AGRA
Growing Africa's Agriculture

KIT Royal Tropical Institute

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Acronyms

AFAP	Africa Fertiliser and Agribusiness Partnership
AGRA	Alliance for a Green Revolution in Africa
ASNAPP	Agribusiness in Sustainable Natural African Plant Product
ASWG	Agriculture Sector Working Group
ASTI	Agriculture Science and Technology Indicators
ATT	Agriculture Technology Transfer
AU	African Union
BMFG	Bill and Melinda Gates Foundation
CAADP	Comprehensive Africa Agriculture Development Programme
CIDA	Canadian International Development Agency
CORAF	The West and Central African Council for Agricultural Research and Development
CRI	Crop Research Institute
DCS	Directorate of Crop Services
DHS	Demographic and Health Surveys
ECOWAS	Economic Community of West African States
EGS	Early generation seed
FAO	Food and Agriculture Organization of United Nations
FASDEP	Food and Agriculture Sector Development Policy
GDP	Gross Domestic Product
GH₵	Ghanaian cedi
GIZ	German Development Agency
GLDB	Grains and Legume Development Board
GMO	Genetically modified organism
IITA	The International Institute of Tropical Agriculture
IFDC	International Centre for Fertilizer and Agricultural Development
ISFM	Integrated Soil Fertility Management
ISSER	Institute of Statistical, Social and Economic Research
JSR	Joint Sector Review
KII	Key informant interview
KIT	Royal Tropical Institute
M&E	Monitoring and evaluation
METASIP	Medium Term Agriculture Sector Investment Plan
MIRA	Micro Reforms for African Agribusiness
MOFA	Ministry of Food and Agriculture
NASTAG	National Seed Traders Association Ghana
NSC	National Seed Council
NVRRC	National Variety Release and Registration Committee
ODK	Open Data Kit
OPV	Open-pollinated variety
PASS	Programme for Africa's Seeds Systems
PICS	Purdue Improved Crop Storage
PFJ	Planting for Food and Jobs programme
PIATA	Partnership for Inclusive Agricultural Transformation in Africa
PGRRI	Plant Genetic Resources Research Institute
PPMED	Policy, Planning, Monitoring & Evaluation Department

PPRSD	Plant Protection and Regulatory Services Directorate
PWC	PricewaterhouseCoopers
R&D	Research and development
SACCO	Savings and Credit Cooperative
SeedPAG	Seed Producers Association of Ghana
SARI	Savanna Agricultural Research Institute
SIPMA	The Smallholder Inclusivity and Productivity for Market Access
SIU	Seed Inspection Union
SMEs	Small and medium-sized enterprises
SSTP	Scaling Seeds and Technologies Partnership
TASAI	The African Seed Access Index
USAID	United States Agency for International Development
USD	US dollars
VBAs	Village-based agents
WACCI	West Africa Centre for Crop Improvement

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1 Summary of results and key messages

1.1 Introduction

The Alliance for a Green Revolution in Africa (AGRA) is catalysing and sustaining an inclusive agricultural transformation in Africa by increasing incomes and improving food security for 30 million farming households in 11 focus countries. Since 2006, AGRA and its partners have worked across Africa to deliver proven solutions to smallholder farmers and thousands of African agricultural enterprises. The alliance has built the systems and tools for Africa's agriculture: high quality seeds, better soil health, and access to markets and credit, coupled with stronger farmer organisations and agriculture policies.

AGRA's theory of change is that sustainable agricultural transformation can be facilitated through a combination of:

- Policy and state capability – investments to work with and support governments to strengthen execution and coordination capacities, enhance transparency, accountability and enabling policy environment;
- Systems development – investments to build downstream delivery systems while providing support to local private sector to scale technologies and services for better productivity and incomes; and
- Partnerships – to facilitate alignment between the government and private sector, improving integration and coordination for investments in agriculture.

In Ghana, AGRA's strategy is to catalyse and sustain inclusive agricultural transformation by contributing to:

- The government's need to refine and develop its sector strategy and flagships backed by a strong agriculture sector with effective coordination and implementation capabilities to deliver on this strategy;
- Strengthening regional agriculture coordination platforms to enhance sub-national coordination;
- Strengthening the agriculture sector delivery systems for improved productivity and marketing of produce as well as increased access to finance.

By executing this strategy, AGRA expects to improve food security and increase incomes for at least 600,000 smallholder households in the Brong Ahafo and Northern regions directly, and 1.2 million smallholder farmers indirectly. Deployment of this strategy in Ghana began in the fourth quarter of 2017 and to date, AGRA has invested US$12.6 million (out of US$26 million) against the strategy. With these funds AGRA has invested in the different bodies of work as below:

- In policy and state capability, AGRA is supporting the development and implementation of various policies and regulations according to the government's needs;
- In farmer and systems development, AGRA has set up four consortia in the target regions (Brong Ahafo and Northern regions) focusing on productivity enhancement and market access of cassava, maize, rice and soybean; a fifth consortium focuses on production and dissemination of quality seed under the Planting for Food and Jobs (PFJ) programme.

- Other investments are directed towards seed development, fertilisers, mechanisation and finance.

For the 2019 outcome monitoring, AGRA Ghana elected to focus on two crops – maize and soybean. For the qualitative systems analysis, AGRA selected seed systems and policy and state capability.

1.2 System analysis

Seed system

The seed system in Ghana has been professionalised in the last 10 years, but is still considered to be in an emerging stage. It is estimated that only 20% of the seed is sourced through the formal seed system. The results of the household survey among maize farmers roughly confirms this, and suggest that 18% of farmers purchase their seeds from agro-dealers (27%, if only referring to open-pollinated varieties (OPVs)). In addition, 7% of farmers receive their seeds from the government (22%, if only referring to OPVs). The majority of smallholder farmers give preference to local varieties for staple crops such as maize.

The identified key constraints in the seed system are:

- Variety development: slow release of varieties (dependent on donor projects);
- Seed production: insufficient supply of early generation seed (EGS) and certified seed;
- Seed marketing and distribution: lack of storage facilities; counterfeit seed in markets;
- Seed use: lack of promotion and extension support;
- Policy and regulation: lack of operationalisation of national seed law; low capacity enforcement of seed regulation (seed inspection).

The government flagship campaign PFJ programme is the main driving force behind the current developments in the seed sector. Subsidies for inputs, in particular certified seed, stimulate the demand among farmers. As a result, seed producers are expanding their seed production capacity.

AGRA provided major contributions to the seed system during the period 2008-2017, by supporting the emergence of private seed producers and strengthening the policies and governance of the seed sector. During 2017-2021, AGRA's present support to the seed system is limited to consortia projects targeting smallholder production in the Brong Ahafo and Northern regions. As the consortia projects were just starting, there was little to no effect observed at farm level for the 2018 cropping season, which should be considered as the baseline.

The small and medium-sized enterprises (SMEs) survey revealed that seed companies scored well on financial stability, but business resilience is still weak as most seed enterprises are relatively young. This also explains the fact that human capital and technology can be further strengthened.

Early results and recommendations:

- AGRA has a strong track record of supporting the seed system in Ghana in the past, and is much appreciated by the other development partners and the Ghanaian Government in that respect. Its current contribution to strengthening the seed system under the Partnership for Inclusive Agricultural Transformation in Africa (PIATA) programme is very modest in comparison to previous support efforts. It is important that AGRA makes clear choices about its investments in the seed sector, trying to address niche areas.
- The PFJ campaign is expected to boost the use of certified season in the 2019 and 2020 seasons. Any effects from AGRA's support will be overshadowed by the PFJ campaign, which will make it difficult to attribute changes directly to AGRA.
- AGRA has contributed to the design of the PFJ campaign. It is however essential that AGRA does play the role of being a 'critical friend', i.e. working with the government but also providing constructive feedback on policies when needed. The main impact that AGRA can have is to ensure that the subsidy scheme does not disturb the seed market, but facilitates the development of a competitive and dynamic commercial seed market which offers a choice to farmers, and runs on the principles of demand and supply.

State capability and policy support

Agriculture in Ghana remains characterised by low productivity despite the fact that Ghana has reached the status of a lower middle-income country. In order to increase agricultural productivity, Ghana has internalised the Comprehensive Africa Agriculture Development Programme (CAADP) into its agricultural policy through the Medium Term Agriculture Sector Investment Plan (METASIP). In 2017, the current government launched its flagship PFJ programme) for the period 2018-2021 in order to revive the agricultural sector.

Ghana has been making progress in the coherence and harmonisation of its policy and regulatory framework for the agricultural sector, but its progress towards CAADP goals was limited in 2017. It has improved progress in 2019, and is now on track in achieving the goals.

AGRA has become a trusted partner of the Ghanaian Government, and is one of the main supporters of the agricultural transformation agenda. AGRA also took on a mediating role between the government and the development partners when the new government was installed. AGRA's activities on policy harmonisation – in particular the seed policies – and state capability are deemed as relevant by the state actors.

Early results and recommendations:

- AGRA's activities on policy harmonisation and supporting state capability are deemed very relevant by the state actors. AGRA seeks to align with the government's priorities, such as the flagship PFJ campaign, yet also advises government on improvements it thinks are necessary;
- Most progress was made on the domestication of the Economic Community of West African States (ECOWAS) regulations on seed and fertiliser. However, given the low agricultural value and limited uptake of good agricultural practices, a lot remains to be done to also see the effects of the policies and regulations on improved agricultural productivity;
- Domestication of ECOWAS regulations and their harmonisation with national policy and regulations will be sustainable when these are ratified and passed through parliament. The sustainability of the PFJ results are yet to be seen, depending on the exit strategy of PFJ and government interest after 2020.

1.3 Household survey

A household survey was carried out amongst a group of maize farmers (N=1145) and a separate group of soybean farmers (N=849). Both groups were sampled from the population of farmers benefitting directly from AGRA interventions. The household survey collected data for the 2018 cropping season. Table 1summarises AGRA outcome indicators for maize and soybean farmers, as baseline measurements. These indicators are used to measure progress at the farmer level towards AGRA's goal of catalysing agricultural transformation for increased income and food security.

Table 1: AGRA outcome indicators (2018 cropping season)

Outcome indicator	Maize	Soybean
G2: Average number of months of adequate household food provision	10.5	10.4
G6: Wealth assets index score	-1.111	-1.021
Indicator 1. Average yield (kg/ha)	577	545
3. Rate of application of target improved technologies or management practices (Indicator 14)	58%	12%
4.4 Average distance (minutes) from farmers to agro-dealers (Indicator 15)	47.2	30.6
4. Percent of farmers accessing agricultural advisory extension support services (Indicator 16)	31%	34%
Percent of hectares under improved technologies or management practices (Indicator 20)	56%	10%
Average fertiliser use (Total N + P + K, kg/ha) (Indicator 21)	30	4.
6. Percent of post-harvest losses (at farm level) (Indicator 22)	2%	1%
33. Percent of total household produce sold through structured market facilities/arrangements (Indicator 30)	2%	1%
10. Value of incremental sales as a result of AGRA (crop revenue in US$) (Indicator 36)	US$36	US$108
Ind 37. Percentage of farmers accessing market information (%) (Indicator 37)	1%	0%
13. Percent farmers using financial services of formal institutions (Indicator 43)	15%	14%

Numbering according to the terms of reference. In parenthesis numbering of AGRA's Theory of Change

Only one third of maize and soybean farmers reported to have sufficient food to meet household needs all year round. The majority of smallholder farmers surveyed belong to the lowest quintile of the wealth assets index (89% and 86% of maize and soybean farmers, respectively). It is important to note that the sampled households are amongst the poorest households in Ghana.

The measured maize yield for the 2018 season in Ghana was low at 577 kg/ha. There is not one specific explanation for this low average yield, but farmers reported that 2018 was a bad season due to unreliable rainfall and problems with fall armyworm attacks. The majority of

farmers grew local maize varieties, which produce significantly lower yields than improved varieties (OPVs and hybrids). The reported average yield for soybean for the 2018 season was 545 kg/ha.

The average adoption rate of productivity-enhancing technologies is higher among maize farmers than soybean farmers. Maize farmers apply fertilisers and pesticides to enhance productivity in particular. For soybean, the application of pesticides is the main productivity-enhancing technology that is used by farmers. Improved varieties of soybean were not yet available for the 2018 season; farmers planted solely local varieties.

Post-harvest losses at the farm level were low; the entire crop production was used as there was no quality differentiation, hence no rejections based on inferior quality. The majority of the household produce was sold on spot markets; sales through structured market arrangements were negligible for maize and soybean.

1.4 SME survey

According to the SME survey, the seed companies scored relatively low on permanent employees (146 staff on average of which 9% is permanent; 61% women) and skilled work force. However, this is inherent to the business type that relies on seasonal labour. The two input supply companies (21 staff on average, 33% women) scored higher on permanent employees but lower on female employees. Value chain enterprises also have a relatively low percentage of skilled and female employees, and employ a large number of casual staff (152 staff on average; 27% women).

2 Objectives and scope of the report

The Royal Tropical Institute (KIT) was contracted by AGRA to implement annual outcome monitoring of its activities under PIATA 2017-2021.

The annual outcome surveys have three different, interrelated objectives:

1. Understand AGRA's progress towards desired outcomes, both for internal and external reporting;
    a. Data and insight into the effect of AGRA interventions on its beneficiaries
    b. Insight into sustainable improvement of the performance of agricultural sector support systems
2. Learn about the performance of AGRA interventions to allow for intelligent evidence-based adaptation of implementation;
3. Document lessons learned for improved design of future AGRA, but also external, interventions.

These objectives are realised through a combination of quantitative and qualitative methods, implemented by a team of qualitative and quantitative experts.

The Ghana team consisted of:

- Two international experts in quantitative data collection in agriculture;
- An international expert in qualitative data collection in agriculture;
- A national coordinator of quantitative and qualitative field-data collection in agriculture.

AGRA Ghana selected maize and soybean as priority crops for reporting for 2018. AGRA also selected the seed system and policy and state capability as the priority domains for system analysis.

Primary data was collected by the qualitative team in Accra and Tamale, Ghana, over a period of two weeks in May 2019. For each system, information was collected via key informant interviews (KIIs). Key informants were identified by AGRA, and a small number were 'snowball' referrals. The consultants also attended The African Seed Access Index (TASAI) workshop in Ghana on 30 May, 2019.

Household survey data was collected in the period May-June 2019 based on AGRA beneficiary lists. The sample was determined using multi-stage random sampling, by first randomly selecting geographically spread locations and then randomly selecting beneficiaries within each location. Households were randomly selected from this population, using two-stage clustered sampling. A total of 1,145 households were interviewed for maize and 849 for soybean in Brong Ahafo (maize and soybean) and Northern regions (maize only).

SME surveys were administered to 15 (out of 19) companies and businesses linked to AGRA interventions.

AGRA Ghana made available country programme roadmaps and information related to issued and planned grants. Secondary data and online reports completed the data sources.

This report should be read keeping in mind the limitations of the study. To manage costs, sample sizes of the household data collection effort had to be capped. Also, the SME performance survey was designed for rapid and cost-effective data collection. The system analysis was limited to two systems, and field data collection was limited to one week per system.

The report results should be interpreted with caution. The household data regard the 2018 main cropping season, and should be considered as a baseline for monitoring future change, as the AGRA-PIATA interventions had not been implemented at a scale from which significant results could be expected in the 2018 season. Similarly, the SME performance measurement will serve as a baseline for measuring change over time. The system change studies have made an effort to place the entirety of AGRA investments in a country, and their impacts on the system, in context. However, because of limited time, the field work, could only cover a portion of AGRA's intervention portfolio.

Part I: Qualitative systems analysis

3 Introduction system analysis

3.1 Agricultural policy context

Ghana attained the status of lower middle-income country in 2010, following the discovery of major offshore oil reserves in 2007. Nevertheless, agriculture continues to be a key pillar of Ghana's economy, accounting for nearly 20% of the national Gross Domestic Product (GDP) in 2017 (World Bank, 2019). The sector employs about 45% of the national labour force predominantly engaged in smallholder agriculture (MOFA, 2017a).

Though Ghana is a net food exporter due to the cocoa sector, it is a net importer of basic food crops (AGRA, 2017a), with an annual food import bill exceeding the estimated value of cocoa exports (US$2 billion) (World Bank, 2017). The country is food self-sufficient in the major staple crops, but it is a net importer of important food crops such as rice and millet (MOFA, 2017b). The agricultural area has been expanding in all regions over recent decades, at the expense of savannahs and forests. The agricultural expansion is directly a result of Ghana's population growth (MOFA, 2017a). Agriculture remains largely rain-fed and is characterised by low productivity (MOFA, 2017c). Fertiliser use is estimated at 15 kg/ha instead of the recommended 50 kg/ha. The use of improved seeds by smallholder farmers is estimated at 15% (the household survey among maize farmers calculates this at 14%). Average productivity for the main food crops is far below the potential yield, indicating a high yield gap of about 50% for maize and 33% for cassava (AGRA, 2017).

The Ministry of Food and Agriculture (MOFA) is responsible for policy and planning for the agriculture sector. In consultation with other stakeholders, MOFA formulated the Food and Agriculture Sector Development Policy (FASDEP II) in 2007. This is still the overarching policy document for the agricultural sector in Ghana. The strategic objectives of FASDEP II are (MOFA, 2010):

- Food security and emergency preparedness;
- Increased growth in incomes;
- Increased competitiveness and enhanced integration into domestic and international markets;
- Sustainable management of land and environment;
- Science and technology applied in food and agriculture development;
- Improved institutional coordination.

METASIP describes the implementation of the policy in order to achieve its objectives. METASIP adopted a sector-wide approach, involving stakeholders in its coordination and implementation (MOFA, 2010).

Ghana signed the CAADP compact in 2009 to modernise its agriculture and increase food security and income generation. Ghana also signed the Malabo Declaration in 2014, committing 10% of the annual public expenditure to agriculture. An agricultural budget expenditure review showed that in 2015, Ghana spent 6.4% of its annual total expenditure on the agricultural sector, resulting in a 3.9% growth rate of the sector (MOFA, 2017b). According to the World Bank (2017), about 5% of annual total expenditure was directed towards the agricultural sector during the period 2001-2014, with about half going to the cocoa sector specifically. Most of MOFA's budget is allocated to operational costs such as

staff salaries and input subsidies, while development partners are the main funders of investment expenditures in agriculture. PricewaterhouseCoopers (PWC) (2018) reported that in 2018 and 2019, respectively, Ghanaian cedi (GH₵) 599 million and GH₵968 million (2% and 2.5% of national sectoral budget) was forecasted to be allocated to MOFA. The increase in allocation in 2019 is attributable to increased investments in the PFJ flagship campaign.

In 2017, the newly elected government launched PFJ to stimulate the agricultural sector. The main aim of the programme is to address the declining growth of agriculture in Ghana. The project consists of five significant pillars; supply of improved seeds to farmers at subsidised prices (50% subsidy), supply of fertiliser at subsidised prices (50% subsidy), free extension services to farmers, marketing opportunities for produce after harvest, and E-Agriculture (a technological platform to monitor and track activities and progress of farmers through a database system). The five main crops selected are maize, rice, soybeans, sorghum and vegetables (chilli peppers, onion and tomato) in line with priority crops as proposed in FASDEP II and its investment programme METASIP (Tanko et al., 2019).

The PFJ seeks to motivate and encourage farmers to adopt certified seeds and fertilisers through a private sector-led marketing framework, by raising the incentives and complimentary service provisions on the usage of inputs, good agronomic practices, and marketing of outputs over an E-Agriculture platform (Tanko et al., 2019). The provision of subsidised certified seeds and fertilisers are an important activity under PFJ. An estimated 600,000 farmers are targeted with subsidised inputs. In addition, investments in extension services support farmers' production. The expectation is that the subsidies will encourage farmers to use improved inputs such as certified seeds and fertilisers. It is assumed that once farmers have observed the improved yields as a result, this will kick-start continuous farmer demand for improved inputs in the coming seasons.

A major outbreak of fall armyworm infested about 250,000 ha of maize in 2017. MOFA took a number of measures to manage the spread of fall armyworm, such as early warning surveillance, awareness raising and distribution of pesticides (MOFA, 2017b).

3.2 AGRA objectives and activities in Ghana

AGRA aims to catalyse and sustain an inclusive agricultural transformation in Africa by increasing incomes and improving food security for 30 million farming households in 11 focus countries. Since 2006, AGRA and its partners have worked across Africa to deliver solutions to smallholder farmers and local African agriculture enterprises. The alliance has invested in the systems and tools for Africa's agriculture: high quality seeds, better soil health, access to markets and credit, and coupled by stronger farmer organisations and agriculture policies.

AGRA Ghana focus and activities, 2008-2016

AGRA has been present in Ghana since 2008 and has invested an estimated US$60 million in market systems, finance, research capacity building and policy and advocacy. AGRA's focus was to strengthen public institutions with the human capacities necessary to drive the sector's technological development and adoption. Such a development was expected to improve yields while supporting private sector and other institutions to deliver services to farmers. Besides capacity building of research and extension, AGRA also invested in strengthening the private seed sector (Figure 1).

