In addition, the decline in sales to the PFJ program was partly due to the delayed payments to the seed growers in 2020. These delays disincentivized sales to the program in 2021. The story of cowpea seed sales was different. In 2021, 75% of cowpea seed was sold to agro-dealers of the PFJ program (compared to 68% in 2019).

Figure 4: Seed sales by category of buyers



SEED IMPORT AND EXPORT PROCESS

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 the import process in days is measured as the sum of the number of days used to obtain import documentation (import permit, phytosanitary certificates, and an International Orange Certificate[12], if applicable) and the number of days to clear seed at the border. It excludes transportation time.

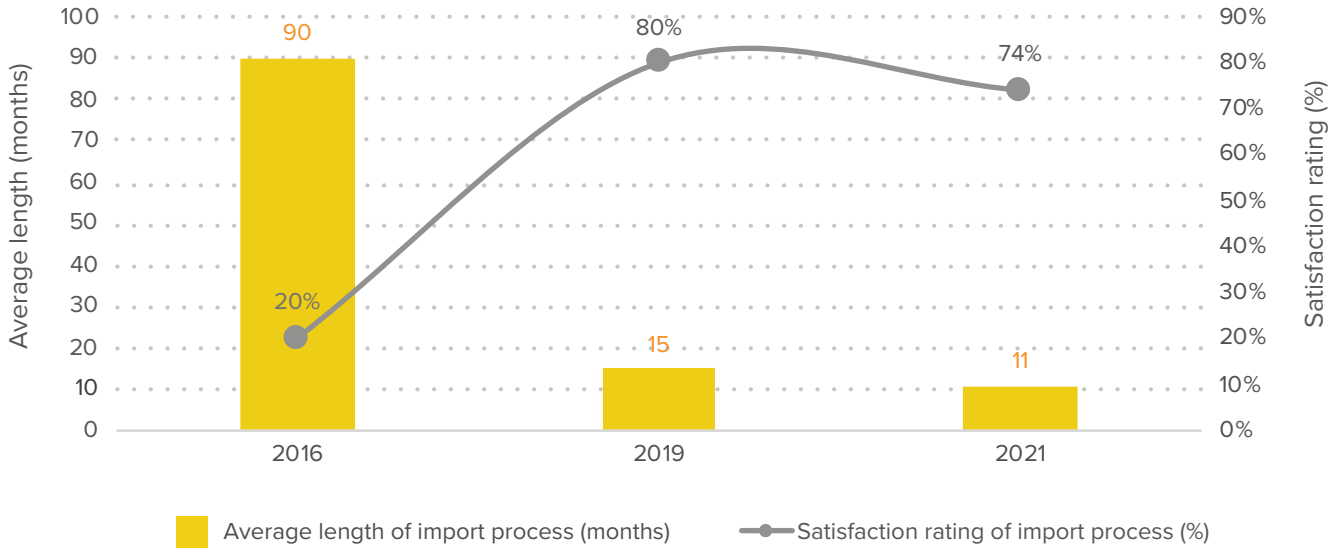
In Ghana, the seed import process starts when a company submits an application (accompanied by an invoice or proforma) to the PPRSD which declares intent to import a certain variety (or varieties). Upon receiving the application, the PPRSD conducts several checks, including a Pest Risk Analysis. If all checks are cleared, an import permit is issued for a specific quantity and weight of the variety.

12 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.

Seed companies reported that the average length of the import process in 2021 was 11 days, broken down as an average of 6.8 days to obtain the import permit and supporting documents, and an average of 4.4 days to clear the seed at the border (Figure 5). The import process duration in 2021 was a slight decrease from the 15 days reported in 2019. Despite the small positive change, seed company satisfaction ratings of the import process declined slightly from excellent (80%) in 2019 to "good" (74%) in 2021.

Companies imported certified seed for maize and rice in 2021. The aggregate volumes imported were 18,130 MT of maize and 5,016 MT of rice. The imported maize seed were hybrid varieties and were for the PFJ program. Maize seed imports originated from Belarus, Brazil, France, India, Malawi, Nigeria, South Africa, Thailand, Turkey, USA, and Zimbabwe. Most of the seed was imported by businesses that were not registered seed growers but seed traders who mainly imported maize hybrids and vegetable seeds for sale. Some of them also bought seed from seed growers and sold seed directly to farmers. Rice seed was imported from Cote d'Ivoire and India. Ghana did not export any seed for the four crops in 2016, 2019, and 2021. It is worth noting that the volume of seed imports increased since the launch of PFJ in 2018. Maize seed imports increased from 2,224 MT in 2019 to 18,130 MT in 2021. Rice seed imports reached 5,016 MT in 2021 (compared to none in 2019). The implications on local seed production and sales are not clear.