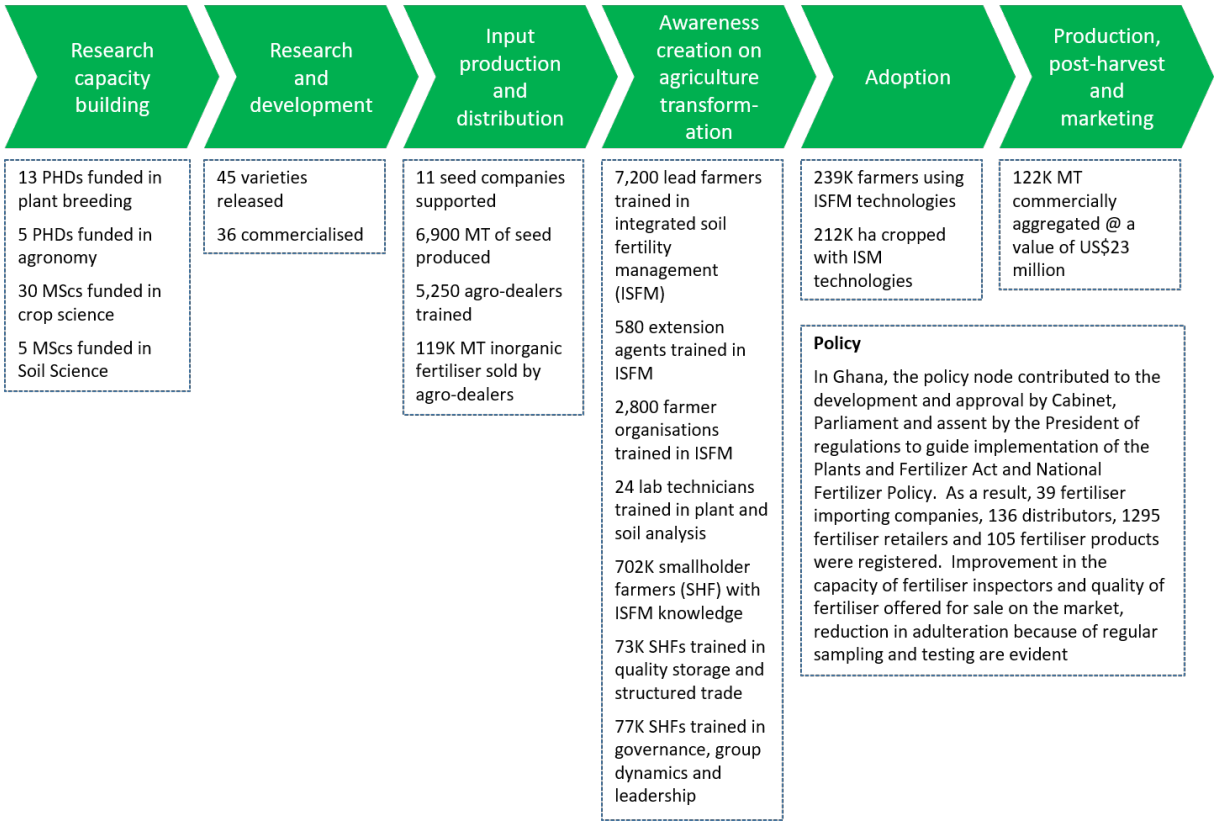

Figure 1: AGRA investments and results in Ghana over the period 2008-2016

AGRA country strategy 2017-2021

AGRA's overall goal in Ghana is to catalyse and sustain an inclusive agricultural transformation to increase incomes and improve food security. For the period 2017-2021, AGRA aims to support 600,000 smallholder farmers in the Brong Ahafo and Northern regions at a cost of US$26 million. AGRA's strategic vision is to work through strong partnerships and prioritise investments that can catalyse and complement funding committed by the government and (international) donors. Specific interventions will include (AGRA, 2017):

- Policy and country support to enhance sector planning, coordination and implementation to deliver on national priorities;
- System and farmer level development in selected value chains and regions to develop input and output market systems in order to drive productivity, strengthen access to markets and finance and increase resilience.

Since 2017, AGRA has approved 17 grants at a total value of US$12,605,430 (Table 2).

Table 2: AGRA approved grants (2017-2019)

System	Grantee	Grant	Value (US$)
State capability	Crop Research Institute (CRI)	Management of fall armyworm infestation in maize	248,000
State capability	MOFA	Establishment of farmer database for input supply	249,784
State capability	The International Food Policy Research Institute	PFJ (monitoring and evaluation (M&E) system)	1,200,000

Policy	Ghana Standards Authority	National Aflatoxin Sensitisation and Management	249,849
Policy	Science and Technology Policy Research Institute	Policy and technical regulation for aflatoxin control	249,850
Policy	National Insurance Commission	Development of Ghana Agricultural Insurance Policy	249, 873
Markets	Rice consortia	Public-private partnerships for competitive and inclusive rice value chain development PFJ; Brong Ahafo and Northern regions	2,382,282
Seed	West Africa Centre for Crop Improvement (WACCI)	Commercialisation of WACCI released maize hybrids	249,991
Seed	Seed consortium	Increasing productivity of smallholder farmers in Ghana through production and dissemination of quality seed to support PFJ; Brong Ahafo & Northern regions	249,690
Seed	Cassava consortium	Ghana Cassava Industrialisation Partnership Project; Brong Ahafo & Northern regions	1,250,073
Fertilisers	CRI	Validating fertiliser recommendations	199,100
Mechanisation	Agro Africa Ltd	Smallholder Agricultural Mechanisation project	87,500
Mechanisation	Tro Tro Tractor Ltd	Smallholder Agricultural Mechanisation project	169,017
Finance	Advans Ghana	Agricultural financing off-takers and smallholder farmer pilot; agricultural lending Technical Assistance Facility	406,218
Finance	First Allied Savings and Loans Ltd	Agency banking in agricultural production	609,632
Finance	Success for People Microfinance Ltd	Financing for smallholder farmers	502,000
Extension	The Smallholder Inclusivity and Productivity for Market Access (SIPMA) consortium	Smallholder inclusive productivity and market; maize and soybean; Brong Ahafo & Northern regions	2,451,342
Extension	Extension consortium	Ghana Extension Systems Strengthening Project; maize and soybean; Brong Ahafo & Northern regions	1,250,073

4 Seed system

4.1 System performance

The seed system of Ghana has been classified as in its 'early growth stage' (AGRA, 2013). An estimated 80% of smallholder farmers source seed from the informal system (MOFA, 2015). Standards and quality are guided by indigenous knowledge and local social structures. As seed transactions are predominantly locally grounded, there is little available performance data on seed use (Mabaya et al., 2017). The formal seed sector in Ghana was dormant for several decades until the year 2000. The Sasakawa Global 2000 programme was the first major donor initiative to revive the formal seed sector. AGRA provided another important impetus from 2007 onwards through the investments of its Programme for Africa's Seeds Systems (PASS) into the formal seed sector, and particularly in regard to the capacity building of private seed producers. However, up to 2015, few new seed varieties were released. The general feeling among stakeholders within the seed sector is that, in the past five years, some major steps have been taken forward in terms of institutional strengthening of the sector as well as consolidating capacities in seed production.

Figure 2 depicts the formal seed chain in Ghana, where variety development, breeder seed production and EGS production are dominated by the public sector, whereas the certified seed production and marketing are predominantly done by the private sector.

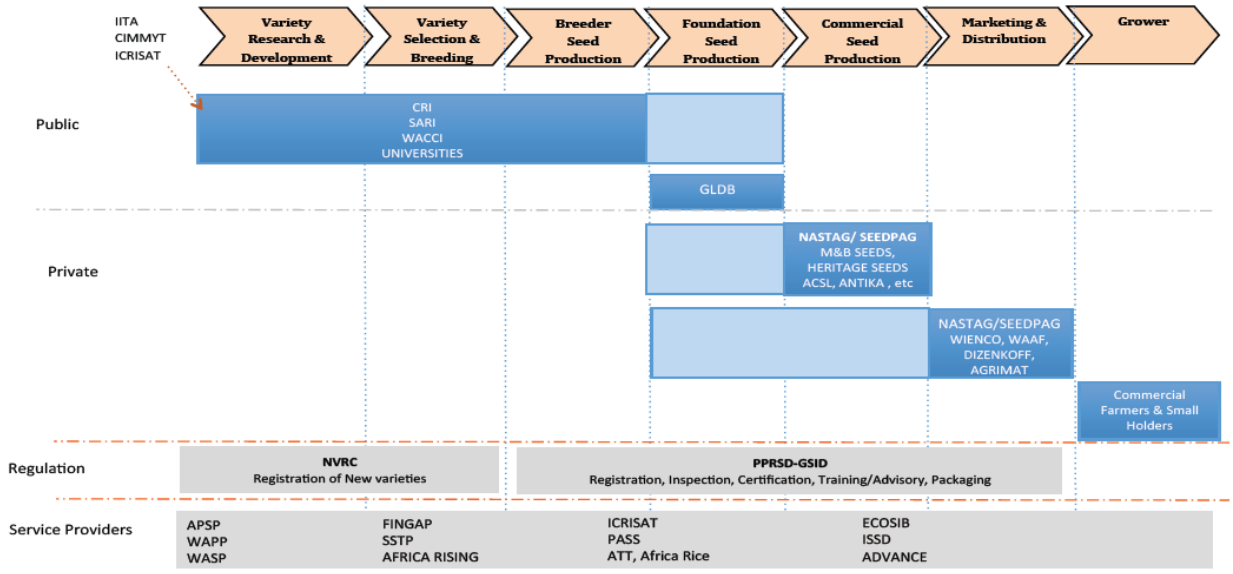

Figure 2: Formal seed system value chain in Ghana
Source: AGRA, 2016

In recent years, seed policies and governance have undergone changes to support the formalisation of the seed sector (Table 3). Although much progress has been made, there are still areas of improvement (Table 4).

Table 3: Timeline of key seed system changes and events in Ghana, 2010 to present

	2010-11	2012-13	2014-15	2016-17	2018-19
Variety development	4 maize varieties and 4 rice varieties released	5 maize varieties, 3 cowpea varieties, 4 groundnut varieties, 3 soybean varieties and AGRA rice variety released	8 maize varieties and 2 rice varieties released	7 maize varieties and 4 soybean varieties released	1 soybean variety released
EGS production			Decline in EGS production by the Grains and Legume Development Board		
Seed multiplication	Emergence of private seed companies				Expansion of seed production area because of PFJ
Seed marketing and distribution					2019: government contracting distribution agents
Seed use				2017: launch of PFJ campaign	
Seed quality assurance					
Seed policies and laws	2010: Plant & Fertiliser Act – formalisation seed sector	2013: National Seed Policy	2015: ECOWAS seed regulation to parliament for ratification 2015: National Seed Plan	2016: Ratification of ECOWAS seed regulation	
Seed system governance and partnerships	2010: establishment of the Seed Producers Association of Ghana			2016: establishment of the National Seed Traders Association Ghana	

Table 4: Current strengths and weaknesses of the Ghanaian seed system according to stakeholders

Seed chain function	Actors	Current strengths	Current weaknesses	Improvement
Variety development	• CRI • Savanna Agricultural Research Institute (SARI) • WACCI (University of Ghana) International Institute of Tropical Agriculture (IITA) • National Variety Release and Registration Committee (NVRRC)	• Qualified plant breeders • Seed companies satisfied with adequacy of breeders • 4 climate-smart maize varieties developed (IITA)	• Low and slow release of new crop varieties (cowpea, maize, rice, soybean) • No government funding for variety development – dependent on international donors • Lack of operational research infrastructure (e.g. no irrigation at breeding stations) • Lack of promotion of new varieties • Lack of variety maintenance	• Need for short-duration varieties (climate change) • Upgrading research facilities • Training of technicians • Passing of Plant Breeding Bill to improve variety release process and stimulate private sector breeding activities *Priority: very high (1)*
EGS production	• Seed producers • Public research	• Emerging private sector for EGS production	• No forecast of (foundation) seed demand • Lack of hybrid seed production capacity	• Seed Co is setting up farms to produce hybrid seed *Priority: medium (3)*
Seed multiplication	• Seed producers • SeedPAG	• Expanding private sector for seed multiplication	• Data lacking on sector performance • Lack of internal quality control	*Priority: low (4)*
Seed marketing and distribution	• Agro-dealers • MOFA (PFJ) • Seed companies	• Good packaging and labelling ensuring traceability	• Market disturbance through the public seed subsidy programme • Lack of storage facilities • Late distribution of certified seed through PFJ • Lack of promotion of improved varieties • Counterfeit seeds on markets	• ECOWAS harmonisation gives access to varieties developed in other countries • Train and accredit agro-dealers *Priority: high (2)*
Seed use	• Farmers • MOFA (PFJ) • Agro-dealers • Seed distributors	• PFJ campaign promoting use of certified seed	• Lack of funds for variety promotion • Inadequate extension support • Limited promotion of certified seed • Reduced seed quality during handling and transport by unqualified distributors	• Strengthen agricultural extension services • Promote newly released climate-smart (maize) varieties *Priority: high (2)*

Seed chain function	Actors	Current strengths	Current weaknesses	Improvement
			• Low yields if good agricultural practices not applied	
Seed quality control	• Seed Inspection Unit	• Seed Act • Each region has a Seed Inspection Unit with trained inspectors • Plans to accredit private seed inspectors	• Set inspection fee too low to pay for inspection costs • Lack of resources, transport, equipment to do proper inspection • No control of fake seeds in markets	• Strengthen capacity of seed inspection services *Priority: very high (1)*
Seed policy and regulation	• MOFA • National Seed Council (NSC)	• Harmonisation of seed policy with ECOWAS regulation • Seed Act and National Seed Policy	• Absence of regulatory framework to operationalise national seed law • Lack of regulation and enforcement • Passing of Plant Breeding Bill on hold in parliament (intellectual property right for plant breeding)	• Pass and implement required seed regulations *Priority: medium (3)*
Seed sector governance and collaboration	• NSC • (National Seed Traders Association Ghana) NASTAG	• NSC has experienced professionals and good network	• Lack of resources	• Improve funding base of NSC • Establish relevance and value of NASTAG for members *Priority: medium (3)*

Variety development

Ghana's own seed programme started in 1958 with the development of hybrid maize varieties and the production of seed within the Seed Multiplication Unit of MOFA. Though the results were good, the costs were too high, requiring huge subsidies, which could not be sustained. Hence, a switch in focus was made to development of OPVs. The commercial use of hybrid maize varieties by Ghanaian farmers really started during the last decade. The current most popular maize variety, Obatanpa, is an OPV that was released in 1992 and is the oldest variety on the market. It accounts for 77% of maize seed produced, despite new maize varieties being developed to address current challenges, such as low yields, climate change effects and nutrient deficiency (Mabaya et al. 2017). This points to a high average age of crop varieties sold, estimated by Mabaya et al. (2017) at:

- Maize: 12.5 years
- Rice: 5 years
- Soybean: 8.5 years
- Cowpea: 14 years

The household survey among maize farmers in the sample areas calculates an average age of maize varieties that is even higher, with 23.5 years. This is not surprising considering that the most commonly used variety was registered in 1992.

The Plant Genetic Resources Research Institute (PGRRI) serves as a germplasm bank for breeders to access materials for selection, evaluation and crossing. However, its laboratories

are poorly equipped, and most breeders prefer to receive germplasm materials from the CGIAR institutes (MOFA, 2015).

At present, there are 73 active breeders in Ghana based at the public research organisations – CRI in Kumasi, and SARI in Tamale. The two public research institutes have been mandated with variety development and the production of breeder seed. Both institutes source germplasm from IITA and the International Maize and Wheat Improvement Center, which is used for variety development. Twenty-six breeders work on the priority crops: 10 for maize, six for rice, five for soybean, and five for cowpea (TASAI, 2019). There is little public funding for variety development, and the plant breeders mainly depend on international donors (e.g. AGRA, the Bill and Melinda Gates Foundation (BMGF), the United States Agency for International Development (USAID) and the West and Central African Council for Agricultural Research and Development (CORAF)) to fund their research. The lack of funding also prevents the upgrading of research facilities (e.g. irrigation, mechanisation, cold storage rooms). Installing irrigation systems is estimated to cut breeding time by half but a lack of irrigation systems limits the number of breeding cycles to one per year. Breeders also indicated that there is a lack of research equipment and trained technicians, which slows down variety development.

Variety development and release takes six to ten years according to breeders. The breeding alone takes at least five cycles. After the breeding, at least two on-station cycles and two on-farm cycles are needed to develop the line. If results are good, the variety is ready for release.

NVRRC, a sub-committee of NSC, is responsible for the release of new varieties. There is a precedency that the variety release process itself takes on average 42 months, which is scored as ‘fair’ by TASAI (2019). The main causes for the long release time are related to delays during on-site trials and delays around committee meetings (Mabaya et al., 2017).

Another issue that requires attention is the maintenance of varieties after they have been released. Plant breeders are therefore asked not only to ensure the availability of breeder seed, but also to sustain a variety maintenance programme. One seed company complained that they wanted produce foundation seed for the hybrid maize variety MS1, but could not acquire the in-bred lines required from the research institute.

Maintaining different varieties involves considerable costs, which research institutions say they cannot carry due to a lack of financial and physical resources. Therefore, breeder seed varieties is often not available if there is low demand (Poku et al., 2018).

Private sector engagement in maize breeding and variety development is limited compared to public efforts. Seed Co is one private enterprise that does have breeding and variety testing facilities and efforts in Ghana (ASI, 2019).

EGS production

The Grains and Legumes Development Board (GLDB), a parastatal of MOFA, is responsible for the bulk of foundation seed production and distribution for registered seed producers. However, its facilities are outdated and its production capacity for foundation seed is limited due to a lack of resources. EGS production by the GLDB has fallen drastically since 2013 (AGRA, 2016). As a consequence, GLDB concentrates on a limited number of varieties that are in high demand, such as the maize OPV Obatanpa (Poku et al., 2018).

The two public research organisations CRI and SARI also produce some foundation seed. However, over the years, the government's financial support to these institutions has been insufficient and there is a notable shortage of quality foundation seed for most of the crops. To date (2020), private sector breeding programmes have been very limited (Mabaya et al., 2017). Only two seed companies produce foundation seed, which they distribute to their out-growers. Production of foundation seed is technically difficult, and a company is required to have a plant breeder to get approval for its production. There is thus a persistent lack of foundation seed for crops such as rice, maize and soybean.

Seed sector stakeholders suggest that the establishment of and investments by private (international) seed companies could be instrumental to help grow Ghana's seed sector. It is expected that the passing of the Seed Act in parliament to guarantee breeder rights (see section on seed policy and regulation), will attract these companies to invest in Ghana. The company Seed Co is specialised in producing hybrid maize and vegetable varieties and is looking into expanding its business in Ghana. The expectation is that Seed Co investments will trigger seed sector professionalisation, and that prices for hybrid seed will drop once Seed Co starts production within Ghana. However, the climate in Ghana is unfavourable (one growing season per year), compared to some other production locations of Seed Co; the demand for hybrid maize seed remains uncertain; and the Plant Breeders Bill is pending, which make Ghana an unattractive investment opportunity.

Plant breeders acknowledge that new varieties stay 'on the shelf' as seed producers are not aware which varieties are available due to lack of promotion. New varieties are published, but this information does not reach farmers, so no demand is created for the new varieties. Variety promotion is hampered by a lack of finance, but also a lack of coordination. Financial dependence on donor-funded projects and government programmes destabilises coordination within the seed chain. On the other hand, breeders do not know the forecasts for seed demands, resulting in a persistent lack of foundation seed according to the breeders. TASAI scores the availability of foundation seed as 'good' (score 67 out of 100) for the four main crops (Mabaya et al., 2017).

Seed multiplication

The seed industry in Ghana was privatised in 1989, but most seed companies have emerged over the last decade. Domestic seed production started to take off in the late 2000s, with AGRA and USAID support. In 2016, there were 17 seed companies engaged in the production and/or marketing of at least one of the four focus crops (Mabaya et al., 2017).

Two of the larger Ghanaian seed companies both started in 2010. However, the production of certified seed is still low, and Ghana is therefore importing seeds from South Africa. Though breeders have released improved varieties in the system, a major challenge for mainstreaming these varieties is the limited availability of EGS (see above). Regarding maize hybrid seed production, seed producers report that it is technically difficult to produce, and they prefer focussing on OPV maize varieties. Hybrid varieties of rice and soybean could be promising for Ghana, but to date, no such varieties have been released, let alone commercialised in Ghana.

The seed companies manage their own farms for seed and grain production, but also work with out-growers. The seed companies support out-growers with tractor services, shelling,

inputs and extension services. Some seed companies work with NGOs who want to engage smallholder farmers in seed production.

The SME survey among nine seed companies showed that their business performance is average. While they offer diversified services and deal with different customers for market risk diversification, they are relatively young businesses and have only been operational for four years on average. Their financial performance is relatively strong, with solid turnover and good access to formal credit. However, their investments in research and development have been rather poor, which decreases their performance score in technology. Regarding human capital, the seed companies showed relatively high numbers of casual labourers.

Before the PFJ campaign, annual seed production in Ghana was far below the estimated domestic demand (Table 5). However, this was a theoretical demand, as certified seed was also sold as grain because farmers did not buy the seed. Real demand for certified seed is not well established, and depends strongly on prices and marketing mechanisms.

Both seed demand and seed production have increased because of the PFJ campaign subsidies for certified seed. It is expected that seed production will further increase in the next two years as seed producers plan to expand further. In 2019, Ghana counted 38 seed companies producing certified seeds, and 498 registered seed producers. However, it is difficult to foresee how seed production will develop when a new government is installed in 2021.

Without financial backing, it is difficult for small-scale seed producers to develop into seed companies and reach economies of scale. Some small-scale seed producers serve as out-growers for larger seed companies. Others try to sell to farmers directly. In particular, the lack of working capital refrains seed producers from scale increase. Seed producers have particular cash flow constraints as they already need to invest in the next seasons' inputs and initiation of production, while the certified seed of last season still needs to be sold. Bank loans carry an interest rate of 26% to 30% annually, which makes the financing of the operational costs very expensive. These interest rates are higher than the estimated profit margins of 10% to 20%, which makes commercial credit a poor source of finance for expansion.

Table 5: Certified seed production in Ghana

Crop	**Certified seed production (MT)** [a]					**Certified seed production (MT)** [b]	**Total national certified seed demand (MT)** [b]	**Shortfall** [b]
	2011	**2012**	**2013**	**2014**	**2015**	**2017**	**2017**	**2017**
Maize	2,670	2,748	2,436	2,072	2,105	4454	22,500	80%
Rice	2,367	2,370	1,303	542	578	1396	16,000	91%
Sorghum	1	-	7	1	10	4	1,500	100%
Soybean	189	197	209	116	213	913	3,200	71%
Cowpea	14	24	73	54	55	106	3,600	97%

Groundnut	-	6	-	1	36	69	40,000	100%

[a] AGRA, 2016

[b] NASTAG presentation TASAI workshop 2019

Seed distribution and marketing

Seed distribution and marketing of certified seed takes place through a multitude of channels. Seed companies market their seed to farmers directly through a network of (agro-dealer) outlets, but also indirectly through contracts with NGOs and the government. The government tends to be the largest buyer as it procures seed for the PFJ programme. One seed company did not acquire a contract with the government in 2019. This means that they market their own seed, but the subsidies heavily influence the market price for certified seed, causing problems for the seed companies and producers that sell seed themselves without subsidies.