Figure 5: Average length and satisfaction rating of import process



SEED POLICY AND REGULATIONS

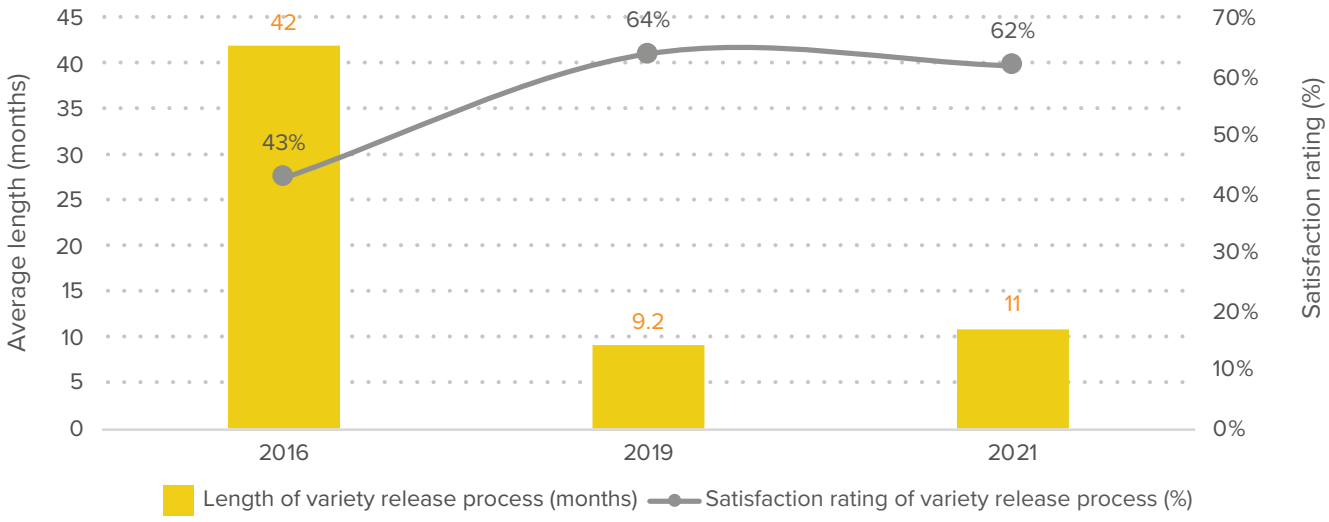
LENGTH OF VARIETY RELEASE PROCESS

Plant variety release constitutes the process by which new varieties undergo various tests for yield including the test for Value for Cultivation and Use (VCU) and the test for Distinctness, Uniformity, and Stability (DUS). Varieties that perform satisfactorily in these tests are approved for release by the National Variety Release and Registration Committee (NVRCC). A vibrant seed sector has a functional variety release system that is well recognized, navigated, and followed by the relevant actors. Lengthy and/or costly variety release processes can limit the number of varieties that are released, 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 spent in developing the variety by the breeder.

In Ghana, breeders apply to the NVRRC for a variety to be released. The variety then goes through the DUS and VCU/ National Performance Trials (NPT) tests, and, depending on the outcome of the trials, the NVRRC approves or rejects the release of the variety. The NVRRC inspects crops at both vegetative and mature stages in a single inspection meeting and this could be done within 6 months. The breeder staggers the establishment of the test plots such that the vegetative stage and the reproductive stage are both available for inspection at the same time. This is done during the cropping season which lasts about 6 months. However, delays sometimes occur if a crop in the test plot fails, and the plot must be established again. Delays also happen when applicants' institutions cannot cover the cost of inspecting the variety test plots or the breeder's presentation of the data from the tests. When the variety is released, the NVRRC presents its report to the NSC for final approval of the variety. The breeder is notified accordingly, and the variety is officially registered in the catalogue of crop varieties released and registered. According to the DCS, the current national variety catalogue is yet to be validated so that it can be published. Importantly, all varieties released in Ghana have been added to the regional variety catalogue (CEDEAO-UEMOA-CILSS 2021).

In 2016, the average length of the variety release process was 42 months, with a seed company satisfaction rating of 43% (Figure 6). In 2019, there was a major decrease in the average length of the process to 9.2 months, while satisfaction ratings shot up to 64%. In 2021, the average length increased slightly to 11 months, resulting in a small drop in seed companies' satisfaction rating (62%).

Figure 6: Average length of variety release process



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 cost of variety release by public breeders includes the cost of the DUS and VCU tests as well as transport and allowances for the NVRRC members to visit field sites, which usually involves two visits for each variety. In 2021, the average cost of variety release was GHC265,000 (US$ 31,800) for maize, GHC262,000 (US$ 31,440) for rice, GHC215,000 (US$ 25,800) for soya bean, and GHC215,000 (US$ 25,800) for cowpea. As shown in Table 13, these figures represent a significant reduction in the cost of variety release between 2019 and 2021. Nevertheless, the cost of releasing a variety in Ghana remains very relatively high, as voiced by the breeders interviewed and when compared with the variety release cost in other countries studied by TASAI.[13] Breeders reported that the high cost of variety release was also a challenge. Specifically, breeders said that they were required to pay the transport costs for several members of the NVRRC. However, according to the GSID, this is being addressed by the NSC. The NSC has proposed to reduce the number of visits to one to reduce variety release process costs.

Table 13: Average cost of variety release process

Crop	Average cost reported in US$ (2019)	Average cost reported in US$[a] (2021)
Maize	53,050	31,800
Rice	46,500	31,440
Soya bean	36,000	25,800
Cowpea	29,233	25,800

a An exchange rate of 1GHC = 0.12 USD was used.

13 See TASAI Dashboard for these comparisons.

STATUS AND IMPLEMENTATION OF NATIONAL SEED POLICY FRAMEWORK

Well-functioning formal seed systems have effective coordinating institutions that work well together. They follow rules and procedures stipulated in clearly defined and regularly updated legal instruments. Ghana's seed regulatory framework comprises the national seed policy, a seed law (Republic of Ghana 2010), and the seed regulations guiding the seed law's implementation. A policy is a statement of intent or course of action adopted by a government to achieve long-term goals. Laws provide regulatory frameworks for policies. Regulations provide the procedures and modalities for the implementation of laws. Table 14 lists the key seed policy instruments in Ghana.

Table 14: Key seed policy instruments in Ghana

Instrument	Description
National Seed Policy	The 2013 National Seed Policy establishes the road map by which all plans, strategies, and actions pertaining to Ghana's seed sector are to be guided. It states priorities and allocates roles and responsibilities to identified partners. It identifies key issues to be addressed as well as the most suitable options for addressing the issues.
National Seed Plan	The National Seed Plan is a plan for the implementation of the National Seed Policy.
Plants and Fertilizer Act 2010, (Act 803)	The seed law provides the legal basis and framework for all aspects of the seed business.
Seeds (Certification and Standards) Regulations of 2018 (l.i. 2363)	The regulations are the legal tools for the enforcement of the seed law. The main purpose of the Regulations is to safeguard the interests of farmers against the use of poor-quality seed.
Plant Variety Protection Act, 2020, (Act 1050)	This Act outlines the conditions of a variety, application, protection, and duration of plant breeders' rights

Ghana's **National Seed Policy** took effect on 1 August 2013 (Republic of Ghana 2013). The policy provides the general direction for the seed sector in the country. It outlines the main objectives for the following areas: research and development, seed production, biotechnology for crop improvement, the informal seed sector, seed marketing and distribution, seed importation and exportation, agricultural extension, seed conditioning and storage, seed regulatory framework, and private sector development. The detailed implementation plan for the policy is outlined in the National Seed Plan.

The **National Seed Plan** is the basic document which specifies how the National Seed Policy's objectives will be realized (Republic of Ghana 2015). Key interventions of the plan include: (1) strengthening the private seed sector's ability to lead the commercial components of the seed sector; (2) addressing the needs of the informal seed sector, seed security, and the seed needs of traditional food crops; and (3) ensuring effective oversight and coordination of the seed industry by strengthening the secretariat of the National Seed Council.