The majority of certified seed is currently distributed through the PFJ programme at subsidised prices. At the time of the field study, the total volumes of seed distributed through the PFJ programme were estimated at 7,725 MT of OPV maize, 6,775 MT of rice, 2,000 MT of soybean and 300 MT of sorghum. However, key informants reported several problems with the seed distribution under PFJ. In 2017, certified seed was imported, but the quality was unknown and farmers later complained that the seed did not perform well. In 2018, the seed distribution under the PFJ programme was coordinated by MOFA; seed was delivered to MOFA, and from there, to the district offices which did not have adequate storage. As a result, the quality of the seed was negatively affected. Only a few enterprises were allowed to sell seed, which made 2018 a difficult year for agro-dealers.

In 2019, seed distribution under the PFJ campaign was sub-contracted to private agents and agro-dealers with the aim that more farmers get timely access to certified seed. The contractors were trained by the government, in collaboration with the Africa Fertiliser and Agribusiness Partnership (AFAP), and ministerial staff at the district and regional level will monitor distribution. Some seed sector stakeholders, however, expressed concerns about this recent move to contract private sector agents for seed distribution. There is no check on the competencies of the contractors and they have little knowledge about how to handle seed or train farmers on the use of certified seed. The contractors are required to compile lists of names and phone numbers of farmers buying seed in order to receive the Government's subsidy payments. However, it is thought that this system is susceptible to fraud, either through selling counterfeit seed or falsifying the farmer lists.

The PFJ campaign has also affected the way seed prices are determined. Prior to the campaign, a national seed advisory board would set the prices based on production costs of seed producers. Now, the seed prices of the major crops are set by the government. In 2018, prices and subsidy levels were published in national newspapers, but this was not the case in 2019.

Several constraints that hamper seed distribution and marketing were mentioned in the KIIs:

- Lack of storage facilities: although the government invested in warehouses, these are designed for grains, not seed. The Plant Protection and Regulation Services (PPRSD) are therefore advocating for basic seed storage systems, particularly in the north of the country. Currently, seed is transported by cars but the system is

inefficient and expensive. If seed can be stored in cooled structures for a few months, farmers can buy seed there through private distributors;
- Loss of quality during transport: most hybrid seed is imported from other countries. However, it is acknowledged that seed is not well handled from the port to the warehouse, and subsequently to the farmer. This results in germination challenges;
- Counterfeit seeds on the markets: it is acknowledged that there are fake seeds on the market (an estimated 20%) but the seed inspectors do not have the capacity to monitor this. There are also crops (cowpea, groundnuts, sorghum) for which no foundation seed or certified seed is available so farmers are forced to use grain as seed instead. The number of seed suppliers is not known as they come and go, but the most recent count was 160 registered seed suppliers.

Seed use

In Ghana, it is widely assumed that on average, 15% of smallholder farmers use certified seeds. According to the Ghana National Seed Plan, certified seed accounted for a mere 11% of the national seed requirement for maize during the period 2011-2013 (Mabaya et al., 2017). The use rate of certified seed, in particular hybrid varieties, is considered to be low, though solid data is lacking. The Institute of Statistical, Social and Economic Research (ISSER) (2017) reports that over half of all smallholder farmers have used hybrid seeds in the past, but only a minority planted an improved variety in 2016 (22% in Brong Ahafo and 38% in Northern region). Although the majority of smallholder farmers (71%) are aware of the existence of improved varieties for maize, there is little awareness of improved varieties for other crops (ISSER, 2017).

The governmental flagship campaign PFJ has been promoting the use of certified improved seed, and providing subsidies for improved seed and fertilisers, since 2017. In total, the government has so far distributed 1,500 MT of hybrid maize seeds. In 2018, 750 MT of hybrid maize seed was distributed, at a farmer price of GH₵12/kg. In 2019, the subsidy increased further so farmers now only pay GH₵3/kg for hybrid maize seed instead of the market price of GH₵25/kg. The price of certified OPV maize seed is GH₵2/kg. The subsidised prices resulted in an increased demand among farmers for improved seeds in 2019, but the household survey does not yet show this, as it is reporting on the 2018 season.

The expectation is that, once farmers are exposed to the benefits of certified seed, they will be willing to pay the full price in future. The subsidy amounts have been increasing gradually over the years, resulting in a situation where farmers are only paying a token price for certified seed. Thus, there is doubt as to whether farmers will be willing to pay the full price when the subsidy stops.

The main reasons for farmers' reluctance to use improved seeds are:
- Quality of seed: due to poor seed handling and transport, and inefficient quality assurance, seed quality deteriorates and farmers' trust in quality declines;
- Cost of seed: production costs of improved seeds are high, resulting in high prices. Hybrid seeds are more expensive than OPVs, hence why farmers prefer the latter;
- Need for good agronomic practices: for improved seeds to deliver high yields, the farmers need to apply good agronomic practices, including the use of agro-chemical inputs. Farmers lack knowledge on the right practices, and/or the funds to purchase the inputs. They also lack access to the right information and cannot see the benefits of certified seeds through demonstration plots or otherwise. There are approximately

2,500 extension workers in Ghana, which equals an extension worker to farmer ratio of 1:1,500, which is very low (Mabaya et al., 2017);

- Investment risks: many key informants confirmed that the use of certified seeds can results in good profits for farmers, but only if used in combination with the right inputs and good agronomic practices. If this is not the case, the yields will remain low and farmers cannot recover the input costs. Using local seeds is thus a low-risk strategy in an environment where seed quality is not always guaranteed, access to inputs is difficult, and technical knowledge on good agronomic practices for specific improved varieties is limited.

Seed quality control

Seed quality control is prescribed in three key documents: i) ECOWAS Seed Regulation, which is included in Ghana's National Seed Regulation (recently passed in parliament), ii) the accreditation of private seed inspectors; and iii) a manual for seed inspectors called Seed Quality Assurance. Minimal seed quality standards are based on the ECOWAS Seed Regulation. Seed Quality Assurance consists of four major activities: certification of seed companies (valid for two years), field inspection, lab testing of seeds, labelling.

Certified seed quality control is carried out during lab tests by the inspectors of the Seed Inspection Union (SIU). The main reasons for rejecting seed are lack of purity and germination. Purity is an issue in rice; 50% of the seed is rejected. For maize, the rejection rate is 5%, whilst the rate for soybean is 30%.

The quality assurance costs are higher than the fees paid by the seed producers. For one season, a seed producer pays an inspection fee of GH₵20 for 1-10 acres, GH₵50 for 11-20 acres and GH₵100 for above 20 acres. The fee is paid to the government, not to the units that are responsible for quality assurance. Part of the money comes back to the PPRSD through annual budgets but this is insufficient to finance field visits of seed inspectors. As a result, seed companies would take inspectors to the field, but the director of PPRSD stopped this practice as it might undermine the inspectors' integrity. The fee cannot be changed as it is part of the legislation; it is currently set at GH₵20, but if increased to GH₵60, it would cover most costs.

There is one SIU per region. In 2018, a total of 35 seed inspectors were employed throughout Ghana (Mabaya et al., 2017). In the Northern region, the SIU contains seven inspectors for the entire region. The seed inspectors visit the fields of seed producers; they are supposed to make four visits per season, but due to a lack of resources and vehicles, they only manage to visit once or twice. The Feed the Future USAID Agriculture Technology Transfer (ATT) project (launched in 2013) provided financial support to the SIU, but this funding ended in 2018. Though seed production is expanding rapidly under the PFJ campaign, seed inspection capacity has remained the same.

The number of seed inspectors is similar to other countries, and the seed companies rated their satisfaction with seed inspection services as 'fair'. Both human resources and logical capacity need to be strengthened (Mabaya et al., 2017). The SIUs also lack equipment, for example, the SIU in the Northern Region does not have a microscope so if there are pathogens, they cannot diagnose the type. In order to inspect larger areas with the same number of people, the PPRSD has requested AGRA to fund drones.

In 2019, the PPRSD took the initiative to accredit private seed inspectors to build a larger workforce for seed inspection. Fifteen private seed inspectors have been trained and are ready to be in service. The selected inspectors were identified among (nearly) retired public seed inspectors and seed producers. The aim was to run a pilot with the private seed inspectors, but a major bottleneck are the low fees for seed inspection. The government has fixed the fee for seed certification at GH₵20 per visit, which is too low to pay the costs for seed inspection and it makes it financially impossible to obtain a meaningful income as a private seed inspector.

There is a problem with counterfeit (fake) seed on the market. During the 2017/2018 season, farmers reported a lack of quality in the seed bought. The subsidies resulted in a shortfall of certified seed so seed was imported from neighbouring countries to fill the gap. Some seed arrived late and distribution was delayed resulting in lower yields. In 2018, proper labelling was introduced so seed could be traced back to the producer if there was any problem. Although the SIU is aware of the presence of counterfeit seed, they do not have sufficient staff to inspect the seed sold in markets.

Seed policy and regulation

In 2010, the Plants and Fertiliser Act (including the Seed Act) was passed which allowed the formalisation of the seed sector in Ghana (TASAI, 2019). The new law authorised the development of varieties by the domestic private sector, as well as access to foreign varieties produced by both public and private organisations (Poku et al., 2018). The Seed Act also initiated the establishment of the NSC, which is mandated to formulate seed policies in Ghana (Aidoo et al., 2012). In addition, the NVRRC, a sub-committee of the NSC, was mandated with crop variety release.

Most key informants consider the seed sector policies to be coherent, but think their implementation is lagging behind due to a lack of resources.

The National Seed Policy of Ghana was published in 2013. The policy objectives are ambitious, hence why MOFA's Directorate of Crop Services (DCS) convenes a working group of international donors to jointly develop a national seed plan. The main objective of the National Seed Policy is to support the development and establishment of a well-coordinated, comprehensive and sustainable private sector-driven seed industry through systematic and strategic approaches (MOFA, 2015). Implementation of the National Seed Plan, however, is slow as there is a high staff turnover at the top level of MOFA (three ministers since 2017).

The Plant Breeders Bill was introduced in parliament in 2013 and has been debated ever since. The Bill is in line with the ECOWAS seed system regulation, and will regulate intellectual property rights to facilitate the private sector's involvement in variety development (currently only research institutes are allowed to do this). The Bill will also allow breeders to receive royalties (2-3%) for the new varieties. This is expected to bring in some additional funding for variety development and provide some financial independence to (public and private) plant breeders. However, opponents to the Bill (e.g. farmer associations) fear that it will result in the monopolisation of the seed sector by multinational seed companies at the expense of smallholder farmers (Ayamga, 2018). The previous government was about to pass the Bill when a discussion about genetically modified organisms (GMOs) delayed the process. Rumours are that rice importers are funding the anti-GMO movement because they do not want to lose their position in the domestic rice market.

The harmonisation of ECOWAS seed regulation is ongoing to facilitate the exchange of varieties between countries. If a new variety is released in one country and entered into the regional variety catalogue, it can be sold in another ECOWAS country without testing. The trade is still at a low level as not many varieties have been released into the regional catalogue, but most ECOWAS countries are harmonising their national seed regulations.

Agriculture is currently a government priority, and the seed sector is highlighted as a key pillar in its agenda for agricultural intensification, so there is current momentum to further strengthen the seed sector. The PFJ flagship campaign is the government's key instrument to support the agricultural sector through: subsidies for improved seeds and fertilisers, extension, and access to markets. The PFJ campaign will remain in place for the duration of the current government, with the expectation that it will establish a vibrant seed industry in the coming two years, and a consistent demand for hybrid seeds among small-scale farmers. There is some lack of clarity about the duration and sustainability of the subsidy programme under the PFJ campaign. Many seed sector stakeholders are uninformed of the subsidy level of the for certified seed from one year to the next. In addition, it is unknown what will happen with this flagship campaign once a new government is installed in 2021. Many stakeholders hope that the current major push will be sufficient to kick-start the demand for certified seed among farmers and establish a dynamic private seed sector. However, public sector institutions continue to play a critical role (e.g. variety development, EGS production, inspection, extension), but require more funding and investment to overcome their capacity constraints and perform their tasks effectively (Poku et al., 2018).

Seed sector governance and collaboration

Ghana has had a National Seed Committee since the 1970s. This was changed into the NSC with the Plants and Fertiliser Act in 2010 to be compliant with the ECOWAS Regional Seed Regulation. The NSC is the coordinating body and administrator of the seed sector, ensuring that various seed sector actors operate in consent. The NSC also supports the government in policy development and implementation, but operates through other institutions and does not have its own infrastructure or facilities. The NSC is essentially a platform where representatives of the seed sector come together as determined by the Seed Law. NSC is also instrumental in connecting stakeholders with MOFA and the Minister of Agriculture. NASTAG, for example, uses this line of communication to advocate for seed sector issues. The MESATIP steering committee is another avenue that NASTAG uses to influence policy.

There are two organisations that have a coordinating function between seed sector stakeholders:

- SeedPAG convenes small-scale seed producers and has had an estimated membership of 200 small-scale farmers since 2010. SeedPAG operates at regional level, as the national body is not performing well;
- NASTAG was established more recently, in 2016, with help of the Feed the Future programme of USAID. NASTAG convenes seed companies, researchers, traders and agro-dealers, with the aim of coordinating the seed value chain. Management staff are currently limited to three due to lack of funding. SeedPAG is one of the 41 members of NASTAG.

There is some rivalry between SeedPAG and NASTAG. SeedPAG represents the individual seed producers, whereas NASTAG is more focused on seed businesses. The two bodies

are operating separately, but should integrate more to increase effectiveness of their advocacy and lobbying activities.

The seed sector stakeholders agreed to establish a seed fund to strengthen the seed value chain, but could not reach an agreement on how to attract the funds. The fund is managed by the PPSRD, however, it has been difficult to raise money for the fund. Funding from parliament has also not been released.

The main donors supporting the seed sector are: African Development Bank, AGRA, the German Development Agency (GIZ), USAID, and the World Bank. The donors tend to fund different parts and activities within the seed sector. Though they try to coordinate efforts and harmonise operations, this is not always successful. The DCS approaches the donors to make sure they work from the National Seed Plan.

4.2 AGRA change ambitions

Between 2008-2017, AGRA invested heavily in the seed sector, particularly in private seed producers and companies, as well as agro-dealers. AGRA continued its support through the Scaling Seeds and Technologies Partnership (SSTP, 2013-2018) programme in order to improve access to foundation seed and strengthen the links between CRI and private seed companies. SSTP acted as a convener, information sharer and funder to strengthen the seed value chain. AGRA also supports the government by contributing to the seed policies and legislation (e.g. national seed plan) and the PFJ campaign.

Current grants under PIATA (2017-2021) include the commercialisation of hybrid maize varieties, supporting farmers in the uptake of improved seed and the industrialisation of cassava. AGRA aims to continue to strengthen the seed sector, but only two investments have been made so far under the PIATA program. Table 6 summarises AGRA's current change ambitions regarding the seed system in Ghana.

Table 6: AGRA's seed system change ambitions

Seed value chain components	Envisioned change	Timing	Intervention	Implementing partners
Variety development	13 seed varieties developed	2017-2021		SARI, CRI
EGS production	Increase quantity and quality of EGS supply by increasing the number of professional actors involved	2017-2021	Scalable platform for contracting between EGS producers and certified seed multipliers	
Seed multiplication	Increase availability of certified seeds (21,690 MT in total) for priority crops	2017-2021	Capacity strengthening of seed companies	Seed companies
Seed marketing and distribution	Marketing of hybrid maize seed	2017-2021	Commercialisation of WACCI released maize hybrids	WACCI
	Enhance access to inputs working with hub agro-dealers	2017-2021	Facilitate partnerships between seed suppliers and agro-dealers	Private sector

Seed use	Uptake of certified seed	Promotion of improved varieties and good agricultural practices	SIPMA consortium
Seed quality assurance	Not known		
Seed policies	Improved seed policies at national level		MOFA
Seed governance and collaboration	Not known		

4.3 AGRA system change results

According to stakeholders, AGRA has been an important supporter of strengthening the seed system in Ghana since 2008. AGRA started with funding post-graduate training of plant breeders and establishing private seed producers and companies for seed production and multiplication (KII NASTAG, 31/05/2019). Another contribution of AGRA has been towards variety development; the Agra rice is very population among farmers.

Most of AGRA's results in changing the seed system in Ghana have been achieved prior to 2017. Current changes are mostly induced by the PFJ campaign, and it is impossible to determine what part of recent changes can be attributed to AGRA.

Variety release

Breeders reported that the formal seed system of Ghana has entirely changed due to the involvement of AGRA, ATT (USAID) and CORAF. Prior to 2017, AGRA supported the capacity of seed companies and as reported by one KII: "AGRA gave birth to seed companies up North" to produce foundation seed and certified seed. AGRA also invested in plant breeding competences through the provision of training. The plant breeders therefore highly appreciate AGRA's holistic support, even though there are still weaknesses in the seed system.

Since 2017, three varieties have been commercialised with support of AGRA. The target for commercialisation of varieties for the period 2017-2019 was 11 varieties (Table 7).

Table 7: Number of seed varieties commercialised with AGRA support (AGRA Performance Indicator 8)

Year	Commercialised seed varieties	Source
2017	3 varieties (target: 3)	AGRA M&E 2019
2018	0 varieties (target: 3)	AGRA M&E 2019
2019	? varieties (target: 5)	AGRA M&E 2019

EGS production

No information is available on AGRA's impact on the production of foundation seed under the current PIATA programme.

Seed multiplication

In 2019, the number of seed companies was estimated at 38. As the government is putting more emphasis on subsidising improved seed, more seed companies are emerging with support of AGRA and USAID. It is estimated that 3,742 MT certified seed was sold in 2018 by seed companies (target was 4,500 MT) supported by AGRA (Table 8).

Table 8: Quantity (MT) of improved seeds of focus crops produced by AGRA-supported enterprises (AGRA Performance Indicator 9)

Year	MT improved seeds sold	Source
2015	2,186 MT for maize only (national aggregate)	Mabaya et al. 2017
2016	1,832 MT for focus crops (national aggregate) 1,432 MT for maize only (national aggregate)	Mabaya et al. 2017
2018	3,742 MT for focus crops (supported enterprises only) (target: 4,500 MT)	AGRA M&E 2019
2019	? MT for focus crops (target: 6,000 MT)	AGRA M&E 2019

Focus crops are: cowpea, maize, rice, soybean

Seed marketing and distribution

The PFJ campaign dominated the seed marketing and distribution efforts of the government in 2019. AGRA's direct influence on this is limited in comparison. Table 9 reports the quantity of certified seed distributed under the PFJ campaign in 2019. At the time of this study, the seed distribution had been finished in the southern part of Ghana, but was still ongoing in the northern part.

Table 9: Quantity (MT) of improved seeds sold as a result of AGRA support (AGRA Performance Indicator 10)

Year	MT improved seeds sold	Source
2019	16,344 MT distributed in southern Ghana under PFJ campaign	KII PPRSD, 03/06/2019

Seed use

The AGRA baseline report (2017b), revealed that 22% and 38% of smallholder farmers in the Brong Ahafo and Northern regions, respectively, planted improved varieties in 2016. The household survey among maize farmers (see chapter 7) found that merely 14% of the smallholder farmers used improved maize varieties in 2018 (usually OPVs; hybrids were largely absent). Farmers suggested that their main motivation for using a certain variety included expected yields, maturing time and taste. At the same time, many farmers were also not aware of different maize varieties, and simply cultivated a certain variety because it was the only one they knew. There are also crops (cowpea, groundnuts, sorghum) for which no certified seed is available so farmers are forced to use local seed instead.

AGRA is promoting the use of certified seed through its consortia projects. SIPMA, for example, focuses on unlocking the maize and soybean value chains to create market access for smallholder farmers. The consortium consists of five organisations: Agribusiness in Sustainable Natural African Plant Product (ASNAPP) which focuses on capacity-building for smallholder farmers; Yedent, an agro-processing company that serves as the market for smallholder farmers; IT consultant company, UCL, focuses on farmer registration to the project; AFAP focuses on training agro-chemical input dealers; and SARI provides improved seed varieties. SIPMA is based on a value chain approach whereby smallholder farmers are linked to an aggregator, which gives them access to technical know-how on crop planning and management, inputs, credit, post-harvest management, and better market linkages. Farmers receive input credits to allow them to purchase improved inputs (e.g. certified seeds and fertilisers) in order to produce the quantity and quality of crop required by the aggregator

or processor. The aggregators bear the responsibility of ensuring that farmers pay back their loans from a portion of their harvest. Yedent is the off-taker in this arrangement, producing industrial raw material and nutritional products from maize and legumes. The arrangement under SIPMA guarantees Yedent a constant supply of raw materials for processing and value addition (AGRA, 2019).

Farmers in Nyeko community (Savelugu District, Northern region) are beneficiaries of the SIPMA consortium supported by AGRA. They receive technical support and inputs on credit as well as market access for improved maize. The Nyeko farmer group reported that they received the inputs late for the 2018 season, but that the hybrid maize variety they planted only grew one cob whereas the local variety produces two cobs per plant. Consequently, the farmers were not convinced by the new variety, but were still planning to plant another 54 acres with hybrid maize in 2019. The farmers did recognise the benefit of using agro-chemical inputs to increase yields.

Farmers in Tindan (Savelugu District, Northern region) explained that they have been recycling their seeds for the last 16-17 years. They acknowledged that when recycling seed for too long, they get more crop diseases and reduced yields. The group planted hybrid maize for the first time in the 2018 season with support from the SIPMA consortium. Two farmers planned to grow hybrid maize on their own farms for the 2019 season as a result; other group members thought it was too expensive, as you need to obtain the seed from the market and buy fertilisers. However, the group wants to show to their peers that commercial farming using inputs is worth the investment. However, at first, the results were disappointing. The Tindan farmers reported that the aggregator Yedent retained 15 bags of 50 kg/acre at harvest as payment for the inputs. According to the farmers, a good yield consists of 18 bags, so they were left with three 50 kg bags. One bag is needed to pay for the tractor hire for ploughing (GH₵60), so this left the farmers with two 50 kg bags (worth GH₵50 each), which is not enough to feed the family. Some farmers obtained less than 15 bags, in which case they had to pay Yedent.

According to the extension agent who worked with this farmer group, farmers can potentially obtain 32 bags of 50 kg/acre if they use all inputs in the appropriate way. About half of the farmers used inputs correctly and obtained 20-32, 50 kg bags per acre in 2018. The costs of all inputs provided (incl. transport) amounted to GH₵720/acre, hence the farmers' re-payment was set at 15, 50 kg bags (with a market value of GH₵750). Farmers who obtained low yields in 2018 because of fall armyworm attacks were asked to pay half of their debt. However, some farmers had not used the inputs properly, or had even sold their inputs to others, in which case, the farmers were asked to pay the debt in full.

Farmers in Yong (Savelugu District, Northern region) will enrol with the consortium project in 2020. Currently, they use mostly local seeds, with only 20% of farmers in the community buying improved seeds. The main reason why farmers are reluctant to buy improved seeds is their observation that local seeds always germinate, whereas improved seed bought in the market do not germinate every time.

Seed quality control

AGRA is focusing predominantly on strengthening of the private sector and supporting policy development, but currently provides no support to seed quality control.

Seed sector organisation and governance

AGRA does not currently work on seed sector organisation and governance. While AGRA works with the Ghanaian Government, it has little engagement with other stakeholders involved in seed sector, such as with organisations like NASTAG.

Seed sector policies
AGRA is recognised for its collaboration with other international donors (e.g. USAID) in helping the government in operationalising its policy, for example, the National Seed Plan.

MOFA's DCS benefitted in particular from AGRA support prior to 2017 through the revision of seed policies, sensitisation of stakeholders, and support of the private sector to produce improved seed. During that period, AGRA specifically focused on strengthening the seed sector; other parts of the agricultural system have received some support but not to the same extent. AGRA also supported the biometric registration of 30,000 farmers, but this was discontinued due to a lack of funding. In 2019, MOFA requested AGRA's support in sensitising farmers on the use of hybrid seed, e.g. through TV programmes. AGRA also supported the preliminary work on the concept of the PFJ programme.

Key informants noted that the main advantage of AGRA and other international donors is not dependent on the national budget of Ghana, and can therefore look at the long-term agenda of the seed sector. Governments and ministers change relatively frequently in Ghana, but international donors can take a long-term approach towards seed sector development.

4.4 Analysis of AGRA results

AGRA's position in the intervention landscape
AGRA has been involved in Ghana's seed sector development since 2007. Through the 2007-2012 PASS, AGRA has supported the professional training of plant breeders, variety development, agro-dealer development (to improve input supply at village level), and the emergence of seed producers and seed companies. In more recent years, AGRA has engaged with policy development to assist MOFA in formulating and operationalising seed policies. AGRA's support continued through the SSTP, but this ended in 2018.

Other donors and interventions on seed system development include the following (MOFA, 2015):

- The Canadian International Development Agency (CIDA) has provided support over many decades, building the capacity of scientists and technicians in the public sector. CIDA also supported the Sasakawa Global 2000 project, which contributed significantly to the development of the Ghana seed sector through capacity building, seed promotion, equipment supplies and a credit facility to seed producers and agro-dealers.
- The Food and Agriculture Organization of United Nations (FAO) has provided continuous assistance to the development of the seed sector for several decades. Through projects and activities, FAO has contributed to the National Seed Programme in various ways, including the National Seed Policy.
- GIZ supported the seed sector between 1970 and 2002, providing capacity building of the public research institutes and also marketing support. The support of GIZ is currently more focused on value chain projects, including for rice, sorghum and soybeans in Upper West and Northern regions.

- Support of the International Fund for Agricultural Development is directed towards roots and tuber crops, supporting improved planting materials of cassava, sweet potatoes and yams.
- The International Centre for Fertilizer and Agricultural Development (IFDC) has assisted the seed sector since 2001, particularly in the development of the private sector (seed producers and agro-dealers).
- USAID has supported the seed industry with equipment supply, vehicles and training under various programmes. USAID sponsors the IFDC-operated project ATTP, covering a wide range of seed development activities, including support to privatisation of the seed sector and policy development.

Relevance

All stakeholders acknowledge that AGRA's past support to seed producers and companies to multiply improved seed has been important to accelerate seed sector development in recent years. AGRA's support to further develop and operationalise seed sector policy is also considered important. The fact that AGRA aligns its interventions with government priorities is much appreciated by public institutions. AGRA's involvement in Ghana's seed sector development is thus considered to have been very relevant so far.

AGRA's current strategy for seed system support is less defined, which makes it difficult to assess its current relevance. Different stakeholders have different views on what support AGRA should be providing at this stage: further support to seed companies, production of foundation seed, variety development (e.g. rice and soybean), support to coordinating bodies (NASTAG, NSC, SeedPAG) and strengthening certification and quality control. As the available resources through PIATA for seed sector development in Ghana are more limited than under PASS and SSTP, it is important that AGRA makes clear choices about its investments.

AGRA has contributed to the design of the PFJ campaign. However, there is a risk that PFJ disrupts the seed system as public seed procurement and distribution systems often hinder free competition between seed companies. Furthermore, public procurement and distribution systems often lack the capacity to ensure that the right varieties are in the right quantity, at the right place and time. Seed market management logistics are better left to private seed enterprises as their own profit is at stake. At the same time, government procurement and distribution crowds out commercial independent seed producers, and destabilises the market.

Considering its close liaison with the Ghanaian Government, providing support to the PFJ seems a good choice. It is however essential that AGRA plays the role of being a 'critical friend' in this regard. The main impact that AGRA can have is to assure that the subsidy scheme does not disturb the seed market, but facilitates the development of a competitive and dynamic commercial seed market that offers a choice to farmers, and that runs on the principles of demand and supply.

Expected impact

There are still a number of systemic problems within the seed sector, including coordination, availability of resources (human, financial and physical) for variety development, EGS production and inspection, and market demand. AGRA's support addresses some of these systemic problems, but not all. Coordination with the government and international donors remains crucial for a coordinated and holistic approach to seed sector development.

Sustainability

The Ghanaian seed sector is still in an emerging stage, and various public and private actors are still dependent on the funding of international donors, such as AGRA, to perform their rolls. The seed sector is still fragile, and its development will heavily depend on future government policies (post 2020) and long-term commitment of international donors. Supporting coordinating bodies such as NSC, NASTAG and SeedPAG can help lobby government for a long-term policy that supports seed sector development. However, NSC, NASTAG and SeedPAG require more support to enable them to fulfil their roles in stakeholder convening, sector coordination and policy lobbying.

5 State capability and policy support

5.1 State and policy performance

Ghana has internalised CAADP into its agricultural policy through METASIP, which is the National Agriculture Investment Plan. The second phase of METASIP (2014-2017) is currently under review, in order to inform METASIP III.

METASIP focusses on policy areas including; irrigation development, fertiliser and seed subsidies, seeds policy, research and extension linkage committees, agriculture mechanisation, and market and value chain development. The fertiliser subsidy component amounts to about a third of MOFA's annual non-wage recurrent expenditure. Despite MOFA's seed sector support, annual production of improved seeds actually declined. For example, the production of foundation seeds by GLDB declined from 82.5 MT in 2010 to 5.9 MT in 2016 (MOFA 2017). In 2017, the current government launched PFJ for the period 2018-2021 in order to revive the agricultural sector.

Though the Ghanaian Government receives funding from development partners, the capacity of the previous government was so low that it has only used 20% of the committed resources, according to one KII. Despite a long history of investments, agricultural growth was nosediving and there was distrust between the development partners and the newly elected government. The Agricultural Sector Working Group (ASWG) is a coordinating platform between government, civil society, the private sector and international donors, but it had been dormant until 2015. The ASWG was revived when the newly elected government started in 2016/2017, with AGRA support of AGRA.

In 2017, Ghana's CAADP progress score (3.9) was just below the benchmark (3.94), meaning it was not on track to meeting the CAADP/Malabo commitments (AU, 2017). Table 10 summarises the key areas of strong and weak performance identified in 2017. Ghana's CAADP progress score improved to 6.67 in 2019, which is just above the 2019 benchmark (set at 6.66).

Table 10: Ghana's progress towards implementing the Malabo Declaration on agricultural transformation in Africa (2017)

Five key areas of strong performance		**Five key areas of weak performance**	
Inclusive institutionalised mechanisms for mutual accountability and peer review	94%	Value of intra-Africa trade of agricultural commodities and services	-4.6%
Evidence-based policies, supportive institutions and corresponding human resources	87%	Share of agricultural land under sustainable land management practices	0.04%
CAADP process completion	57%	Increase of agriculture value added per agricultural worker	1.1%
% population undernourished	5%	Annual growth of the agriculture value added (agricultural GDP)	3.6%
Prevalence of wasting among children under 5 years old	5%	Public agriculture expenditure as a share of total public expenditure	6%
Country progress score (out of 10): 3.9 – *not on track*			

Source: AU, 2017

Table 11 provides a narrative overview of the state capability indicators. Overall, many indicators are in progress where efforts have been made in recent years to harmonise policies, revive coordinating bodies and engage with stakeholders. However, there is a general acknowledgement that implementation is still lagging due to the limited capacities (human resources, finance, infrastructure) of public services.

Table 11: State capability indicators

Dimension	Indicators	Status	Narrative	Sources
Political commitment	▪ Agricultural transformation is high on political agenda		Government is prioritising agricultural transformation in policy making, notably in its flagship programmes PFJ and One District, One Factory. However, implementation of policies and acts is sometimes lacking.	▪ KIIs
	▪ Government expenditures on agriculture (share of agriculture in total expenditure)		Ghana expenditure is thought to be well below the 10% benchmark; an expenditure review is currently in progress (2019). Ghana's progress was classified as 'not on track' in 2017.	▪ KIIs ▪ AU, 2017
Agriculture transformation policies	▪ Clear vision and strategy for agricultural transformation		Cohesive vision and national policy on agricultural transformation, based on evidence-based policy making, with sufficient level of detail to permit implementation.	▪ Policy documents ▪ KIIs
	▪ Policy coherence		National policies affecting agricultural transformation are coherent and consistent around key goals to enable alignment of investments and harmonisation of efforts at various levels. METASIP and FASDEP are providing the overarching policy framework. However, each government prioritises its own interests.	▪ Policy documents ▪ KIIs
	▪ Policy responsiveness		Policies evolve over time in response to the dynamics of technological change and growing private sector capabilities. The Joint Sector Review meets annually to hold the government accountable. Lessons are acted upon in the flagship programmes. However, each government prioritises its own interests.	▪ KIIs
Enabling environment	▪ Legal framework for private sector development		The national legal framework is stable and hospitable to private sector investment. The flagship programmes encourage private sector involvement. Domestication of	▪ Enabling the Business of Agriculture

			ECOWAS regulations further facilitate private sector engagement.	
	▪ Economic or regulatory incentives support private sector development		Clear incentives for the private sector are set in the flagship programmes. Ghana ranks 120/190 in the Ease of Doing Business Index[1]. Ghana ranks 106/140 on the Global Competitive Index[2]. On average, it takes 14 days to start a business (in 2018).[3]	▪ Enabling the Business of Agriculture ▪ Ease of Doing Business Index ▪ Time required to start a business (days) – World Bank
	▪ Rural infrastructure		Large-scale investments are made into rural infrastructure: roads, warehouses education, electricity and communication.	▪ World Development Indicators (rural electrification) ▪ The United Nations Educational, Scientific and Cultural Organization (literacy) ▪ Global Competitiveness Index
Implementation and delivery	▪ Organisational structures for policy implementation and service delivery		Organisational structures at national and local levels are in place to implement policies and deliver required services (e.g. seed sector), but some are still maturing.	▪ KIIs
	▪ Organisational capacity for implementation and service delivery		There is a general sense that organisations with direct responsibility for policy implementation and service delivery have insufficient human, technical and financial capacity at national and local levels. According to the Agriculture Science and Technology Indicators (ASTI), there are nearly 600 full-time equivalent agricultural researchers employed. Public funding is 0.9% of agricultural GDP, whereas 32% of the funding comes from donors.[4]	▪ Key informant interviews ▪ Agricultural Science and Technology Indicators
	▪ Mobilisation/ leveraging of private sector and donor investments for implementation and service delivery		Resources and investments are attracted into the agricultural sector, e.g. from multilateral funds, development partners and the private sector. Private sector funds are still very limited.	▪ KIIs
Coordination	▪ Different government agencies/units at national and local levels coordinate on agricultural transformation		The ASWG and Joint Sector Review (JSR) are multi-stakeholder platforms that review and discuss agricultural issues regularly. The NSC has this mandate for the seed sector. These mechanisms have	▪ KIIs

			been revived and strengthened in recent years.	
	▪ Government coordinates with stakeholders, including development partners and the private sector		Government, donors, and the private sector work together to facilitate agricultural transformation through ASWG and JSR.	▪ KIIs
Accountability	▪ Policies on agricultural transformation are developed based on feedback from rural stakeholders		The ASWG and JSR are the main mechanisms to facilitate rural stakeholders participation in policy development to increase accountability. NASTAG and farmer unions are also engaged.	▪ KIIs
	▪ Policies and results on agricultural transformation are published and accessible		Information on policies and results is publically available and shared in a timely manner, e.g. through websites, public announcements and other mechanisms.	▪ KIIs
	▪ Results-driven M&E of agricultural transformation		Policies are monitored based on specific objectives, performance indicators and targets to measure the accomplishment of objectives.	▪ KIIs

[1] https://tradingeconomics.com/ghana/ease-of-doing-business

[2] https://tradingeconomics.com/ghana/competitiveness-rank

[3] http://datatopics.worldbank.org/world-development-indicators/themes/states-and-markets.html

[4] https://www.asti.cgiar.org/

Green: Policy commitment achieved

Amber: Significant progress made but policy commitment not yet fully implemented

Red: Bottlenecks and/or delays preventing progress on policy commitment

5.2 AGRA change ambitions

AGRA's strategy for Ghana is to catalyse and sustain the agricultural transformation agenda by contributing to (AGRA operational plan 2017):

- The government's need to refine and develop its sector strategy and flagships backed by a strong agriculture sector with effective coordination and implementation capabilities to deliver on this strategy;
- Strengthening regional agriculture coordination platforms to enhance sub-national coordination;
- Strengthening the agriculture sector delivery systems for improved productivity and marketing of produce, as well as increased access to finance to impact incomes and improve food security.

AGRA's ultimate goal in Ghana is to achieve agricultural transformation and Ghana's Governments is thus a key strategic partner towards this aim as it can create the necessary conditions to enable transformation. AGRA is developing plans to help Ghana achieve the international goals it has committed to, as set out in CAADP, ECOWAS and the Sustainable Development Goals.

Prior to the PIATA programme, AGRA supported the development of policy nodes and hubs in several countries, including in Ghana. These developed into the Micro Reforms for African

Agribusiness (MIRA) project (2013-2018).[1] Through MIRA, local and international technical assistance was provided to identify, prioritise and 'reform' issues in agricultural policy, legislation and regulation that constrained private sector investments and agribusiness development. The aim of MIRA was to improve the enabling agribusiness environment in order to expand investments by agribusinesses in agricultural value chains of staple food crops. Under MIRA, AGRA supported the Ghanaian Government in ratifying the ECOWAS seed and fertiliser regulations.

AGRA developed a multi-annual strategy for the PIATA programme in Ghana in 2016, but a new government came into power in 2016/2017, and relationships with international donors/development partners were strained. AGRA decided to engage with the new government first and get an understanding of their plans, as well as mediate between the new government and other development partners. AGRA seeks to collaborate with the Ghanaian Government as and when issues or opportunities arise to support smallholder farmers.

Table 12 provides an overview of AGRA's support to policy and state capability under the PIATA programme. AGRA provides its support mostly through contracting consultants to support the government. AGRA Ghana indicates that the content of its financial and supervisory support is driven by MOFA, as they need to take ownership of the outcomes. AGRA has supported the government in the following areas:

- Seed sector development: in particular developing the policy framework and programmes (see chapter 4);
- Support to soil research institutes to develop fertiliser blends for different regions;
- Aflatoxin policy;
- Agricultural insurance policy and regulation;
- Smart-subsidy model for fertiliser through digital registration (35,000 farmers registered; target was 200,000 farmers);
- Agricultural expenditure review (2019/2020);
- Progress and roadmap for Malabo commitments.

Table 12: AGRA state capability ambitions

	Timing	Envisioned change	Scope and scale	Implementing partners
Political commitment	2019	Agricultural expenditure review	National	MOFA
	2017	Progress and roadmap for Malabo commitments	National	MOFA
Agriculture transformation policies	2008-2018	Establish seed and fertiliser policy and legislation	National	MOFA, USAID
	2018-2019	Review METASIP II	National	MOFA
	2019	Review FASDEP	National	MOFA
	2017	Strengthen PFJ flagship strategy	National	MOFA

[1] The MIRA project is funded through the Bill and Melinda Gates Foundation (BMGF)

	Timing	Envisioned change	Scope and scale	Implementing partners
	2019	Rearing for Food and Jobs (livestock) (2019-?)– now working on strategy document	National	MOFA
	2019	Planting for export and rural development (2019-2024) – AGRA helped develop the strategy document	National	MOFA
Enabling environment	2019	Agricultural expenditure review	National	MOFA
	2019	Domestication of ECOWAS fertiliser and seed regulations	National	MOFA
	2019	Review FASDEP	National	MOFA
Implementation and delivery	2019	Domestication of ECOWAS fertiliser and seed regulations	National	MOFA
	2018-2019	Review METASIP II	National	MOFA
Coordination	2017	Reviving ASWG	National	MOFA, development partners
Accountability	2019	Agricultural expenditure review	National	MOFA
	2018-2019	Review METASIP II	National	MOFA

5.3 AGRA system change results

When the new government came into power in 2016/2017, it was setting out new strategies for the agricultural transformation agenda in Ghana. AGRA played an important role in supporting the government to develop a strategy plan for its flagship PFJ programme, reach out to other development partners and mobilise resources. MOFA committed US$114 million to PFJ, whereas other development partners committed US$260 million. AGRA also took up a brokerage role between the government and other development partners, as relationships were strained. The ASWG was revived to review the government's policies and enhance coordination between the government and development partners. The ASWG includes development partners (donors) in agriculture, farmers' representatives, civil society, and government and relevant ministries, and meets every month to discuss issues in agriculture (KII Policy, Planning, Monitoring & Evaluation Department (PPMED), 03/06/2019).

Through the MIRA project, national and ECOWAS regulations and standards for seed and fertilisers have been harmonised. The expectation is that this will facilitate cross-border trade within West Africa. Awareness-raising among stakeholders has been carried out, but it might take several years to see any impact. A policy on high-quality cassava flour has been put on hold with the change of government.

AGRA monitors its own progress related to policy support. In Ghana, most AGRA-supported policies are at least at the stage of approval. However, for some legislation, it can take years to pass through parliament. Table 13 shows the progress that has been made on the various policies under MIRA.

Table 13: AGRA policy tracking

Policy activity	Status
Seed regulation	Stage 5: legislation
ECOWAS seed domestication	Stage 6: implementation
ECOWAS fertiliser domestication	Stage 6: implementation
Fertiliser subsidy	Stage 4: approval
Cassava flour policy	Stage 4: approval

Source: AGRA M&E data

AGRA seems to have found a niche in supporting policy development and coherence which is well appreciated by MOFA. However, grants are considered small and reporting requirements are high, and it was also thought that AGRA could improve on communicating and coordinating its own activities to stakeholders and partners.

One of the biggest challenges for AGRA is the change in government. As a new government comes into power, interests change and it may not be possible to complete what was started. For example, the previous government wanted to develop a policy to use cassava flour in composite flour. However, this is not a priority for the current government and so the policy has been stalled.

AGRA aims to support the government in the implementation of the Malabo Declaration. Based on the KIIs, the following assessment is made regarding progress on AGRA's policy indicators in Ghana (Table 14):

Table 14: Overview of Ghana's progress on AGRA's policy indicators

AGRA policy indicator	**Ghana score**
Indicator 50: Functional multi-stakeholder coordination body that links with regional bodies	In progress – existence of coordination body; performance is improving
Indicator 51: Rate of implementation of annual national agriculture sector programmes and/or strategies	Not known
Indicator 52: Active multi-stakeholder coordination body, ASWG and a donor working group	Achieved – ASWG and donor working group are both operational (performance is improving)
Indicator 53: Percent of national budget allocated to agriculture	2.5% (based on PWC 2018); expenditure review is ongoing
Indicator 54: Percent annual government agriculture expenditure of annual budget allocation to agriculture	2015 – 6%; current expenditure under review
Indicator 55: Percent national agriculture annual budget funded by donors and other private sector partners	Not known – 32% of 2016 annual budget for research and development for CSIR was provided by ASTI
Indicator 56: Rate of participation (%) in policy processes and mutual accountability forums from private sector and civil society	Not known

AGRA policy indicator	Ghana score
Indicator 57: Reporting on progress through the CAADP scorecard	CAADP scorecard done in 2017 – total score was 3.9 CAADP scorecard done in 2019 – total score was 6.67

5.4 Analysis of AGRA results

AGRA's position in the intervention landscape

AGRA is one of the main actors supporting the Ghanaian Government in its agricultural transformation agenda. AGRA invested in building a good relationship with the government and is well connected at a high level. AGRA is now a trusted partner, and at times, mediates between MOFA and other development partners. Other important development partners working on state capability and donor support are BMGF, the European Union, FAO, Global Affairs Canada and USAID, amongst others.