The Plants and Fertilizer Act, 2010 (ACT 803) provides a legal basis and framework for all aspects of the formal seed system in Ghana. It was passed by parliament in 2020 and assented to by the President on 6 September 2010 (Republic of Ghana 2010). The Act has three technical parts: Part One - Plant Protection, Part Two – Seeds, and Part Three - Fertilizer Control. Part 2 of the Act established the PPRSD and the NSC as implementing bodies. The PPRSD, a directorate in MOFA, is responsible for the import and export of plant materials, seed inspection and surveillance, quality control and certification. These mandates are implemented by the GSID and the Plant Quarantine Division (PQD), both of which under the PPRSD. The DCS coordinates seed policy matters and the activities of the NVRRC.

The Seeds (Certification and Standards) Regulations, 2018 (l.i. 2363) is the legal tool for the enforcement of Part Two of the Plants and Fertilizer Act, 2010 (Act 803) related to seeds. The Regulations were gazetted on 20 November 2018 and came into force on 18 December 2018 (ROG 2018).

The Plant Variety Protection Act, 2020 (Act 1050) provides a legal framework to protect the rights of plant breeders. Act 1050 was passed in November 2020 and gazetted on 29 December 2020 (ROG 2020a).

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 seeds 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.

The GSID leads seed law and seed regulation implementation in Ghana. It is responsible for registering seed growers, dealers, cleaners,[14] importers, and exporters as well as managing all import and export services (documentation, seed inspection and certification, and monitoring seed production). The law requires that all seed be processed and labeled before being marketed to farmers.

Implementation of the ECOWAS Regional Seed Regulations: The study assessed four key areas of implementation required under the Economic Community of West African States (ECOWAS) regulations: i) setting up a national seed committee; ii) issuing a decree for seed import and export; iii) updating the National Variety Catalogue; and iv) creating a seed support fund. Of these four elements, the first three have been implemented. Ghana's national seed committee has been established. The Plant Quarantine Division of the PPRSD ensures that the procedures for the import and export of plants and plant materials specified under Part One of the Plants and Fertilizer Act, 2010 (Act 803) are strictly followed. The variety catalogue was up to date as of 2019, and the variety release procedures have been harmonized with ECOWAS requirements. The fourth element of the regulations, the seed sector fund, has been set up in Ghana but is not yet operational. In addition to the above, standards governing seed certification as well as field and laboratory inspection have been harmonized with ECOWAS standards.

Seed growers considered the degree of enforcement of the seed regulations to be "good" in 2021 (78%) and in 2019 (72%). This represents a solid improvement from the rating in 2016 (56%). The high ratings in 2019 and 2021 can be attributed to the passing and subsequent implementation of the Seed Regulations in 2018.

14 Seed cleaners are mentioned in the Act, but they are not defined. However, by "seed cleaning", the law refers to seed processing.

EFFORTS TO ERADICATE COUNTERFEIT SEED

Counterfeit seed threatens the seed sector in two important ways. First, seeds of inferior quality that are falsely labeled as certified seed may cause farmers to lose confidence in certified seed and opt for informal sources that they know. Second, it threatens the success of efforts to increase the adoption of improved varieties, because farmers are not sure which seed is genuine. In many instances, the incidences of counterfeit seed are associated with institutional and NGO markets which are predominant in immature sectors. TASAI tracks the number of suspected 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.

In 2021, the number of suspected cases of counterfeit seed reported to seed companies was 39. This was an increase from the 33 cases reported in 2019 (Table 15). In contrast, no case of counterfeit seed was reported to the PPRSD (the regulatory institution) in 2021. Although, it did have dedicated staff to investigate cases of counterfeit seeds. In general, the PPRSD receives many alerts about suspected cases of counterfeit seed. However, after further investigation, the cases are not always confirmed.

MOFA promotes the following methods to address the sale of counterfeit seed: i) monitoring by GSID seed inspectors; ii) using seed packages with labels and certification tags; iii) requiring seed growers to show evidence of procurement of basic seed; iv) registering seed growers and dealers; and v) creating awareness as part of the PFJ program.

In 2021 seed companies' satisfaction with government efforts to address counterfeit seed was "fair" at 54%. This was a decline from the "good" rating at 74% in 2019 but an improvement from the "poor" rating at 32% observed in 2016. While there were no official reported suspected cases of counterfeit seeds in 2021, growers were aware of the problem. They cited instances where seed businesses supplyied seed to the government without verifying the source of the basic seed and cases where guilty offenders received overly lenient punishment for their offence.

As part of efforts to reduce the incidence of counterfeit seed, NASTAG contracted mPedigree (a technology consulting firm) to produce seed traceability stickers and support the rolling out of a pilot program with three seed companies (Antika Company Ltd. in the Upper West region, IWAD Ghana Ltd in Northeast Region, and M&B Seeds & Agricultural Services Ltd. in Volta region). This effort is ongoing.

Table 15: Seed companies' satisfaction rating of government efforts to address counterfeit seed

Indicators	2016	2019	2021
Number of suspected cases of counterfeit seed (reported to seed companies)	MD[a]	33	39
Number of cases of counterfeit seed (government)	MD	MD	0
Seed industry satisfaction with government effort to address counterfeit seed (out of 100%)	32%	74%	54%

extremely poor | poor | fair | good | excellent

a "MD" refers to missing data.

USE OF GOVERNMENT SUBSIDIES

Seed subsidies are intended as a short or medium-term measure to encourage farmers to adopt quality seed of 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. It may foster private sector, value chain development and provide incentives for humanitarian seed aid or it may create unsustainable business models in the seed sector.

Planting for Food Jobs (PFJ) is flagship government program that launched in April 2017 to target smallholder farmers through seed (maize, rice, soya bean, and cowpea) and fertilizer subsidies. Since its inception in April 2017, annual funding for the program has increased.[15] The most recent phase of the program provides extension services and marketing support (Pauw 2022). In 2021, the cost of the subsidy was GH₵ 497,583,826.00 (US$ 59,710,059) out of which 42% was spent on seed and rest on fertilizer. By May 2021, approximately 1.7 million out of a target 2 million farmers had been registered for the program.[16]

Annually, participating growers respond to an expression of interest call to participate in the PFJ program. The companies submit their proposals to the DCS. Then an evaluation team comprised of procurement officers reviews the proposals and selects eligible companies to participate in the program. Selected growers receive allocations to distribute seed through their input dealers based on the total quantity of consignment to be distributed to farmers in that particular year. Records of the quantity of seeds and fertilizers distributed to the dealers are submitted to DCS for processing and to the Ministry of Finance for payment. The prices for the seed supplied to PFJ are determined by assessing the production costs, followed by negotiations between government and private growers. According to the DCS, the subsidy program made inputs more accessible to farmers who can now choose from among multiple varieties supplied through the program.