Relevance

AGRA's activities on policy harmonisation and supporting state capability are deemed very relevant by the state actors. AGRA seeks to align with the government's priorities, such as the flagship PFJ campaign, yet also advises government on improvements it thinks are necessary.

Expected impact

Most progress has been made on the domestication of ECOWAS seed and fertiliser regulations. However, given the low agricultural value and limited uptake of good agricultural practices, a lot remains to be done to also see the effects of the policies and regulations on improved agricultural productivity.

Sustainability

The domestication of ECOWAS regulations and their harmonisation with national policy and regulations will be sustainable when these are ratified and passed through parliament. The sustainability of the PFJ results are yet to be seen, depending on the exit strategy of PFJ and the government interests after 2020.

Part II: Quantitative household survey

6 Methodology of the household-level survey

6.1 Introduction

One of AGRA's intervention instruments is funding farmer-level interventions through consortia projects and other investments. AGRA considers the continued use of outdated production technologies and practices as one of the biggest hurdles to increasing smallholder farmer productivity in Africa. However, farmers are known to adopt new technologies when they are useful, affordable, and available locally. In the past, AGRA has invested in the development and production of new crop varieties that are higher-yielding, resistant to local pests and diseases, and are more resilient in the face of environmental and climatic stress. In addition, collaborations with the African private sector have contributed to the establishment of village-based agents (VBAs).

Under the PIATA programme, AGRA gives grants to consortia that promote market-oriented agriculture by focussing on improving productivity and profitability of specific crop commodities (mostly cereals and legumes) for smallholder farmers. These value chain projects provide farmers with access to improved technologies and inputs, training and (structured) markets. The expectation is that smallholder farmers will be assured of a ready market for their produce, which will trigger intensification of production, and the buyers (processors or aggregators) will get a steady supply of quality crop produce.

The household-level survey is designed to measure changes at farm level. This is part of the internal monitoring of change within the beneficiary population of AGRA's interventions against an agreed upon (restricted) set of indicators. This allows for the continuous tracking of progress towards desired outcomes at farm level. The methodology targeted data collection by external, local and international consultants under the guidance and coordination of KIT.

The households' survey monitored the following indicators:

- Average number of months of adequate household food provision (Goal indicator 2)
- Wealth assets index score (Goal indicator 6)
- Average yield (kg/ha) of focus crops
- Rate of application of target improved productivity technologies or management practices at farmer level
- Percent of farmers accessing agricultural advisory extension support services
- Average fertiliser use
- Percent of post-harvest losses
- Value of smallholder incremental sales (value of additional volumes sold)
- Percent of farmers accessing financial services of formal institutions
- Average age of varieties of focus value chains on farmer fields
- Additional indicator 1: Average distance to agro-dealer
- Additional indicator 2: Hectares under improved productivity technologies or management practices
- Additional indicator 3: Farmers' clients
- Additional indicator 4: Small seed pack' exposure and utilisation

6.2 Sampling strategy

As the purpose of this assignment is monitoring performance against specific indicators, AGRA and KIT jointly decided to opt for a statistically sound, yet targeted, sample strategy. AGRA and KIT also agreed not to make use of counterfactuals. The target population for this study are all AGRA beneficiaries in the Northern and Brong Ahafo regions in Ghana. The sampling was done based on AGRA beneficiary lists.

The sample was determined using multi-stage random sampling, which first randomly selects geographically spread locations, within which, beneficiaries are then randomly selected. A sample of 2,000 households was randomly selected from the AGRA beneficiary population, using two-stage clustered sampling. The sampling procedure was done twice: two different samples were selected for maize and soybean, using an identical sampling procedure.

Firstly, districts that cover 60% of the population were randomly selected. Concentrating the sample in a subset of districts made data collection logistically feasible and at the same time, ensured sufficient spread of the data. The number of interviews to be conducted per district was then determined proportionally to the beneficiary population in each district. Thereafter, communities were randomly selected in the districts. The number of interviews per community was again determined based on the relative population size. Within each community, the number of male and female farmers to be interviewed was determined proportionally to the number of male and female beneficiaries in the community. Respondents were selected randomly. A buffer (about 20% of interviews to be conducted) was added in each community in case the selected sample could not be found.

The total number of surveys to be completed was agreed upon between KIT and AGRA, based on budget availability, and statistical reliability. The sample size per crop was set at 1,000, from which, a change in yields of 10% among the survey population with a confidence level of 95%, was expected (see Figure 3).

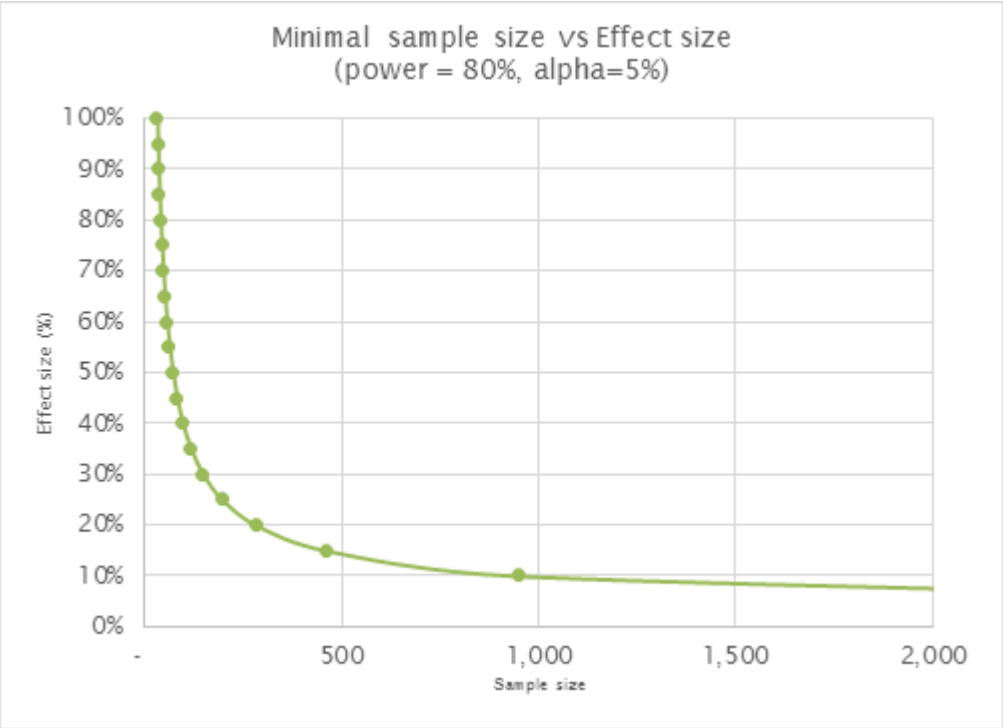

Figure 3: Power calculation

6.3 Survey structure

The main unit of analysis was the household. Therefore, it was possible that multiple household members were involved in answering questions. The survey always started with AGRA's main beneficiary, but during the survey, the respondent could switch. Questions on agricultural production were answered by the person in the household most knowledgeable in this area. Questions on household food security were answered by the household member in charge of food and cooking, which was usually a woman.

The survey starts with a general part, followed by a crop-specific part, and then another set of generic questions. At the start of the survey, the enumerator selects the crop cultivated by the respondent. This ensures that only questions concerning that crop appear in the interactive form. The same applies for the respective seasons in which the farmer cultivated the respective crop.

The survey instrument was designed to collect detailed information on the following topics:

- General:
    - Demographics and wealth indicators
- Crop-specific:
    - Agricultural land
    - Production of the focus crop
    - Allocation of the focus crop
    - Revenues
    - Crop varieties and seed use
    - Use of productivity-enhancing technologies
    - Post-harvest practices
    - Farmers' clients
- General:
    - Agricultural extension

- Financial services
- Food security

The data was collected using tablets and Open Data Kit (ODK), in combination with the secured survey site Kobo Toolbox. ODK is the leading open-source platform for collecting, storing and processing quantitative survey data. The use of this application ensures quick and reliable data collection. The questionnaire programmed in ODK makes calculations during the survey. This allows for referencing to responses given previously. It also allows for data checks, since it reduces the chance of errors by warning enumerators when unexpected values are entered. The form also includes skip-logics, so that enumerators only ask relevant questions based on previous responses. This ensures efficiency in data collection.

6.4 Limitations of the household survey

When interpreting this data, there are a few aspects that should be kept in mind. Firstly, the purpose of the assignment is 'internal' monitoring of change. As such, the assignment does not require impact measurement of AGRA and partners' interventions, and therefore does not require to measure change against counterfactuals and attribution of results.

In the second place, since the sampling was based on AGRA's beneficiary lists, the sample is only representative of AGRA's beneficiary population and its representativeness cannot be extended to the wider region or nation.
Furthermore, the lists of beneficiaries provided by AGRA were often incomplete and local consultants faced challenges in finding the sampled households due to incorrect beneficiary information. This was especially prevalent for households in the soybean sample. In turned out that, at the time of the survey, a large part of the sampled population had in fact not yet started cultivating soybean. Also, the target population was not always reached by any AGRA intervention or support.

Finally, since the focus crop was changed from rice to soybean at short notice, a programming error in the survey instrument lead to a mistake in the logic of the survey form. Consequently, information on soybean varieties was not collected.

7 Household-level results: maize in the Northern and Brong Ahafo regions (2018 season)

7.1 Sample description maize farmers

Survey area

A total sample of 1,145 maize-cultivating households were interviewed in the Northern (95%) and Brong Ahafo region (5%). Within the Northern region, interviews were conducted in 37 communities, spread over 17 districts. Within the Brong Ahafo region, interviews were conducted in five communities, spread over five districts. The division of the sample over the two regions is proportional to the number of beneficiary households in each region. Figure 4 shows the geographical spread of surveyed households.

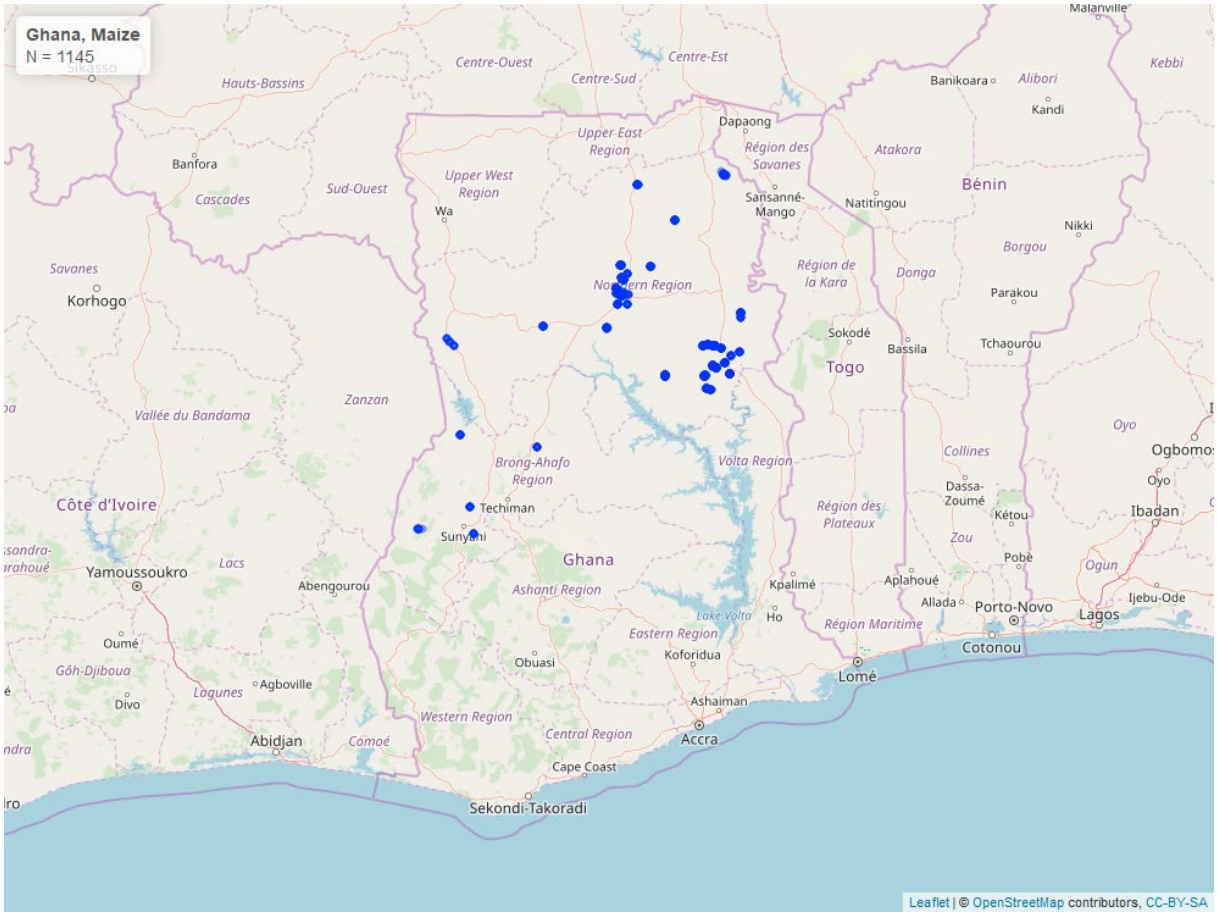

Figure 4: Location of farm household interviews, maize sample

Farm household characteristics (maize farmers)

Respondents were all beneficiaries of interventions supported by AGRA. The division of male and female respondents was more or less equal: 56% male, 44% were female. In 49% of the cases, the beneficiary was also the head of the household. This number was

significantly higher for female-headed households (82%) than male-headed households (47%). Respondents were on average 39 years old (see Figure 5).

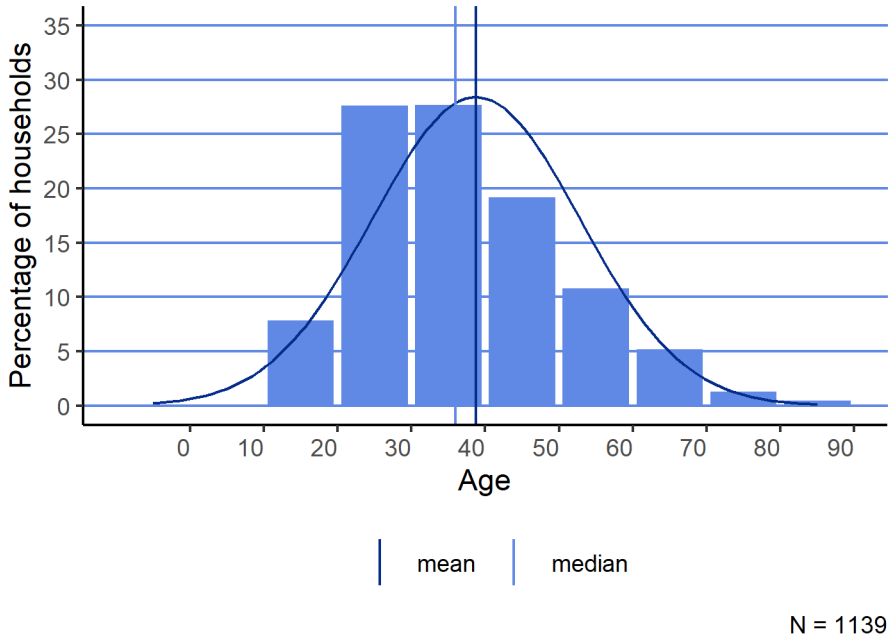

Figure 5: Distribution of age of respondent

Maize-growing households in northern Ghana are large. On average, they consist of 10.6 members (4.9 adults and 5.8 children), with female-headed households being significantly smaller (see Table 15).

Table 15: Household composition maize farmers

Household size	All	Male-headed	Female-headed	sig
Number of children in the household	5.8	5.8	4.6	***
Number of adults in the household	4.9	4.9	4.4	
N	1143	1060	82	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Almost all households (99.3%) own agricultural land. The average amount of land owned is 3.5 ha. Almost half of this land (1.2 ha) is used for maize cultivation (see Figure 6). There is a significant difference in land ownership and cultivation between male-headed and female-headed households.

A minority of 17% of households intercropped maize with other crops. Most commonly, maize is intercropped with groundnut (36%) and cassava (13%).

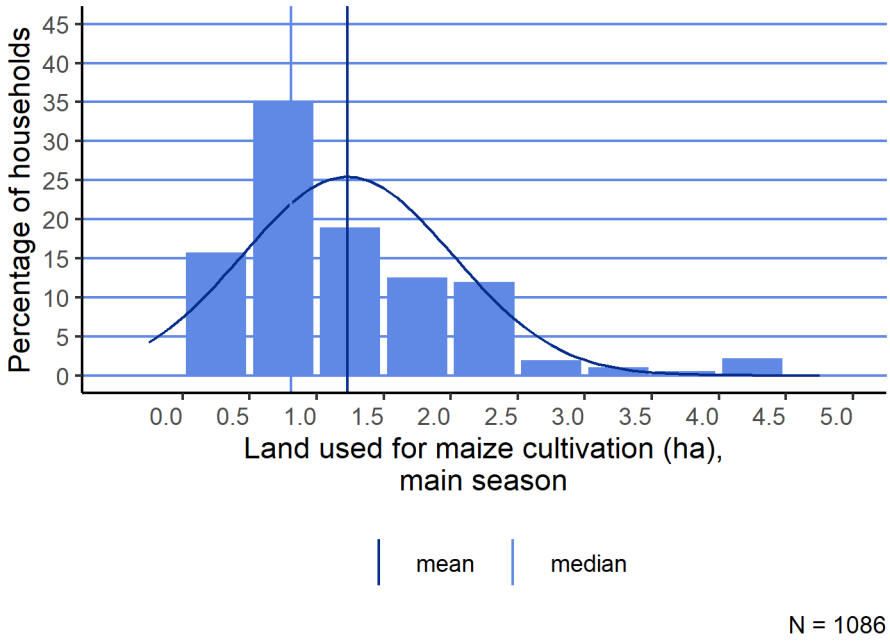

Figure 6: Distribution of land allocated to maize (ha), main season

In northern Ghana, there are two farming seasons for maize – the main season and the lean season. The main season ranges from approximately April/May until July/August. The lean season lasts from September until January/February. However, Table 16 shows that almost all households cultivated maize in the main season, while only a small share cultivated maize in the lean season. Due to the low number of respondents, this report only presents data for the main season.

Table 16: Percentage of households producing maize, per season

	All	Male-headed	Female-headed	sig
Main season	99%	99%	99%	
Lean season	6%	5%	11%	**
n	1144	1060	83	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%

7.2 Main indicators maize farmers

Table 17 gives an overview of the primary indicators collected. See Annex 2 (data dictionary) for definitions of each indicator. The indicators and underlying behavioural patterns are discussed in further detail in the following sections.

Table 17: Overview of main indicators for maize farming households

	All	Male-headed	Female-headed
G2: Average number of months of adequate household food provision	**10.5**	**10.5**	**10.3**
G6: Wealth assets index score	**-1.111**	**-1.112**	**-1.100**

	All	Male-headed	Female-headed
G6.1 Share of households in first wealth quintile (%)	89%	89%	87%
G6.2 Share of households in second wealth quintile (%)	10%	10%	10%
G6.3 Share of households in third wealth quintile (%)	1%	1%	1%
G6.4 Share of households in fourth wealth quintile (%)	0%	0%	1%
G6.5 Share of households in fifth wealth quintile (%)	0%	0%	0%
IWI International Wealth Index	41.4	41.4	40.3
1. Average yield (kg/ha)	**577**	**578**	**552**
3. Rate of application of target improved technologies or management practices	**58%**	**59%**	**48%**
3.1 Adoption of improved varieties (%)	14%	15%	11%
3.2 Adoption of endorsed varieties (%)	0%	0%	0%
3.3 Number of seasons variety is recycled	7.0	6.9	7.2
3.4 Adoption of endorsed planting practice (%)	45%	45%	45%
3.5 Adoption of inorganic fertiliser (%)	53%	54%	44%
3.6 Adoption of endorsed fertiliser (%)	41%	41%	32%
3.7 Adoption of organic fertiliser (%)	6%	6%	4%
3.8 Adoption of inoculants (%)	NA	NA	NA
3.9 Adoption of pest-management practices (%)	70%	70%	68%
3.10 Adoption of endorsed post-harvest practices (%)	23%	23%	13%
3.11 Adoption of improved storage (%)	2%	2%	2%
3.12 Use of designated storage facilities (%)	0%	0%	0%
3.13 Adoption of tablets to preserve quality of recycled seed (%)	14%	14%	9%*
Ha under improved technologies or management practices (%)	**56%**	**56%**	**56%**
3.14 Area under improved varieties (%)	16%	16%	16%
3.15 Area under inorganic fertiliser (%)	56%	56%	56%
3.16 Area under pesticides (%)	73%	73%	73%
4. Access to agricultural advisory extension support services	**31%**	**31%**	**30%**
4.1 Avg. no. of visits per year by agri. advisory extension support services	2.3	2.3	2.0*
4.2 Received small seed pack (%) (additional indicator 4)	6%	6%	5%
4.3 Used small seed pack (%) (additional indicator 4)	83%	82%	100%*
4.4 Distance to nearest agro-dealer (minutes)	47.2	47.2	47.8
5. Nitrogen application (kg/ha)	**16.3**	**16.7**	**11.8**

	All	Male-headed	Female-headed
5.1 Phosphorus application (kg/ha)	7.5	7.7	6.0
5.2 Potassium application (kg/ha)	7.1	7.2	5.8
Average fertiliser use (Total N + P + K, kg/ha)	**30.5**	**31.1**	**2.**
6. Percent of post-harvest losses (%)	**2%**	**2%**	**1%**
10. Value of incremental sales as a result of AGRA (crop revenue) (US$)	**35.8**	**37.0**	**17.6**
13. Access to formal financial services (%)	**15%**	**15%**	**14%**
13.1 Bank account (%)	13%	14%	12%
13.2 Agricultural loan (%)	3%	3%	4%
13.3 Agricultural insurance (%)	0%	0%	0%
17. Average age of varieties used (years)	**23.5**	**23.5**	**24.2***
33. Sale through structured trading facilities/arrangements (%)	**2%**	**2%**	**0%***
33.1 Selling to traders/middlemen (%)	78%	78%	78%*
33.2 Selling to consumers (%)	15%	14%	15%*
33.3 Selling to friends/neighbours (%)	1%	1%	0%*
33.4 Selling to aggregation centre (%)	0%	0%	0%*
33.5 Selling to farmer organisation (%)	0%	0%	0%*
33.6 Selling to wholesalers (%)	8%	8%	7%*
33.7 Selling to processors (%)	2%	3%	0%*
33.8 Selling to retailers (%)	15%	14%	26%*
33.9 Selling to company (undefined) (%)	1%	1%	0%*
33.10 Selling to institutional buyers (%)	NA	NA	NA
37. Access to market information through formal channel (%)	**1%**	**1%**	**0%**

The composition of variables can be found in the data dictionary in Annex 1; N might vary across indicators
** indicates that the average has been calculated with less than 50 observations*

7.3 Number of months of adequate household food provision (indicator G2)

Table 18 reports the average number of months of adequate household food provision. It shows that the AGRA-supported farmers have, on average, enough food to meet their family's needs during 10.5 months of the year. No significant difference in food security was found between male-headed and female-headed households.

Table 18: Average number of months of adequate household food provision (G2)

	All	Male-headed	Female-headed
G2: Average number of months of adequate household food provision	10.5	10.5	10.3

Figure 7 shows the distribution of the months of adequate household food provision; 35% of AGRA-supported farmers report to have had enough food to meet their family's needs during the entire year. However, 14% did not have enough food for one month; and 25% were food insecure for two months. No one reported to experiencing food insecurity for more than six months per year.

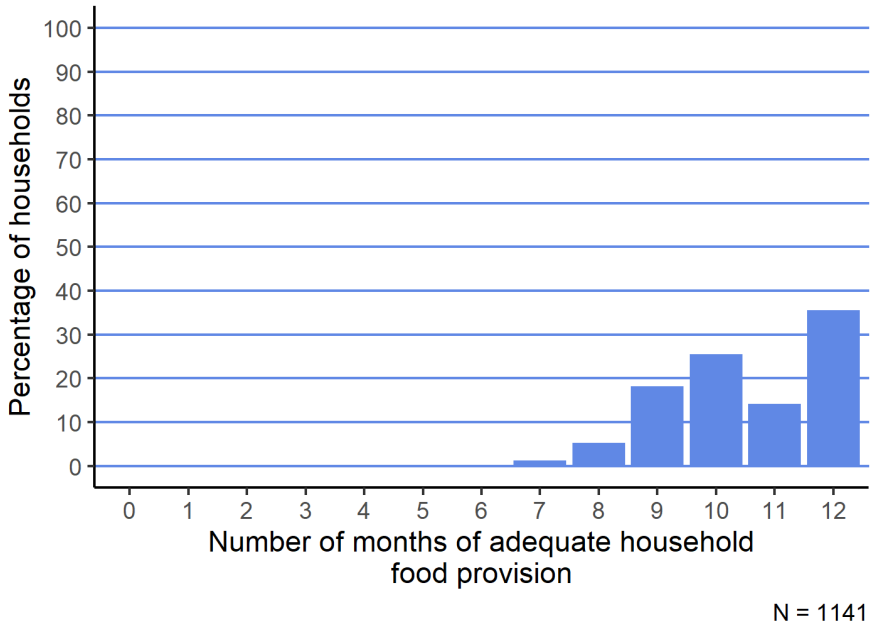

Figure 7: Distribution of number of months of adequate household food provision (G2)

Figure 8 shows the distribution of months with adequate household food provision over the year. July and August 2018 and June and July 2019 were the months in which food insecurity was highest. This is in line with expectations, as these months are towards the end of the main cropping season (wet season) and food insecurity is usually highest right before harvest.

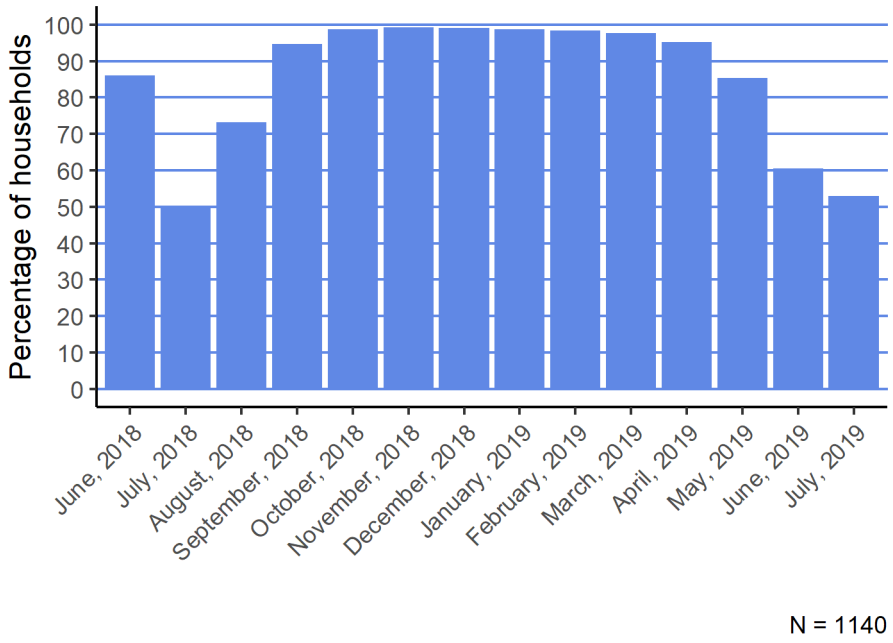

Figure 8: Distribution of months with adequate household food provision

7.4 Wealth asset index score (indicator G6)

Table 19 shows the quintile distribution of the Demographic and Health Surveys (DHS) wealth index. The DHS household wealth index is a composite measure of a household's cumulative living standard. It is composed of data on asset ownership, materials used for housing construction, and types of water access and sanitation facilities[2]. Wealth index scores were compared with the national Ghanaian DHS distribution for rural areas to determine the household's relative wealth as compared to the country average. As can be seen from Table 19, most households (89%) are in the first (poorest) wealth quintile. Ten percent are in the second quintile, and only 1% are in the third quintile or above. The households in the sample are thus among the poorest households in the country. Geographically, this is as expected, as the north of the country is generally less wealthy than the south.

Table 19: DHS wealth index

	All	Male-headed	Female-headed
G6: Wealth assets index score	-1.111	-1.112	-1.100
G6.1 Share of households in first wealth quintile (%)	89%	89%	87%
G6.2 Share of households in second wealth quintile (%)	10%	10%	10%
G6.3 Share of households in third wealth quintile (%)	1%	1%	1%
G6.4 Share of households in fourth wealth quintile (%)	0%	0%	1%

[2] Source: https://dhsprogram.com/topics/wealth-index/Wealth-Index-Construction.cfm

G6.5 Share of households in fifth wealth quintile (%)	0%	0%	0%
IWI International Wealth Index	41.4	41.4	40.3

7.5 Yield (indicator 1)

Maize yields are estimated by dividing the total maize production by the area of land under maize cultivation. To enhance data accuracy, respondents were able to answer questions in units of their preference for both production and land size. The preferred unit for production was most often bags or bowls, while the preferred unit of land size was most often acres. Production and land data units were then converted to kilograms and hectares. Out of 1,145 interviewed households, 28 respondents did not know their maize production, while 20 respondents did not know the exact area of land that was cultivated.

Respondents reported an average maize production of 723 kg per household. Figure 9 shows the quantity distribution of maize harvested. Production was significantly higher among male-headed households (see Table 20). The average value of maize production per household is estimated at GH₵1,086 (US$235).

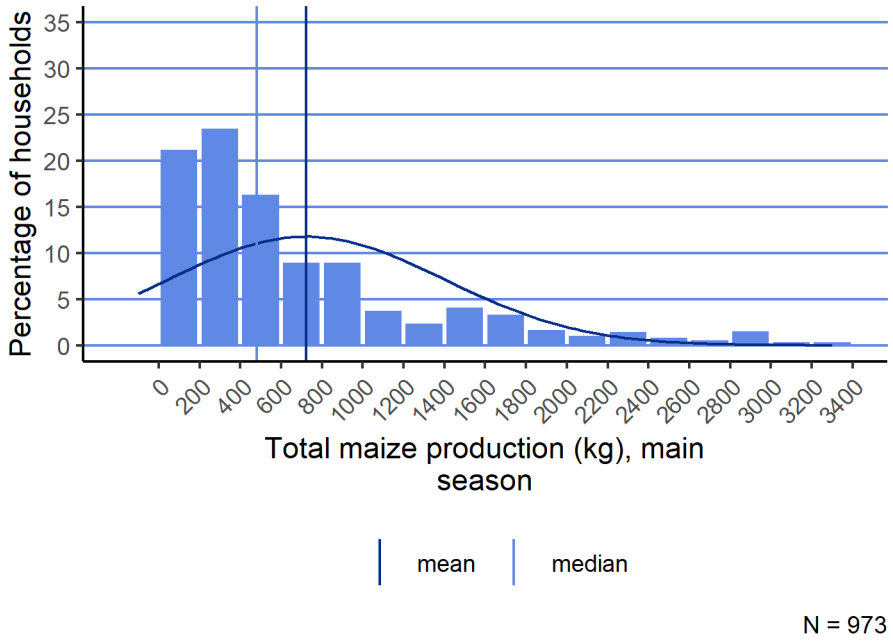

Figure 9: Distribution of total production of maize (kg), main season

Table 20: Total production of maize (kg), main season

Total maize production (kg), main season	All	Male-headed	Female-headed	sig
Mean	723.6	740.6	469.5	***
Median	480.0	500.0	300.0	
n	973	912	61	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Maize yields are on average 577 kg/ha (see Table 21 and Figure 10) and while male-headed households had, on average, higher production figures than female-headed households,

there was no substantial difference in yields. This is due to the fact that male-headed households had larger areas of land under maize cultivation.

Table 21: Average maize yield (kg/ha)

	All	Male-headed	Female-headed
1 Average yield (kg/ha)	577	578	552

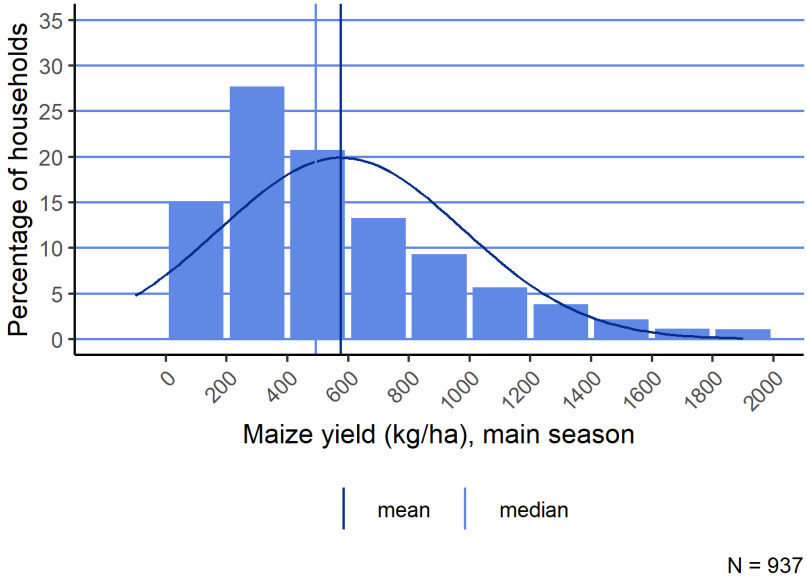

Figure 10: Distribution of average maize yield (kg/ha), main season

Most farmers (63%) perceived the main season's harvest of 2018 to be worse than usual, whereas 30% considered it a normal season. The remaining 7% considered the season to be better than usual (see Table 22).

Table 22: Ranking of the 2018 main season's maize harvest compared to other seasons (percentage of households per answer)

This season's harvest relative to other seasons	All	Male-headed	Female-headed	sig
Normal	30%	31%	26%	
Worse than usual	63%	63%	68%	
Better than usual	7%	7%	5%	
n	1104	1027	76	

*Note: significance from a Chi-squared statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

7.6 Rate of application of target improved productivity technologies or management practices (indicators 3, 5, 17)

Improved varieties, recycling and planting practices

Improved varieties

Table 23 shows that 14% of the surveyed farm households make use of improved maize varieties that are either hybrids or improved OPVs. In Ghana, the varieties promoted by AGRA are Abontem, Bihilfa, Junjor Wari, Kpari-Faaso, Lake 600, Opeiburoo, Tintim and Wang Dataa. In 2018, none of the households used these endorsed varieties (see Table 23).

Table 23: Main indicators for the use of improved varieties, recycling, and planting practices

	All	Male-headed	Female-headed
3.1 Adoption of improved varieties (%)	14%	15%	11%
3.2 Adoption of endorsed varieties (%)	0%	0%	0%
3.3 Number of seasons variety is recycled	7.0	6.9	7.2
3.4 Adoption of endorsed planting practice (%)	45%	45%	45%
17 Average age of varieties used (years)	23.6	23.6	24.2
Ha under improved technologies or management practices (%)	56%	56%	56%

Table 24 lists the varieties grown. It shows that the large majority of households apply local varieties, without specifying the name. This is more common among female-headed households. An outstanding result is that an additional 17% do not know which variety they cultivate. After local varieties, the variety sowed at the highest frequency is the OPV Obatanpa. Only 11% of households indicate to have sown this variety.

Table 24: Maize varieties used (percentage of households per variety), main season

Varieties	All	Male-headed	Female-headed	sig
Local variety, unspecified	59%	59%	70%	**
Don't know	17%	17%	15%	
Obatanpa	11%	11%	10%	
White maize	4%	4%	2%	
Agric seed company, unspecified	4%	4%	2%	
Other	3%	3%	0%	
Yellow maize	1%	1%	1%	
CSIR-Aburohema	1%	1%	0%	
Dadaba	1%	1%	1%	
Sanzal-sima	1%	1%	1%	
Okomasa	1%	1%	0%	
Aburohema	1%	1%	0%	
n	1,131	1,049	81	

Varieties	All	Male-headed	Female-headed	sig

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 0.5% are combined in 'Other'

Table 25 groups the cultivated varieties into hybrid, local variety, or OPV categories. However, due to the large number of farmers not knowing which variety they cultivate, 27% of varieties could not be classified within one group. Table 25 also shows that 59% of farmers sowed local varieties, and 14% sowed improved OPVs. Only four households (0.35%) cultivated a hybrid variety in 2018.

Table 25: Type of main maize variety (percentage of households per variety type), main season

Type of main variety, main season	All	Male-headed	Female-headed	sig
Local variety	59%	58%	69%	
Not able to classify	27%	27%	20%	
OPV	14%	14%	11%	
Hybrid	0%	0%	0%	
n	1131	1049	81	

*Note: significance from a Chi-squared statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

The main motivation for selecting a certain variety is, by far, yields (63%). Additionally, households select varieties based on favourable maturing time (33%) and taste (31%). However, a large share of households also indicated cultivating a certain variety simply because it is the only variety that they know. Table 26 shows that a variety's yield potential is significantly more important to male-headed households, while receiving a price premium from buyers is significantly more important for female-headed households.

Table 26: Appreciated traits of the main maize variety used (percentage of households per trait), main season

Maize variety traits	All	Male-headed	Female-headed	sig
Yields	63%	63%	53%	*
Maturing time	33%	33%	33%	
Taste	31%	31%	35%	
It's the only variety that I know	22%	22%	23%	
Conservation (storage time)	19%	19%	23%	
Tolerance to droughts	16%	16%	11%	
Only variety available	15%	15%	12%	
Processing	10%	10%	15%	
Appreciated by buyers (market)	8%	8%	10%	
Tolerance to diseases	5%	5%	5%	
It was free	4%	4%	1%	
Tolerance to pests	3%	3%	4%	
Price and/or premium from buyers	3%	3%	7%	**
Tolerance to floods	2%	3%	1%	
Colour	2%	2%	2%	
Other	2%	2%	2%	
n	1130	1048	81	

Maize variety traits	All	Male-headed	Female-headed	sig

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'

The average age of hybrid and OPV varieties used by farming households is 23.6 years (see Table 27). Seeds are, on average, recycled for seven seasons before they are renewed. Table 28 shows the source of seeds, which differs per variety type. Whereas local varieties are most often obtained from the field of a community member (54%) or market stalls (20%), OPVs most often come from agro-dealers (27%) and government extension services (22%). The four households that cultivated hybrid varieties all received the seed from government extension agents.

Table 27: Age of main maize variety (years), main season

Age of main variety (years), main season	All	Male-headed	Female-headed	sig
Mean	23.6	23.6	24.2	
Median	27.0	27.0	27.0	
n	152	143	9	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
n = number of Hybrid/OPV varieties of which the age could be classified. Age could not be classified for 84% of Hybrid and OPV varieties.

Table 28: Source of seed of main maize variety (percentage of households per source), by type of variety, main season

Source of the seed, main season	All	Local variety	OPV	Hybrid	sig
Recycled from the field of friend/family/neighbour… etc.	54%	72%	33%	0%	
Agro-dealer	18%	6%	27%	0%	
Market stall (not specifically for inputs)	20%	21%	15%	0%	
Government Extension Services	7%	1%	22%	100%	
Other	1%	0%	3%	0%	
n	287	121	55	1	

*Note: significance from a Chi-squared statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Categories smaller than 1% are combined in 'Other'

In line with expectations, there is a large yield difference between households cultivating different types of varieties, where OPVs and hybrids result in higher yields than local varieties. This difference is roughly 200 kg/ha, and is statistically significant at the 1% level (Table 29).

Table 29: Average maize yield (kg/ha), by type of variety, main season

Maize yield (kg/ha), main season	All	Local variety	OPV	Hybrid	sig
Mean	576.8	516.3	744.6	700.1	***
Median	494.2	432.4	741.3	556.0	
n	937	565	131	3	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Planting practices

Table 23 shows the percentage of farmers adopting endorsed planting practices. In Ghana, the planting practice promoted by AGRA concerns spacing: households are advised to plant

seeds with a spacing of 25 cm intra-row and 75 cm inter-row. In total, 63% of the households used fixed spacing (Table 30). The other households broadcasted their seed (2%), or planted without using fixed spacing (scattering) (35%).

Table 30: Planting method of maize (percentage of housing per method), main season

Planting method, main season	All	Male-headed	Female-headed	sig
Broadcasting	2%	2%	1%	
Scattering	35%	35%	36%	
Planting with fixed spacing	63%	63%	63%	
n	1107	1025	81	

*Note: significance from a Chi-squared statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Table 31 shows that, among the farmers who planted using fixed spacing, 25-75 cm is indeed the most commonly used spacing. It is applied by 72% of farmers who planted using fixed spacing.

Table 31: Spacing between maize seeds (percentage of households per method), main season

Planting method, spacing, main season	All	Male-headed	Female-headed	sig
25-75 cm (promoted)	72%	72%	73%	
20-80 cm	12%	12%	16%	
40-80 cm	9%	9%	6%	
20-70 cm	5%	5%	6%	
Other	2%	3%	0%	
n	711	660	51	

*Note: significance from a Chi-squared statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Categories smaller than 1% are combined in 'Other'

Fertiliser use

Table 32 presents the main indicators on fertiliser use. About half of households (53%) applied inorganic fertiliser, which was significantly higher among male-headed households. In total, 56% of the farmers applied inorganic fertilisers to their maize crop.

Table 32: Main indicators for the adoption and use of fertilisers

	All	Male-headed	Female-headed
3.5 Adoption of inorganic fertiliser (% of households)	53%	54%	44%
3.6 Adoption of endorsed fertiliser (% of households)	41%	41%	32%
3.7 Adoption of organic fertiliser (% of households)	6%	6%	4%
3.15 Area under inorganic fertiliser (%)	56%	56%	56%
5. Nitrogen application (kg/ha)	16.2	16.6	11.8

5.1 Phosphorus application (kg/ha)	7.5	7.6	6.0
5.2 Potassium application (kg/ha)	7.0	7.1	5.8
Average fertiliser use (Total N + P + K, kg/ha)	30.5	31.1	22.8

In Ghana, AGRA promotes the NPK (nitrogen, phosphorus, potassium) fertiliser, which has a 15-15-15 formula, and Actyva Yara, which consists of NPK 23-10-5, 2 magnesium oxide, 3 sulphur, and 0.3 zinc. Forty one percent of farmers applies these endorsed fertilisers. Other fertilisers used in Ghana are ammonium sulphate (applied by 50%) and urea (applied by 12%).

On average, NPK users applied 139 kg NPK/ha. Actyva application is on average 150 kg/ha by product users. This application rate ammonium sulphate is lower at 95 kg/ha, and urea lower still at 96 kg/ha.

Nitrogen is the macronutrient applied in the largest quantity (16.2 kg/ha), followed by phosphorous (7.5 kg/ha) and potassium (7.0 kg/ha). Additionally, low quantities of the secondary macronutrients calcium, magnesium and sulphur are applied in Ghana (see Table 33). The micronutrient zinc is also applied, but the quantity is negligible.

Table 33: Nutrients applied for maize (kg/ha), main season

	All	Male-headed	Female-headed	sig
Nitrogen application (kg/ha), main season	16.2	16.6	11.8	*
Phosphorus application (kg/ha), main season	7.5	7.6	6.0	
Potassium application (kg/ha), main season	7.0	7.1	5.8	
Sulphur application (kg/ha), main season	5.9	6.0	4.4	
Calcium application (kg/ha), season i	0.0	0.0	0.0	
Magnesium application (kg/ha), main season	0.2	0.2	0.0	*
Boron application (kg/ha), main season	0.0	0.0	0.0	NA
Zinc application (kg/ha, main season	0.0	0.0	0.0	
n	1125	1044	80	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

The most common source of information on fertiliser types is observation in the community (48%), or self-learning (26%). Only 2% of households reported that they received information on fertiliser type from their VBA. The majority of households has been applying fertiliser for longer than five years. The most common fertiliser application method is top dressing, around four weeks after planting (46%), and dropping it by the seed around 15 days after planting (31%). The first of these practices is promoted by AGRA. Top dressing at other stages is also popular.