In 2021, 65% of the surveyed seed growers had a positive opinion about the subsidy program, against 20% (neutral opinion) and 15% (negative opinion). Those with a positive opinion mentioned that it has raised awareness of the importance of certified seed, ready market (government), etc. Furthermore, this demand from the government indirectly pushed seed companies into demanding basic seed from the different sources.

TASAI tracks seed growers' satisfaction with the implementation of the PFJ program with respect to the openness and transparency and the predictability of the seed procurement process. In 2021, the satisfaction ratings for all three aspects of the subsidy program declined from those of 2019 particularly the efficiency of payment which declined to "poor" (32%) from "fair" (43%) in 2019 (Table 16). According to seed growers of the TASAI study, the major reasons for the low rating on efficiency of payments are delays despite the contract agreement that they would be paid within three months. In some instances, the program still owed seed growers for purchases made in the past two years. A recent evaluation of the PFJ program corroborates these results (Pauw 2022). Although the evaluation show that that maize and rice production levels were more than 40% higher as a result of PFJ, there were challenges of targeting of the intended resource poor smallholders and women, because the program was universally accessible. In addition, nearly 5 years since the launch of the program, it lacks a comprehensive monitoring and evaluation system.

15 Projected funding increased from GHC 189.5 million to 1, 571 in 2022. The number of beneficiaries increased from 202,000 in 2017 to 1,736,510 in 2020 (Pauw 2022).

16 "MoFA targets 2 million farmers for 2021 PFJ," Graphic Online, Communications Group Limited., accessed on December 6, 2022, https://www.graphic.com.gh/news/general-news/mofa-targets-2-million-farmers-for-2021-pfj.html

Table 16: Seed companies' opinion of the implementation of the government subsidy program

Aspect of the government seed subsidy program	Rating (out of 100%)	
	2019	2021
Openness and transparency of the seed procurement process	67%	60%
Predictability of the seed procurement process	60%	53%
Efficiency of payments	43%	32%

extremely poor | poor | fair | good | excellent

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. Membership for national seed associations typically includes seed companies, seed growers, seed cooperatives, seed associations, individual seed producers, and (at times) agro-dealers.

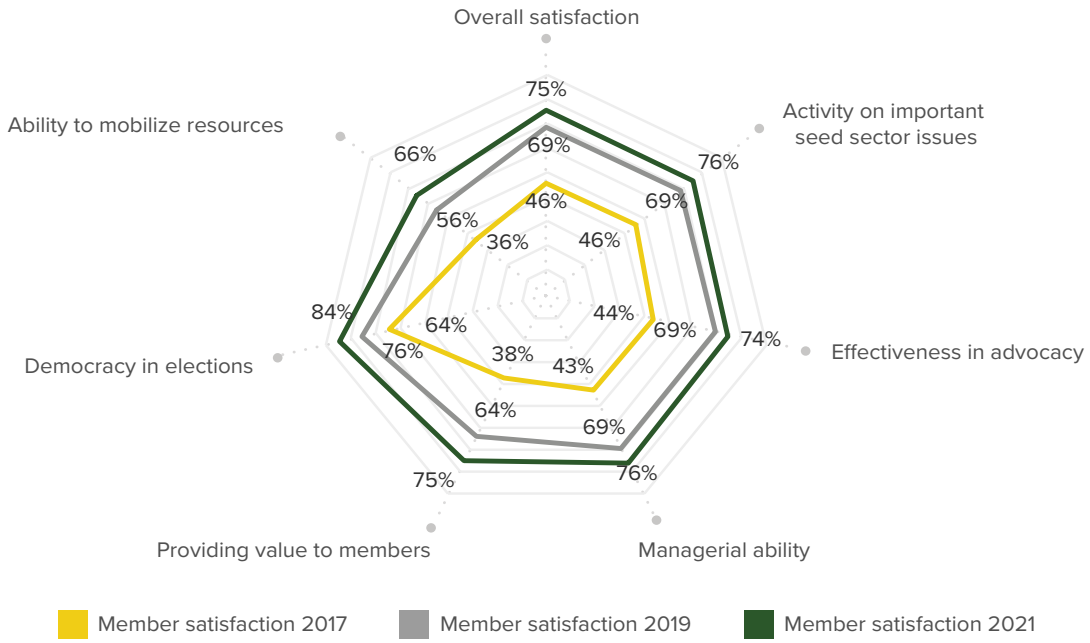
The National Seed Trade Association of Ghana (NASTAG) was established in 2016. NASTAG is affiliated to the African Seed Trade Association (AFSTA) and is represented in the NSC. Currently, NASTAG has 58 members who represent different actors across the seed value chain. Members include seed companies, agricultural input traders, NGOs involved in extension services, and research institutions. NASTAG has 15 detailed objectives summarized into four broad categories: i) building the capacities of members for business effectiveness and competitiveness; ii) advocating for national, regional, and global seed enterprises; iii) communicating effectively among members and stakeholders; and iv) establishing a solid financial, representative, accountable and sustainable association (NASTAG 2020).

The seed companies interviewed included 30 NASTAG members, who were asked to rate their satisfaction with the association's performance across seven performance indicators, presented in Figure 7. In 2021, members' ratings improved across all seven areas. This is in line with the steady improvements recorded since 2016 and may be attributed to NASTAG's outreach programs and other activities. NASTAG's activities included the folllowing: (1) supplying certified seed under PFJ in 2021 to all the regions of Ghana, and (2) organizing district level seed and input fairs in four districts of the Northern region (Wa Municipal in the Upper West Region, Sisala East Municipal in the Upper West Region, Sawla-Tuna-Kalba District in the Savannah Region, and Mumprugu-Moaduguri District in the Northeast Region) to promote the use of certified seed. NASTAG also sensitized farmers on the use of quality seed via local radio stations across the country.

Over the last three years, NASTAG has registered several notable achievements. In collaboration with other seed sector actors, NASTAG initiated and convened dialogues that led to the passing of the Plant Variety Protection Act in 2020. In collaboration with the NSC and under the auspices of MoFA, the association also organized the 2nd Ghana Seed Business and Networking Forum dubbed "SEEDLINK 2021." Under the USAID Ghana Inclusive Agricultural Transformation Project in collaboration the GIZ MOAP projects, NASTAG organized three district seed and input fairs to promote the use of certified seeds. NASTAG completed 13 demos. In partnership with input suppliers, these demos aimed to promote members' seeds and teach farmers how to apply fertilizers and crop protection products such as pesticides and herbicides.

NASTAG has identified the following areas as priorities for seed industry reform in Ghana: (i) strengthening government efforts in seed quality assurance and improving seed companies' capacities in seed quality control, and (ii) promoting newly released varieties and farmer awareness of the importance of improved seed and enhancing consumer protection.

Figure 7: Members' opinion of NASTAG



ADEQUACY OF SEED INSPECTORS

Seed inspection services ensure that certified commercial seed meets the regulatory quality standards. Inspection services require 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.

Seed quality assurance in Ghana is performed under the mandate of the GSID established within the PPRSD of MOFA. The GSID provides internal and external quality assurance systems.

In 2021, the GSID employed 45 seed inspectors (10 women and 35 men), all of which are public inspectors. Currently, Ghana has no private inspectors. The number of inspectors remained unchanged from 2019 to 2021. According to the Head of the GSID, up to 100 seed inspectors would be required to cope with the growing number of seed growers. Inspectors would also need to be well resourced to keep pace with the growing number of seed growers. The satisfaction rating for seed inspection services was "good" at 70%. This was a decline from 75% in 2019 but still significantly higher than the "fair" rating (49%) recorded in 2017 (Table 17). This could be attributed to the increased level of employment (22 inspectors), as a result of the PFJ program.

The GSID notes that the main challenge facing the seed inspection services is the lack of vehicles and motorcycles to facilitate the movement of the seed inspectors to the seed fields. To improve its efficiency, the GSID has adopted several digital tools, including GPS-enabled devices to read the coordinates of fields, and digital cameras to capture images on the field. The GPS-enabled devices facilitate traceability on the fields as well as calculations of the area/ dimensions on the fields, while the digital camera is used to capture evidence and to facilitate examination of field cases. Examples of identified evidence include plant diseases and weeds.

Table 17: Number and rating of the adequacy of seed inspectors

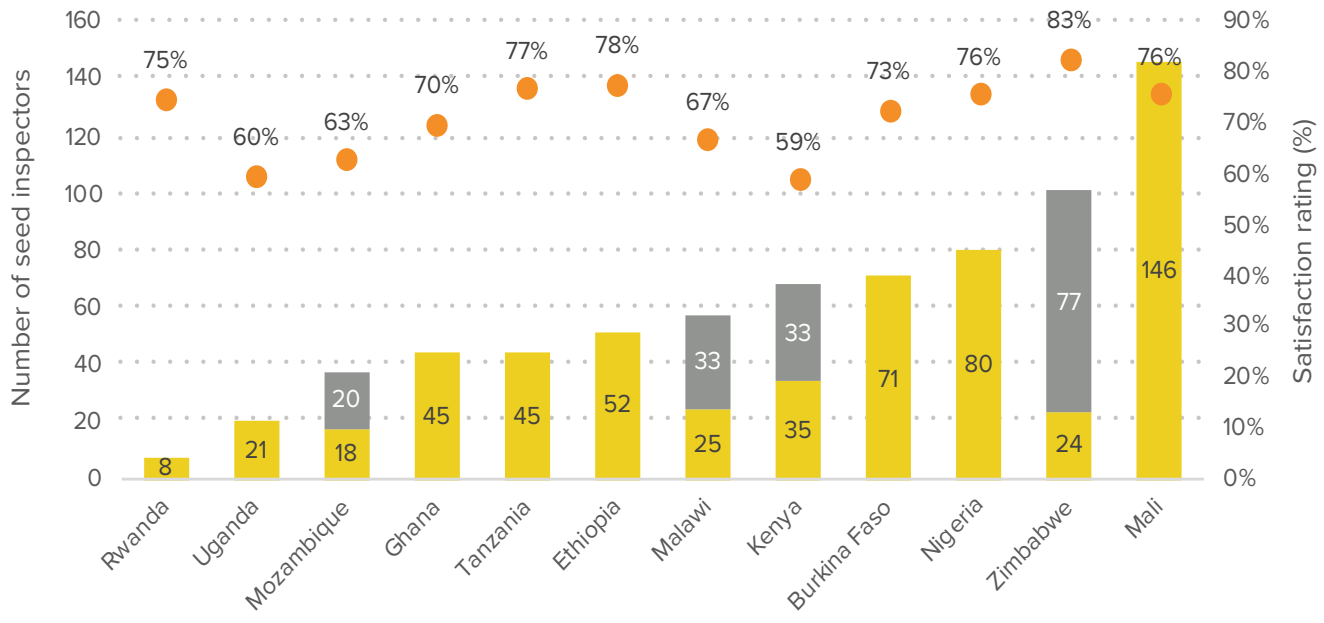
Indicators	2017	2019	2021
Number of public seed inspectors	32	45	45
Number of private seed inspectors	0	0	0
Seed industry satisfaction with seed inspectors (out of 100%)	49%	75%	70%

extremely poor | poor | fair | good | excellent

Figure 8 shows the number of seed inspectors in countries recently studied by TASAI. Mali, Burkina Faso, and Nigeria have the highest number of public inspectors.[17] Public seed inspection services are complemented by private or authorized seed inspectors in Kenya and Mozambique.

17 Data ranges from years 2020 to 2022.

Figure 8: Number and satisfaction rating of seed inspectors in Africa



SERVICE TO SMALLHOLDER FARMERS

ADEQUACY OF EXTENSION SERVICES

Well-functioning agricultural extension services are critical to the successful adoption and utilization of improved seeds 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 seeds 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.