Only 6% of households use organic fertiliser. Organic fertiliser is most often manure (88%) or compost (30%) (see Table 34). Crop residues and granular fertiliser are applied as well, albeit by a low number of farmers. Information on organic fertilisers mainly comes from traditional knowledge. Most farmers (85%) obtain information on organic fertiliser from sources within the community. The large majority of farmers have used organic fertiliser for more than five years.

Table 34: Types of organic fertiliser used for maize (percentage of households per type)

Types of organic fertiliser	All	Male-headed	Female-headed	sig
Granular	1%	2%	0%	
Compost	30%	30%	33%	
Manure	88%	88%	100%	
Crop residues	12%	11%	33%	
n	67	64	3	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
n = households that apply fertiliser

There are substantial differences in productivity between farmers who apply fertiliser and farmers who do not. In line with expectations, yields are higher amongst farmers that apply fertilisers (see Table 35); the difference of 222 kg/ha is highly significant.

Table 35: Average maize yield (kg/ha), by fertiliser use (yes/no), main season

Maize yield (kg/ha), main season	All	No	Yes	sig
Mean	576.8	453.6	675.5	***
Median	494.2	370.7	593.1	
n	937	423	513	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Pest management practices

Table 36 shows the percentage of households who have adopted pest management practices. Adoption of pest management practices is defined as the percentage of households applying pesticides, herbicides and/or fungicides. The table shows that 70% of households used pest management practices.

Table 36 Adoption of pest-management practices

	All	Male-headed	Female-headed
3.9 Adoption of pest-management practices (%)	70%	70%	68%

From all three types of agro-chemicals, herbicides are used most (62%), followed by pesticides (10%) (see Table 37). The share of households that applied fungicides is negligible: only 0.44% (five households).

Table 37: Percentage of households applying agro-chemical inputs, main season

	All	Male-headed	Female-headed	sig
Pesticide application, main season	10%	10%	6%	
Herbicide application, main season	68%	68%	68%	
Fungicide application, main season	0%	0%	0%	
n	1131	1049	81	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

In most cases, agro-chemicals are applied to the entire land area. Of the farmer's land area combined, 62% was treated with herbicides and 9% with pesticides (see Table 38). Due to the low number of households applying fungicides, fungicides are applied on less than 1% of cultivated land.

Table 38: Percentage of total land area used for maize cultivation under agro-chemical inputs, main season

	All	Male-headed	Female-headed	sig
Percentage of total land area under pesticides, main season	9%	9%	4%	
Percentage of total land area under herbicides, main season	62%	63%	60%	
Percentage of total land area under fungicides, main season	0.3%	0.3%	0.4%	
n	1145	1060	83	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

In most cases (77%), farmers applied herbicides before weeds emerged, but nearly half (47%) applied herbicides post-emergence (see Table 39). A quarter (24%) of households applied herbicides in both incidences. Whilst APRA endorses this practice of application pre- and post- weed emergence, information on herbicides is usually obtained within the community: 86% learned about herbicides from fellow community members. Only 1% received information on herbicides from their VBA. In addition to herbicide use, 92% of households apply weeding. On average, the farmers weeded their crops 1.8 times per season.

Table 39: Timing of herbicide application for maize (percentage of households per answer), main season

	All	Male-headed	Female-headed	sig
Pre-emergence (promoted)	77%	75%	93%	***
Post-emergence (promoted)	47%	48%	42%	
n	767	711	55	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
n = households that apply herbicides

Post-harvest practices

Table 40 shows the main indicators of post-harvest practices endorsed by AGRA with the purpose of minimising post-harvest losses. Various post-harvest practices are captured in four indicators. The adoption of endorsed post-harvest practices (indicator 3.10) is defined as the use of a sheet or tarpaulin at least once during maize processing (drying and threshing). The adoption of improved storage facilities (indicator 3.11) measures the percentage of farmers storing maize in silos or double liner hermetic storage bags (such as Purdue Improved Crop Storage (PICS) bags). Households use designated storage facilities (indicator 3.12) when they store maize at farmer's organisations, private storage facilities, or through the warehouse receipt systems.

Table 40: Main indicators for the adoption of improved post-harvest practices

	All	Male-headed	Female-headed
3.10 Adoption of endorsed post-harvest practices (%)	23%	23%	13%
3.11 Adoption of improved storage (%)	2%	2%	2%
3.12 Use of designated storage facilities (%)	0%	0%	0%
3.13 Adoption of tablets to preserve quality of recycled seed (%)	14%	14%	9%*

A quarter (23%) of the farmers used a tarpaulin at least once during processing. Table 41 shows that 21% of the households use a tarpaulin when drying maize (a practice promoted by AGRA). In most cases (87%), households learned about tarpaulin use themselves, or from observation in the community. The majority (85%) of the households that used a tarpaulin have been doing so for more than four years.

Table 41: Use of sheeting when drying maize (percentage of households), main season

Usage of sheet/tarpaulin when drying maize, main season	All	Male-headed	Female-headed	sig
Mean	21%	21%	11%	**
n	1102	1026	75	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Most farmers (72%) still thresh their maize manually. Tarpaulin use during threshing is low: only 14% (see Table 42). Again, household's main source of information on tarpaulin use is observation in the community (90%). The majority (89%) of households that use tarpaulins for threshing have been doing so for over four years.

Table 42: Use of sheets for manual threshing of maize (percentage of households), main season

Usage of sheet/tarpaulin when threshing maize, main season	All	Male-headed	Female-headed	sig
Mean	14%	14%	7%	
n	794	735	58	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

When it comes to improved storage facilities, PICS bags, or other improved bags, are not (yet) widely used for maize storage in Ghana. Only 2% of households stored their maize in improved bags (Table 43). Although PICS bags are originally designed to store beans, AGRA also promotes them for maize storage in Ghana. Due to the small share of households using PICS bags, the uptake of improved storage facilities is very low in Ghana (2%).

Table 43: Percentage of households using PICS bags for maize storage, main season

Usage of PICS bags, main season	All	Male-headed	Female-headed	sig
Mean	2%	2%	3%	
n	1103	1026	76	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

While the use of improved storage facilities is low. Table 44 shows that 14% of households recycling seeds makes use of tablets that prevent quality loss in seed storage. This practice is also promoted by AGRA in Ghana.

Table 44: Use of preservative tablets for maize seeds, main season

Usage of preservative tablets for maize seed, main season	All	Male-headed	Female-headed	sig
Mean	14%	14%	9%	
n	604	571	33	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Besides stocking maize with the purpose of personal consumption later, it can also be stocked for the purpose of selling (when prices are high). Only 19% of households stock maize for this purpose. On average, households stocked 335 kg. The percentage of households using designated storage facilities is 0: all households that stock maize used their own storage facilities (see Table 45).

Table 45: Type of storage used for maize (percentage of households per type), main season

	All	Male-headed	Female-headed	sig
Own storage	100%	100%	100%	
Farmer organisation storage	0%	0%	0%	
Warehouse receipt system	0%	0%	0%	NA
n	228	214	14	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%

7.7 Access to agricultural advisory support services (indicator 4)

Access to agricultural advisory extension support services is defined as the percentage of households that interacted with an agricultural extension officer during the previous 12 months. During these months, 31% of households were visited by an agricultural extension officer (see Table 46). On average, households that met with an extension officer were visited between two and three times during the year.

Table 46: Main indicators for access to agricultural advisory support services

	All	Male-headed	Female-headed
4 Access to agricultural advisory extension support services	31%	31%	30%
4.1 Avg. no. of visits per year by agricultural advisory extension support services	2.3	2.3	2.0
4.2 Received small seed pack (%) (additional indicator 4)	6%	6%	5%
4.3 Used small seed pack (%) (additional indicator 4)	83%	82%	100%*
4.4 Distance to nearest agro-dealer (minutes)	47.2	47.2	47.8

Table 47 shows that extension officers were most often affiliated with the Ghanaian Government (74%); 29% were affiliated with NGOs, and only 3% of extension officers were VBAs.

Table 47: Affiliation of extension service provider (percentage of households per provider)

Type	All	Male-headed	Female-headed	sig
Government	74%	75%	68%	
Company	5%	4%	8%	
NGO	29%	29%	16%	
Farmer promoter/VBA	3%	3%	4%	
Don't know	6%	5%	20%	***
Other	1%	1%	0%	
n	354	329	25	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'

The most common extension method used among farmers who have participated in any kind of extension activities is farmer field schools (see Table 48). Fifteen percent of farmers indicated to have engaged in these schools. Demonstration plots, technology packages and transfer of knowledge in the farmer's organisation were mentioned by 8%, 5% and 5% of the households, respectively.

Table 48: Type of extension method used (percentage of households per method)

Method	All	Male-headed	Female-headed	sig
None	73%	74%	71%	
Farmer field schools	15%	14%	17%	

Method	All	Male-headed	Female-headed	sig
Demonstration plot	8%	8%	10%	
Technology packages	5%	5%	2%	
Transfer of knowledge within farmer organisation/training of trainers	5%	5%	4%	
Mentoring by lead farmers	4%	4%	8%	*
Don't know	3%	3%	5%	
Support by farmer promoter	2%	2%	0%	
Other	1%	2%	1%	
n	1142	1058	83	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'

Another aspect of advisory extension services is the distribution and use of promotional seed packs. Table 46 shows that only 6% of households received a small seed pack for the 2018 season. The uptake of the promotional seed packs is 83%, and female-headed households reported to planting the seeds from the seed pack more often than male-headed households.

Generally, appreciation of the seed packs is high: 85% of the households that planted the seeds are appreciative of them. Table 49 shows that farmers mainly appreciate the seeds for their yields and the (short) maturing time. Other appreciative aspects that were frequently mentioned include tolerance to pests (24%) and taste (20%).

Table 49: Variety traits that are positively appreciated of the promotional maize seed pack (percentage of households per trait)

Maize variety traits	All	Male-headed	Female-headed	sig
Yields	83%	84%	50%	
Maturing time	43%	43%	50%	
Tolerance to pests	24%	25%	0%	
Taste	20%	20%	0%	
Tolerance to diseases	13%	14%	0%	
Tolerance to droughts	11%	9%	50%	*
It was free	9%	9%	0%	
Conservation (storage time)	4%	5%	0%	
Processing	4%	5%	0%	
Tolerance to floods	2%	2%	0%	
Other	0%	0%	0%	NA
n	46	44	2	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'
n = households that appreciated the seeds from the promotional seed pack

Access to agricultural extension services also includes distance to the nearest agro-dealer. Distance to agro-dealers is based on travel time. As can be seen in
Table 50, average travel time is 47 minutes. When visiting the agro-dealer, households most often go by motorbike or car (indicated by 46% and 23%, respectively), followed by bicycles (17%) and by foot (13%). Farm households lived on average 12.5 km away from an agro-dealer.

Table 50: Average travel time to agro-dealer (minutes)

Distance to agro-dealer in minutes	All	Male-headed	Female-headed	sig
mean	47.2	47.2	47.8	
median	40.0	40.0	39.0	
n	834	777	56	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
n = number of people who answered in time-unit

7.8 Access to formal financial services (indicator 13)

Table 51 shows that 15% of the surveyed households have access to formal financial services. This means that 15% of the households has access to at least one bank account, a formal agricultural loan, or an agricultural insurer. This indicator thus only includes access to formal financial services, provided by formal financial institutions, and excludes access to informal financial services such as from village money lenders, relatives, or saving groups.

Table 51: Main indicators for access to formal financial services

	All	Male-headed	Female-headed
13 Access to formal financial services (%)	15%	15%	14%
13.1 Bank account (%)	13%	14%	12%
13.2 Agricultural loan (%)	3%	3%	4%
13.3 Agricultural insurance (%)	0%	0%	0%

The most accessible financial service of the three variables for this indicator, is a bank account. Thirteen percent of households have at least one bank account. Much lower, with 3%, is access to a loan. None of the households took out agricultural insurance in 2018. Households were not familiar with crop insurance.

While only 3% of the farmers took out a loan through a formal arrangement (banks, microfinance institutions, savings and credit cooperatives or mobile money), in total, 13% of farmers accessed a loan in 2018.

Table 52 shows the types of loan providers that were being used in 2018. Only 20% were provided by formal financial institutions such as banks or Savings and Credit Cooperatives (SACCOs). Most common are financial loans via family or friends, and village money lenders.

Table 52: Types of loan providers (percentage of households per provider)

Loan providers	All	Male-headed	Female-headed	sig
Family or friends	59%	60%	50%	
Village money lender	9%	8%	12%	
VSLA/ISLC/VICOBA (Informal savings and loans group)	7%	7%	12%	
SACCO/Credit Union	8%	8%	6%	

Loan providers	All	Male-headed	Female-headed	sig
Microfinance institution (MFI)	5%	4%	12%	
Bank	7%	8%	0%	
Trader	5%	5%	0%	
Other	2%	1%	6%	
n	152	136	16	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'
Excluding households that did not take loans

7.9 Post-harvest losses (indicator 6)

Post-harvest losses are measured by the amount of maize that is lost after harvesting as a share of total production. Table 53 shows that post-harvest losses were low in 2018; the average of 2% indicates that almost no maize was lost post-harvest. The majority of the sample (84%) did not lose any maize post-harvest. Losses of the remainder of the sample were low. Farmers lost between 3 and 500 kg, and 103.8 kg on average. While interpreting this data, it should, however, be kept in mind that post-harvest losses are typically difficult to estimate for farmers, as losses are typically not measured. Also, maize of inferior quality is often still used rather than considered as lost.

Table 53: Main indicator for post-harvest losses

	All	Male-headed	Female-headed
6 Percent of post-harvest losses (%)	2%	2%	1%

7.10 Access to market information (indicator 37)

The percentage of maize farmers that has access to formal channels of market information (SMS, radio, television, internet and the farmer's organisation) is only 1% (see Table 54).

Table 54: Main indicator for access to market information

	All	Male-headed	Female-headed
37. Access to market information through formal channel (%)	1%	1%	0%

Farmers do, however, use informal channels to acquire market information. Table 55 shows that, amongst farmers that sell their maize, market information is mainly acquired on the market itself (62%), from buyers (56%) and from other farmers (32%).

Table 55: Sources of market information used by farmers (percentage of households per source)

Source of market information	All	Male-headed	Female-headed	sig
Radio	2%	2%	0%	
Buyer	56%	55%	74%	**
Farmer to farmer	32%	32%	30%	
Market	62%	63%	44%	*

Source of market information	All	Male-headed	Female-headed	sig
Other	1%	1%	0%	
n	455	428	27	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'
n = households that sold maize

7.11 Sales channels (indicator 33)

Table 56 shows the main indicators for farmers' sales channels. It includes information on sale through structured trading facilities/arrangements, as well as information on farmers' clients.

Table 56: Main indicators on farmers' sales channels

	All	Male-headed	Female-headed
33 Sale through structured trading facilities/arrangements (%)	2%	2%	0%
33.1 Selling to traders/middlemen (%)	78%	78%	78%
33.2 Selling to consumers (%)	15%	14%	15%
33.3 Selling to friends/neighbours (%)	1%	1%	0%
33.4 Selling to aggregation centre (%)	0%	0%	0%
33.5 Selling to farmer organisation (%)	0%	0%	0%
33.6 Selling to wholesalers (%)	8%	8%	7%
33.7 Selling to processors (%)	2%	3%	0%
33.8 Selling to retailers (%)	15%	14%	26%
33.9 Selling to company (undefined) (%)	1%	1%	0%
33.10 Selling to institutional buyers (%)	N/A	N/A	N/A

A household is considered to sell through a structured trading facility when they sell at least part of their harvest through a formal contract. The survey revealed that 2% of farmers sold their harvest under a formal contract in 2018. Only one household received inputs (fertiliser) on credit as part of this contract.

Table 56 shows that farmers' clients are mainly traders or middlemen (78%), consumers (15%) and wholesalers (15%).

7.12 Value of incremental sales as a result of AGRA (indicator 10)

The value of incremental sales as a result of AGRA cannot be determined yet as only one round of data collection has been completed. Therefore, total revenues from maize sales are reported as a baseline value. Revenues were calculated by multiplying the quantity sold (in kg) by the common price received per kg. Values were converted to kilograms in the instances where quantities were reported in different units.

Table 57: Value of incremental sales as a result of AGRA

	All	Male-headed	Female-headed
10 Value of incremental sales as a result of AGRA (crop revenue in US$) – baseline value	35.8	37.0	17.6

Average value of production among households who marketed part of their production is GH₵1086 (US$235.00) (Table 58, Table 59). The average revenue from selling maize was GH₵165 (US$35.80[3]) per household. Total revenues from maize sales in GH₵ are shown in Table 60. Revenues are significantly higher for male-headed households.

Table 58: Crop value (GH₵) of maize produced

	All	Male-headed	Female-headed
Average value of production in GH₵	1086	1115	540
n = households that sold maize			

Table 59: Crop value (US$) of maize produced

	All	Male-headed	Female-headed
Average value of production in US$	235	241	116
n = households that sold maize			

Table 60: Sales value (total revenue) of maize sold per household, main season – calculated variable (IO5.3 – 36) – KIT indicator 10

Revenue from sales of maize, main season (GH₵)	All	Male-headed	Female-headed	sig
Mean	165.1	170.8	81.0	**
Median	0.0	0.0	0.0	
n	942	882	60	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
n = households that sold maize

The difference in revenues achieved by male and female-headed households is not caused by the price households receive for their maize. On average, households receive GH₵1.2/kg of maize. This price is almost identical between male- and female-headed households (see Table 61).

Table 61: Price received for maize (GH₵)

Common price received for maize (GH₵/kg), main season	All	Male-headed	Female-headed	sig
Mean	1.2	1.2	1.1	

[3] This value is converted from GH₵ to US$ by using the 2018 average exchange rate of 1 US$ = 4.618 GH₵

Common price received for maize (GH₵/kg), main season	All	Male-headed	Female-headed	sig
Median	1.2	1.2	1.0	
n	393	373	20	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
n = households that sold maize

Instead, the difference in price achieved between male- and female- headed households arises from quantities. Revenues for male-headed households are higher because male-headed households, on average, sell larger quantities. Table 62 shows that male-headed families sell higher shares of their harvest. Additionally, since male-headed households produce more maize (as was shown in Section 7.5), male-headed households also sell larger quantities in absolute terms.

Table 62: Allocation of maize harvest to different household uses (percentage of total harvest)

	All	Male-headed	Female-headed	sig
Maize used for consumption (% of harvest), main season	65%	64%	72%	**
Maize kept for seed (% of harvest), main season	4%	4%	2%	
Maize given away (% of harvest), main season	4%	4%	2%	*
Maize used as payment for inputs (% of harvest), main season	2%	2%	1%	
Maize bartered or exchanged for goods (% of harvest), main season	0%	0%	0%	
Maize sold (% of harvest), main season	19%	19%	15%	
Post-harvest losses of maize (% of total harvest), main season	2%	2%	1%	
n	973	912	61	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

8 Household-level results: soybean in the Northern region (2018 season)

8.1 Sample description soybean farmers

Survey area

Soybean households were located in the Northern region[4]. A total of 849 households were visited[5]. Interviews were conducted in 38 communities, spread over the following 11 districts:

- Gushiegu (49%)
- Kpandai (20%)
- Nanumba North (7%)
- Karaga (5%)
- Sagnerigu (1.7%)
- Kumbugu (2.7%)
- Mamprusi East (3%)
- Tamale (0.3%)
- Gonja Central (5%)
- Mamprusi West (1.4%)
- Savelugu-Nanton (5%)

Figure 11 below shows the geographical spread of surveyed households.

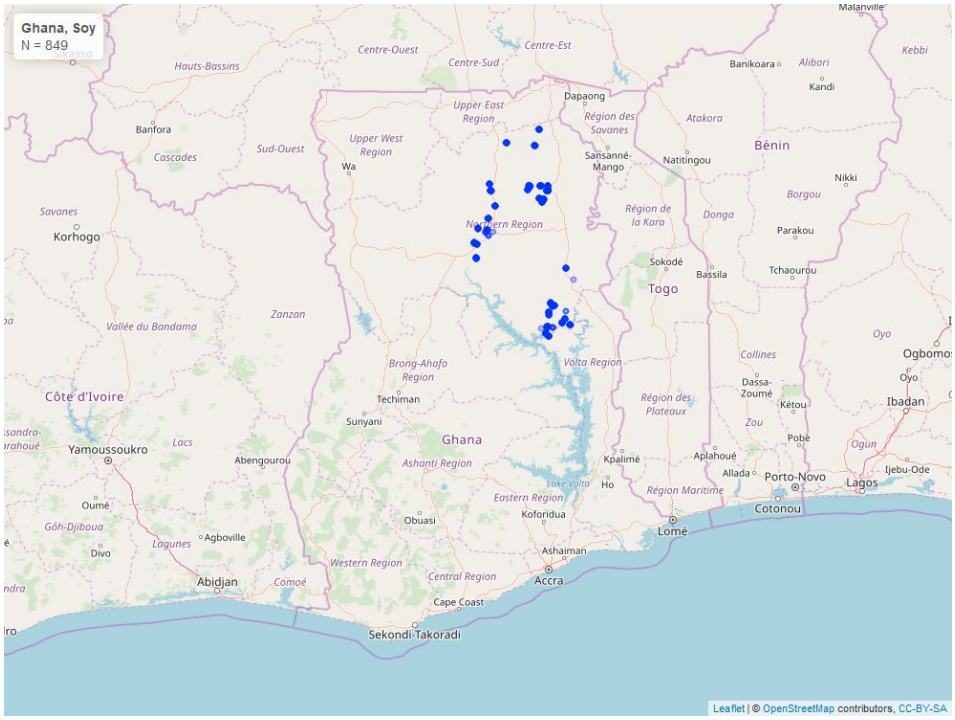

Figure 11: Location of farm household interviews, soybean sample

[4] This includes the current Northern, Savannah and North East regions.
[5] Although the sample consisted of 1,000 soybean farmers, a total number 849 households were visited. The gap was caused by discrepancies between the beneficiary lists and information in the field: many farmers listed as soybean farmers, indicated they had never cultivated soybean.