In Ghana, public extension services operate under the Directorate of Agricultural Extension Services (DAES) in MOFA. Currently, agricultural extension services range from top-down and to participatory approaches like the World Bank's Training and Visit (T&V), commodity participatory approaches, farmer field schools (FFSs), and innovative ICT-based approaches which provide advice to farmers online. ICT-based approaches enable agricultural extension officers to send information to and receive feedback from individuals and/or groups via WhatsApp. Groups are often formed based on location or type of commodity. Moreover, agricultural programs are discussed on community radio stations, where farmers can phone in to ask questions and receive answers from the District Agricultural Officer and the Agricultural Extension Officer. For many years, MOFA's national and local staff implemented extension programs (GFRAS-Ghana).

According to DAES, MOFA employed 4,559 public extension officers (864 women and 3,695 men) in 2021. This includes the 2,700 extension officers that were employed in 2019 as part of the PFJ program. Table 18 shows that the number of private extension officers reduced from 60 (7 women and 53 men) in 2019 to 48 (5 women and 43 men) in 2021. The reduction in the number of private extension officers who conducted agricultural extension activities can be attributed to two factors. First, private extension officers moved into the public sector as they were seeking employment during recruitment of public extension officers under PFJ. Additionally, cost cutting measures in the era of high production cost led to staff retrenchment in the private sector.

According to 2018/19 Agricultural Census (ROG 2020b), Ghana had 2,585,531 agricultural households in 2017/18. Based on the extrapolation of the population growth rate (4.3%) over a two-year period, the number agricultural households in 2021 increased to 2,696,709. The ratio of public extension officers to agricultural households was 1:592 which was a slight improvement from the ratio of 1:604 in 2019 and 1:1,000 in 2017 (Table 18). Despite the improvement in the ratio, the seed industry satisfaction rating decreased from 61% (good) in 2019 to 59% (fair) in 2021. This may be attributed to the increase in the number of registered seed growers in 2021, which was not matched by the increase in the number of extension officers.

The government uses innovative tools to deliver extension services to farmers. Agricultural extension officers use WhatsApp groups to send information to farmers and receive feedback. The digital classroom system relies on educational apps e.g., use of Zoom and Google apps such as Crop Farmers App, AgriApp, and OneSoil and websites to enhance learning. Film video shows in communities are used to disseminate information on good agricultural practices. While community radio programs are used to discuss opportunities and expectations around agricultural programs, agricultural information centers avail information to farmers in the form of books and manuals. An agricultural extension officer is always in the facility and addresses farmers' concerns.

Table 18: Number and adequacy of agricultural extension services

Indicators	2017	2019	2021
Number of public extension officers employed by the government	2,484	4,286	4,559
Number of private extension officers employed by seed companies	27	60	48
Total number of extension officers	2,511	4,346	4,607
Ratio of public extension officers to agricultural households	1:1,000	1:604	1:592
Seed industry satisfaction with extension officers (out of 100%)	52%	61%	59%
Interpretation of satisfaction	Fair	Good	Fair

CONCENTRATION OF THE AGRO-DEALER NETWORK

Agro-dealers play a key role in Africa's seed distribution operations, 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. TASAI tracks the number of agro-dealers and, where possible, disaggregates registered from non-registered agro-dealers. This indicator is not crop-specific.

In Ghana, registering as an agro-dealers follows the steps below:

- Applicant to register business with the Registrar General's Department.
- Applicant to register business with the MOFA-PPRSD Regional Office, where the business is located. This is done after the initial registration with the Registrar General.
- An officer from the PPRSD to inspect the facility to record GPS location and suitability for storing fertilizers.
- PPRSD to issue a (renewable) license valid for two years.

In 2021, there were 2,258 registered agro-dealers in Ghana compared to the 3,543 agro-dealers in 2019. In addition, seed companies worked with an average of 38 agro-dealers. The PFJ program strengthened the relationship between seed growers and agro-dealers, as most seed was distributed through agro-dealers. The decline in the number of agro-dealers in 2021 is attributed to the government's effort to deregister agro-dealers without a valid license (PPRSD 2022). The drop also resulted in a higher ratio of agro-dealers per agricultural household, changing from 1:730 in 2019 to 1:1,194 in 2021. The current ratio of agro-dealers to farming households is 1:1,194 (Table 19).

The PPRSD provides training and capacity-building support to agro-dealers. While the PPRSD does not track the percentage of women participants, they indicated that they felt that women participated fully in all of their programs.

Table 19: Number of agro-dealers and satisfaction rating of the agro-dealer network

Indicator	2017	2019	2021
Number of agro-dealers	3,153	3,543	2,258
Ratio of agro-dealers to agricultural households	1:788	1:730	1:1,194
Average number of agro-dealers per seed company	186	115	38
Seed industry satisfaction with agro-dealer network (out of 100%)	64%	63%	63%

extremely poor | poor | fair | good | excellent

AVAILABILITY OF SEED IN SMALL PACKAGES

Since 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. TASAI tracks the percentage of seed sold in different package sizes, i.e., 2 kg and below, 2-10 kg; 10-25 kg, and above 25 kg.

As shown in Figure 9, most of the cowpea (71%) and maize seed (55%) were packaged in sizes of 2kg or less. Maize is widely produced by both smallholder and large-scale farmers. The packaging for medium and large-scale farmers was made up of 18% (2-10 kg) and 27% (more than 25 kg). In the case of cowpea, this is because cowpea seed production is undertaken mostly by smallholder farmers. The remaining 29% was sold in larger package sizes, catering to a few medium-scale producers. The results for rice are consistent with the findings in 2019 which indicated that 95% of rice seed was sold in packages weighing over 25 kg. Most of the soya bean seed (63%) was sold in large packages of 25 kg and above. Soya bean production in Ghana is mainly a commercial enterprise, so the main buyers of soya bean seed are large commercial farmers, most of whom require package sizes of 10-25 kg or 25 kg and above. Similarly, 73% of rice seed was packaged in bags weighing over 25 kg, as most rice is produced by large scale commercial enterprises. The remaining 27% of rice seed was sold in smaller packages to cater to smallholder producers.

All the seed growers surveyed (100%) included their contact information on/inside the seed package.

Figure 10 compares percentage of maize seed sold in small packages in 12 African countries.[18] Tanzania (99%), Rwanda (87%), and Kenya (80%) sell most of the maize seed in packages of 2 kg or less. In comparison, about half of maize seed (55%) in Ghana is sold in small packages.

18 Data ranges from year 2020 to 2022.

Figure 9: Percentage of seed sold in different package sizes (2021)

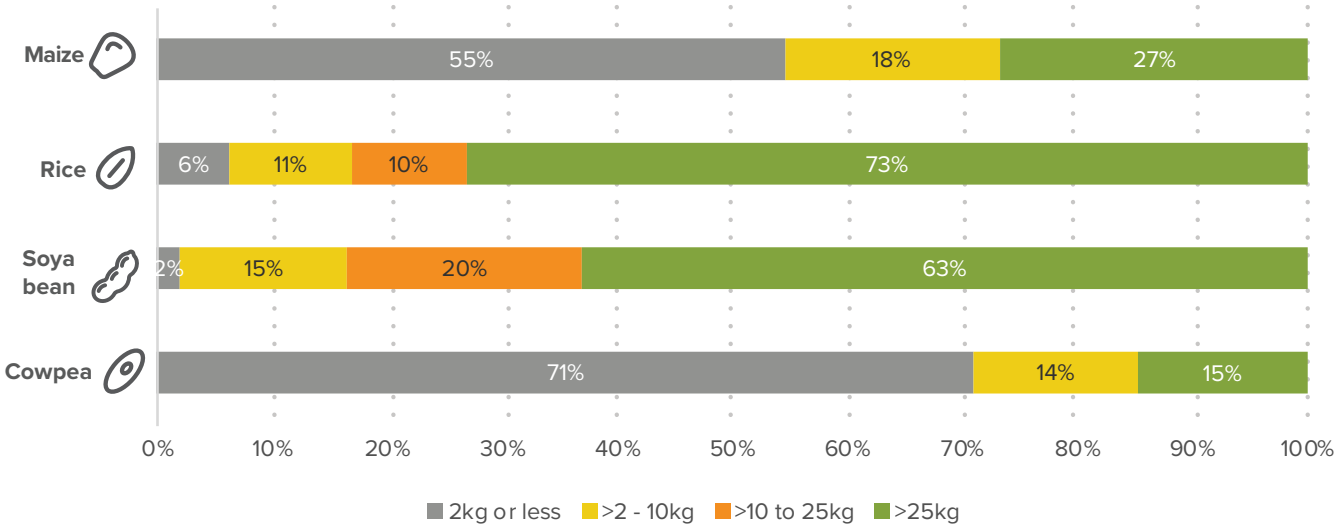
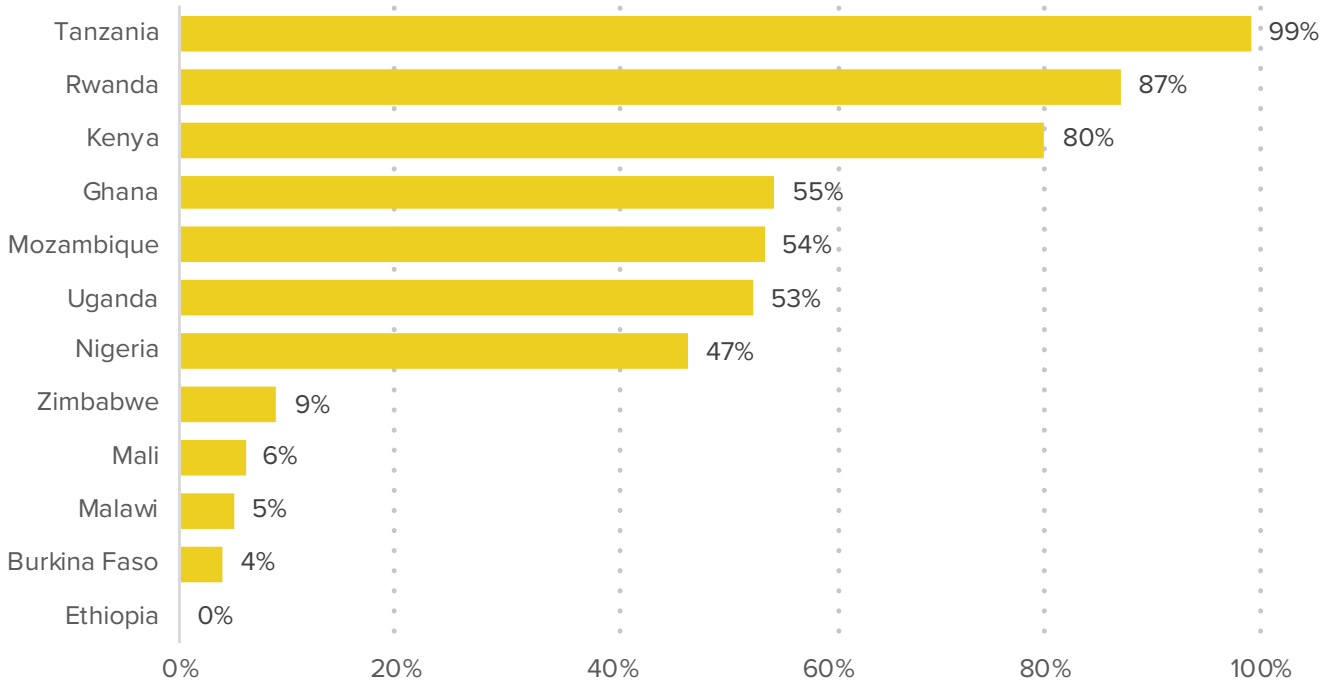


Figure 10: Percentage maize seed sold in small packages (2 kg or less)



SEED AND GRAIN PRICES

The seed and grain prices at the time of planting are a good measure of the affordability of improved seed. These data points are 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 that resource-poor farmers will purchase certified seed. This indicator tracks the retail price of seed (at the agro-dealer level) vis-à-vis the market price of grain at the time of planting.

In 2021, the seed prices for all four focus crops were higher than the grain prices. Seed growers expressed their concerns about the high prices of basic seed, herbicides, pesticides and labor which increased over the period. Hybrid maize seed costs were more than three times the price of maize grain. The prices of OPV maize, rice, and soya bean seeds were nearly the same as the grain price. However, the price of cowpea grain was about half the price of seed. The increase in seed and grain prices may be attributed to the increase in production input prices in 2021. Price adjustments for subsidized fertilizers under the 2021 Planting for Food and Jobs Campaign (MOFA 2021) resulted in significant price hikes.

The PFJ program is administered as a price subsidy. In 2021 the percentage of the price subsidy was 15%. This was a reduction from the 50% price subsidy when the PFJ began in 2017. In general, seed growers and farmers purchased fertilizers at higher prices in 2021. In 2021, the price of hybrid maize seed was GH₵ 18.00 and this was constant from prices in 2019. Over the two years, the prices for OPV maize, rice, and soya bean increased slightly (Table 20). Cowpea seed price increased from GH₵ 7.00 in 2019 to GH₵ 10.00 in 2021.

Table 20: Seed and grain prices

Crop	Average seed prices (GH₵/kg)[19]			Average grain prices (GH₵/kg)		
	2017	2019	2021	2017	2019	2021
Maize (hybrid)	8.54	18.00	18.00	MD[a]	1.41	5.00
Maize (OPV)	5.82	4.20	6.00	MD	1.41	5.00
Rice	3.88	3.80	6.00	MD	3.96	5.00
Soya bean	7.00	4.60	8.00	MD	2.46	7.00
Cowpea	8.15	7.00	10.00	MD	4.0	5.00

a "MD" refers to missing data.

19 Seed prices for 2017 were converted back to local currency using a rate of 3.882690 based on Ghana's exchange rate history: "US dollar to Ghana cedi exchange rate history," CakProfi, Online Calculator, accessed December 6, 2022, https://www.calcprofi.com/exchange-rate-history-us-dollar-to-ghana-cedi.html

CONCLUSION

Ghana's formal seed system is in the early growth stage of development (Ariga et al. 2019). The early growth stage is characterized by established breeding programs and an evolving seed policy environment. Seed companies and growers produce and sell a limited range of staple crops. While governments and NGOs still play a significant role in the sector, the agro-dealers network that supports the distribution of seeds to smallholder farmers has declined over time. The percentage of farmers using hybrid maize in 2019 and 2020 was 32.4% and 22.5% respectively (Ifie et al. 2022) and thus, there is ample opportunity for the sector to grow. While the 2022 TASAI Ghana study highlights areas for improvement, it has also found positive developments in the seed industry, most of which result from recent government initiatives.

Under the **research and development** category, the number of varieties released was stagnant for cowpea and soya bean. This stagnation was attributed to insufficient funding and a lack of breeding facilities and equipment. However, in response to the PFJ program, the number of maize and rice varieties released increased since 2018 due to seed growers' heightened demand for basic seed.

In the **industry competitiveness** category, Ghana presented a competitive environment, with a wide range of seed growers involved in producing seed. The HHI figures indicate that maize seed production is the most competitive in the industry, while soya bean seed production is the least competitive. This can be attributed to the PFJ program. Most of the commonly sold varieties are over 10 years old, signaling a low rate of commercialization of newly released varieties.

In Ghana, the requisite **seed policy**, as well as legal and regulatory instruments, are in place, and the implementing institutions are playing their respective roles and functions accordingly. However, to reach optimal functioning, these institutions require more – and regular – public funding and increased human resource capacity. Some positive signs in this area are seed growers' increased satisfaction ratings with the adequacy of seed inspectors, that the National Seed Regulations are in harmony with the ECOWAS Regional Seed Regulations, and that crop varieties released in Ghana are listed in the ECOWAS Crop Variety Catalogue. The PFJ program enhanced the seed sector in Ghana by providing a reliable channel to market certified seed. Although seed growers rated the transparency of the subsidy program as "good" at 60%, this was a decline from the 67% rating in 2019. The satisfaction with the predictability of the procurement process declined from "good" in 2019 to "fair" in 2021. The efficiency of the payment process declined further from the "fair" rating in 2019 to "poor" rating in 2021. The three evaluation measures indicate that the government needs to improve PFJ processes by facilitating a comprehensive monitoring and evaluation of the program.

Institutional support for the seed sector in Ghana is provided by NASTAG and the GSID of MOFA. NASTAG has increased its membership to the current 58 from 32 members in 2017. Members' ratings on the performance of NASTAG in all aspects have increased steadily since 2017. Another important aspect of institutional support is seed inspection, under the mandate of GSID. The number of seed inspectors has remained unchanged since 2019, which is not in keeping with the growing number of producers. Seed growers interviewed by TASAI said that, while GSID staff discharged their duties efficiently, they lacked resources to be fully equipped and mobilized to be more efficient.

In the area of **service to smallholder farmers,** the number of public extension officers increased by 83.5% during 2017-2021, which led to an improvement in the ratio of extension officers to agricultural households. The number of agro-dealers declined as a result of governments' deregistration of agro-dealers without licenses. Seed growers' level of satisfaction with the concentration of agro-dealers remained "good" since 2017, reflecting a healthy collaboration between seed growers and agro-dealers, who are the main distribution conduit for PFJ seed. A large portion of the seeds for maize and cowpea, the crops most widely planted by smallholder farmers, were sold in small packages. As part of the government's efforts to support the extension delivery system, extension officers are employing ICT tools such as digital classrooms.

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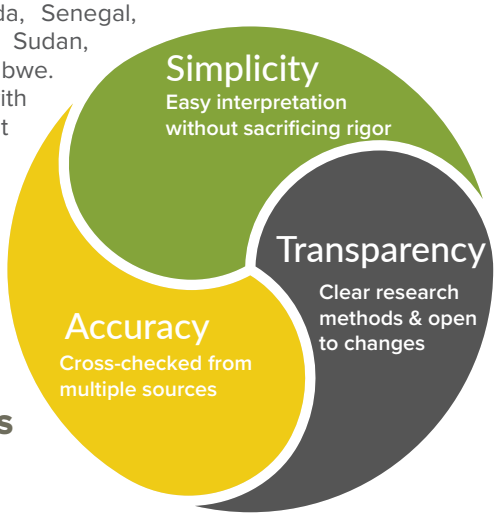
ABOUT TASAI

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. The intended outcome of the index is improved access to locally adapted, affordable, and high-quality seed of improved varieties by smallholder farmers in Sub-Saharan Africa.

To assess the status of the seed industry value chain, TASAI tracks indicators in the following five categories: Research and Development, Industry Competitiveness, Policy and Regulations, Institutional Support and Service to Smallholder Farmers. By the end of 2022, TASAI studies will have been completed in 22 African countries: Burkina Faso, Burundi, the Democratic Republic of Congo, Ethiopia, Ghana, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, South Sudan, 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 approach is guided by the principles of Simplicity, Transparency, and Accuracy.

TASAI PRINCIPLES



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