Farm household characteristics (soybean farmers)

The majority of soybean respondents were women (71%), most likely explained by the fact that legume crops are considered as a woman's crop in many communities. Only 31% of soybean respondents were head of their households. Respondents were on average 36.9 years old (see Figure 12).

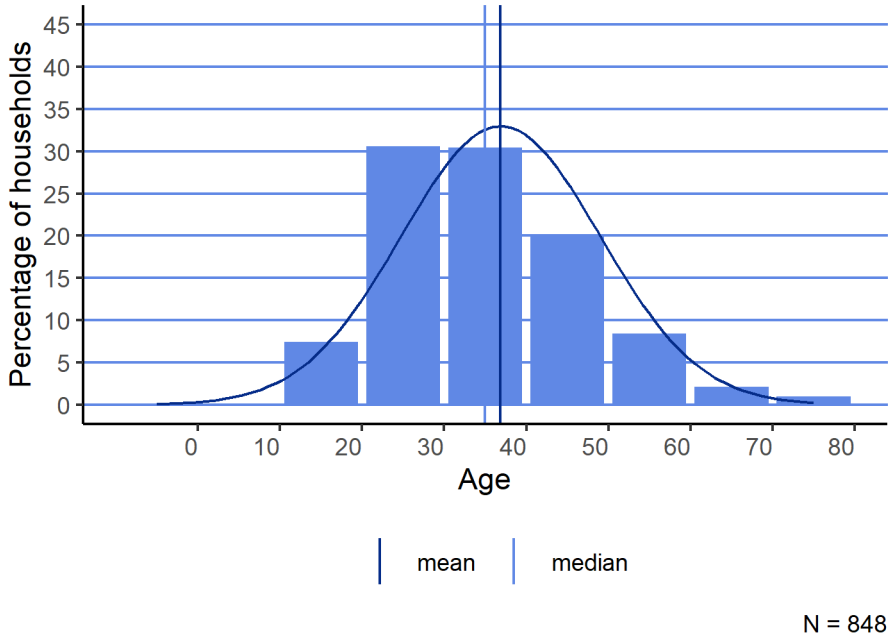

Figure 12: Distribution of age respondent

Soybean-growing households in northern Ghana are large. On average, they consist of 11.5 members (5.3 adults and 6.1 children), with female-headed households being significantly smaller (see Table 63).

Table 63: Household composition soybean farmers

Adult/children	All	Male-headed	Female-headed	sig
Number of children in the household	6.1	6.3	4.9	***
Number of adults in the household	5.3	5.4	4.8	
n	849	766	83	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Almost all households (99.7%) own agricultural land. The average area of land owned is 3.5 ha, less than half of which (1 ha) is used for soybean cultivation (see Figure 13). There is a significant difference in land ownership between male-headed and female-headed households, with male-headed households, on average, owning more land. The extra land owned by men is not used for soybean cultivation; male-headed and female-headed households attribute more or less equal amounts of land to the cultivation of soybeans.

Only 4% of the households have intercropped soybean with other crops. Most commonly, soybean is intercropped with groundnut or millet.

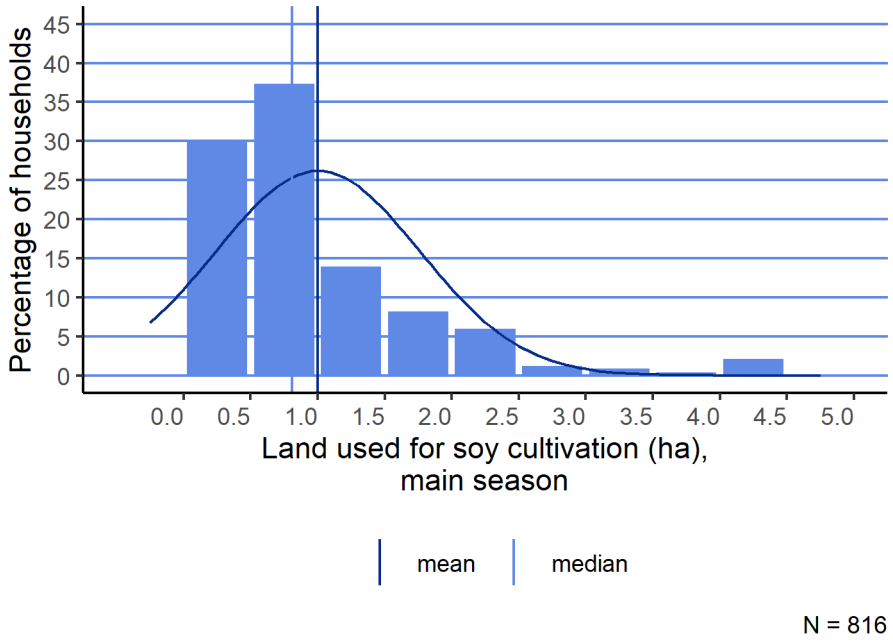

Figure 13: Distribution of land allocated to soybean (ha), main season

In northern Ghana, there are two farming seasons for soybean – the main season and the lean season. The main season ranges from approximately April/May until July/August. The lean season lasts from September until January/February. However, Table 64 shows that all households, with only one exception, cultivated soybean in the main season. Consequently, this report only presents data for the main season.

Table 64: Percentage of households producing soybean, per season

	All	Male-headed	Female-headed	sig
Main season	100%	100%	100%	
Lean season	0%	0%	0%	
n	849	766	83	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%

8.2 Main indicators soybean farmers

Table 65 gives an overview of the primary indicators collected. See Annex 2 for definitions for each indicator. The indicators and the underlying behavioural patterns are discussed in further detail in the following sections.

Table 65: Overview of main indicators, soybean-farming households

	All	Male-headed	Female-headed
G2: Average number of months of adequate household food provision	**10.4**	**10.4**	**10.2**
G6: Wealth assets index score	**-1.021**	**-1.022**	**-1.012**
G6.1 Share of households in first wealth quintile (%)	86%	86%	88%

	All	Male-headed	Female-headed
G6.2 Share of households in second wealth quintile (%)	13%	13%	12%
G6.3 Share of households in third wealth quintile (%)	1%	1%	0%
G6.4 Share of households in fourth wealth quintile (%)	0%	0%	0%
G6.5 Share of households in fifth wealth quintile (%)	0%	0%	0%
IWI International Wealth Index	44.7	44.8	43.1
1. Average yield (kg/ha)	**545**	**557**	**435**
3. Rate of application of target improved technologies or management practices	**12%**	**11%**	**17%**
3.1 Adoption of improved varieties (%)	NA	NA	NA
3.2 Adoption of endorsed varieties (%)	NA	NA	NA
3.3 Number of seasons variety is recycled	NA	NA	NA
3.4 Adoption of endorsed planting practice (%)	NA	NA	NA
3.5 Adoption of inorganic fertiliser (%)	12%	11%	17%
3.6 Adoption of endorsed fertiliser (%)	1%	1%	4%
3.7 Adoption of organic fertiliser (%)	2%	2%	1%
3.8 Adoption of inoculants (%)	NA	NA	NA
3.9 Adoption of pest-management practices (%)	65%	66%	55%
3.10 Adoption of endorsed post-harvest practices (%)	15%	16%	14%
3.11 Adoption of improved storage (%)	2%	2%	1%
3.12 Use of designated storage facilities (%)	0%	0%	0%
3.13 Adoption of tablets to preserve quality of recycled seed (%)	3%	3%	0%*
Ha under improved technologies or management practices (%)	**10%**	**10%**	**10%**
3.14 Area under improved varieties (%)	NA	NA	NA
3.15 Area under inorganic fertiliser (%)	10%	10%	10%
3.16 Area under pesticides (%)	70%	70%	70%
4. Access to agricultural advisory extension support services	**34%**	**35%**	**22%**
4.1 Avg. no. of visits per year by agri. advisory extension support services	2.4	2.4	2.8*
4.2 Received small seed pack (%) (additional indicator 4)	6%	6%	2%
4.3 Used small seed pack (%) (additional indicator 4)	94%	96%	50%
4.4 Distance to nearest agro-dealer (minutes)	30.6	30.5	31.4
5. Nitrogen application (kg/ha)	**2.8**	**2.5**	**5.0**
5.1 Phosphorus application (kg/ha)	0.8	0.7	1.5

	All	Male-headed	Female-headed
5.2 Potassium application (kg/ha)	0.8	0.7	1.4
Average fertiliser use (Total N + P + K, kg/ha)	4.3	3.9	7.9
6. Percent of post-harvest losses (%)	**1%**	**1%**	**0%**
10. Value of incremental sales as a result of AGRA (crop revenue) (US$)	**107.8**	**111.7**	**69.3**
13. Access to formal financial services (%)	**14%**	**15%**	**10%**
13.1 Bank account (%)	13%	13%	7%
13.2 Agricultural loan (%)	2%	2%	2%
13.3 Agricultural insurance (%)	0%	0%	0%
17. Average age of varieties used (years)	**NA**	**NA**	**NA**
33. Sale through structured trading facilities/arrangements (%)	**1%**	**1%**	**0%**
33.1 Selling to traders/middlemen (%)	84%	84%	81%
33.2 Selling to consumers (%)	8%	8%	5%
33.3 Selling to friends/neighbours (%)	0%	0%	0%
33.4 Selling to aggregation centre (%)	0%	0%	0%
33.5 Selling to farmer organisation (%)	0%	0%	0%
33.6 Selling to wholesalers (%)	5%	5%	2%
33.7 Selling to processors (%)	1%	1%	2%
33.8 Selling to retailers (%)	14%	14%	17%
33.9 Selling to company (undefined) (%)	1%	1%	0%
33.10 Selling to institutional buyers (%)	NA	NA	NA
37. Access to market information through formal channel (%)	**0%**	**1%**	**0%**

The composition of variables can be found in the data dictionary in Annex 1; N might vary across indicators
** indicates that the average has been calculated with less than 50 observations*

8.3 Number of months of adequate household food provision (indicator G2)

Table 66 reports the average number of months of adequate household food. It shows that the AGRA-supported farmers have, on average, enough food to meet their family's needs during 10.4 months of the year. No (significant) difference in food security was found between male-headed and female-headed households.

Table 66: Average number of months of adequate household food provision (G2)

	All	Male-headed	Female-headed
G2: Average number of months of adequate household food provision	10.4	10.4	10.2

Figure 14 illustrates the distribution of months of adequate household food provision, and shows that 33% of AGRA-supported households reported to having enough food to meet family needs during the entire year. Only 13% did not have enough food for one month; and 22% were food insecure for two months. Thirty two percent struggled to meet food needs for between six and nine months of the year. None of the respondents reported to experiencing food insecurity for more than six months of the year.

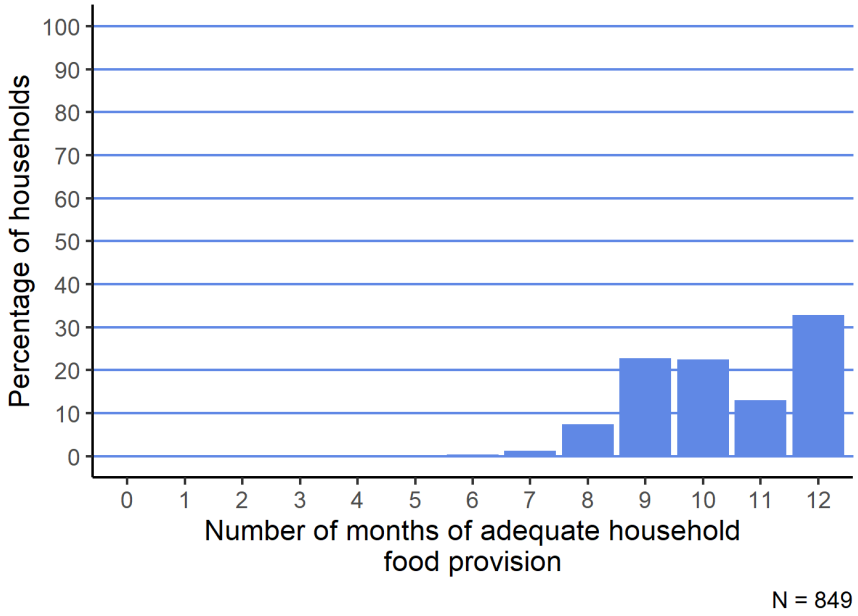

Figure 14: Distribution of number of months of adequate household food provision (G2)

Figure 15 shows the distribution of months with adequate household food provision over the year. The figure shows that July and August 2018 and June and July 2019 were the months in which food insecurity was highest. This is in line with expectations, as these months are towards the end of the main cropping season (wet season) and food insecurity is usually highest right before harvest.

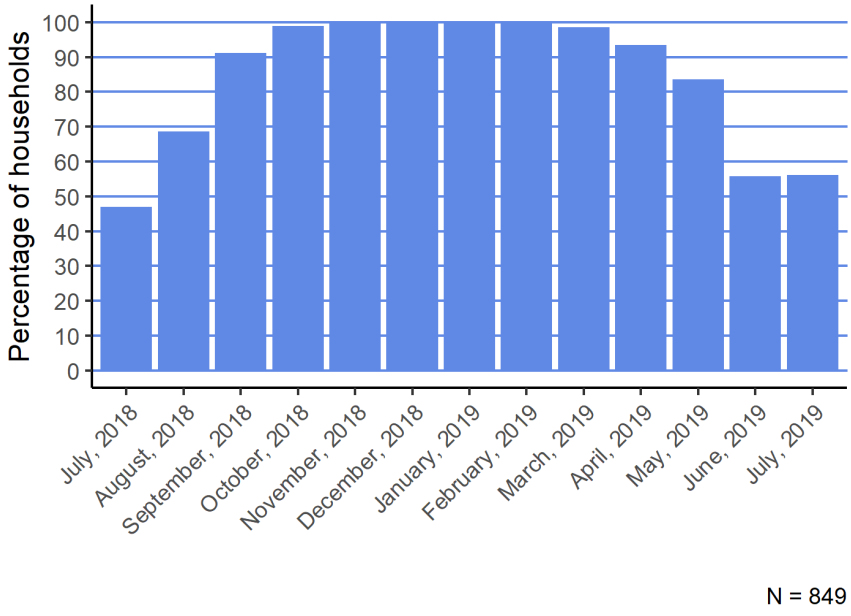

Figure 15: Distribution of months with adequate household food provision

8.4 Wealth asset index score (indicator G6)

Table 67 shows the quintile distribution of the DHS household wealth index, which is a composite measure of a household's cumulative living standard. It is composed of data on asset ownership, materials used for housing construction, and types of water access and sanitation facilities[6]. Wealth index scores were compared with the national Ghanaian DHS distribution for rural areas to determine the household's relative wealth as compared to the country average. As can be seen from Table 67, most households (86%) are in the first (poorest) quintile, and 13% in the second quintile. Only 1% are in the third quintile and up. The households in the sample are thus among the poorest households in the country. Geographically, this is what would be expected, as all the surveyed households live in the north of the country, which is generally less wealthy than the south.

Table 67: DHS wealth index

	All	Male-headed	Female-headed
G6: Wealth assets index score	-1.021	-1.022	-1.012
G6.1 Share of households in first wealth quintile (%)	86%	86%	88%
G6.2 Share of households in second wealth quintile (%)	13%	13%	12%
G6.3 Share of households in third wealth quintile (%)	1%	1%	0%
G6.4 Share of households in fourth wealth quintile (%)	0%	0%	0%
G6.5 Share of households in fifth wealth quintile (%)	0%	0%	0%
IWI International Wealth Index	44.7	44.8	43.1

8.5 Yield (indicator 1)

Yield figures are calculated by dividing the total production by the amount of land under soybean cultivation. To enhance data accuracy, respondents were able to answer questions in units of their preference for both production and land size. The preferred unit for production was most often bags or bowls, while the preferred unit of land size was most often acres. These production and land data units were then converted to kilograms and hectares. Out of 849 interviewed households, eight respondents did not know their soybean production level, while 15 respondents did not know how much land was used to cultivate soybean.

Respondents reported an average soybean production of 557 kg. Figure 16 shows the quantity distribution of soybean harvested. Total soybean production per household was significantly higher among male-headed households than female-headed households (see

[6] Source: https://dhsprogram.com/topics/wealth-index/Wealth-Index-Construction.cfm

Table 68). The average value of production per household was estimated at GH₵838 (US$181).

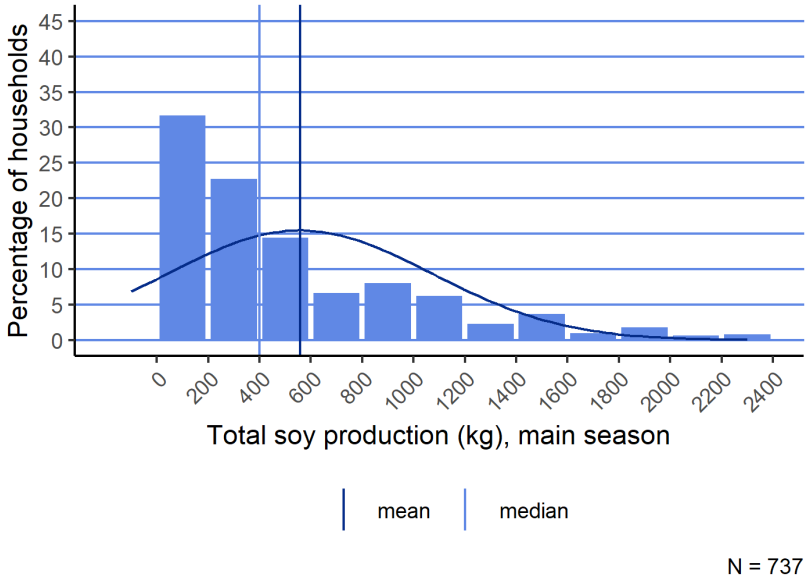

Figure 16: Total production of soybean (kg), main season

Table 68: Total production of soybean (kg), main season

Total soybean production (kg), main season	All	Male-headed	Female-headed	sig
mean	557.3	575.9	388.5	***
median	400.0	400.0	300.0	
n	737	664	73	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Soybean yields are on average 545 kg/ha (see Table 69 and Figure 17). Average yields were higher for male-headed households than for female-headed households. This difference in production quantities between male- and female-headed households is large, about 122 kg/ha, and highly significant (1% level). Since land attributed to soybean cultivation was similar between the households, the difference in yield is attributed to the higher production quantities among male-headed households.

Table 69: Average soybean yield (kg/ha)

	All	Male-headed	Female-headed
1 Average yield (kg/ha)	545	557	435

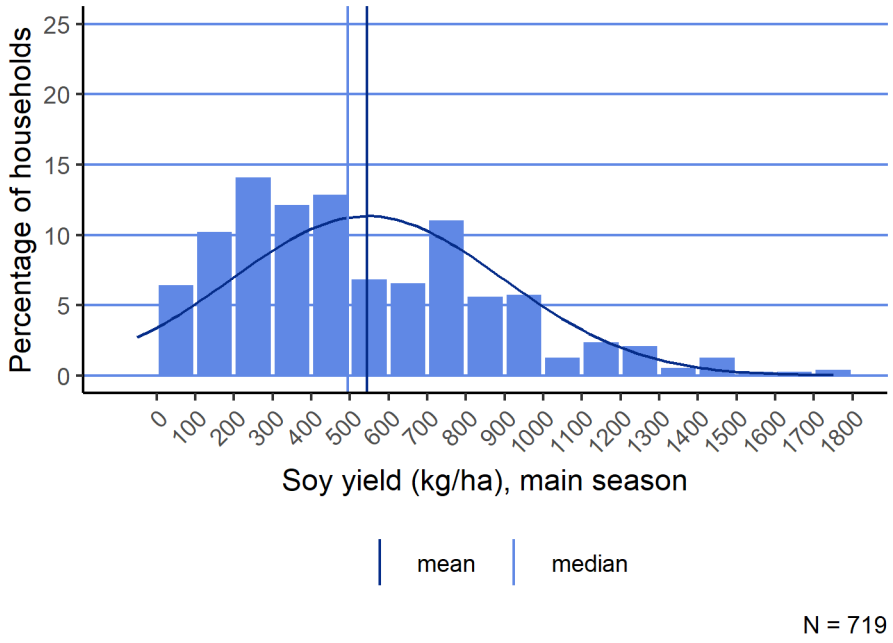

Figure 17: Distribution of average soybean yield (kg/ha), main season

About half of the surveyed households (51%) perceived the 2018 main season harvest to be worse than usual, whilst 41% considered it normal. The remaining 8% considered the season to be better than usual (see Table 70).

Table 70: Ranking of the 2018 season's main soybean harvest compared to other seasons (percentage of households per answer)

Soybean harvest relative to other seasons	All	Male-headed	Female-headed	sig
Normal	41%	41%	44%	
Worse than usual	51%	50%	54%	
Better than usual	8%	9%	2%	
n	839	757	82	

*Note: significance from a Chi-squared statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

8.6 Rate of application of targeted improved productivity technologies or management practices (indicators 3, 5, 17)

Improved varieties, recycling and planting practices

Improved varieties

Unfortunately, due to a programming issue, only a small share of households answered questions on the type of varieties used. Consequently, it is not possible to give an accurate figure on the adoption rate of improved OPV soybean varieties. The same applies to the average age of varieties used.

In Ghana, AGRA promotes the use of Afayak, Jenguma, Songola and Suon Pu-Gon varieties. None of the households indicated that they used one of these endorsed varieties. Due to this, the adoption rate of endorsed varieties is 0%. Households indicated that the

main reason for choosing a certain variety was that it was usually the only variety available to them, or that it was the only variety they knew.

Since no detailed information on seed use is available, it is not possible to report on the specifics of seed use.

Table 71: Main indicators for the use of improved varieties, recycling, and planting practices

	All	Male-headed	Female-headed
3.1 Adoption of improved varieties (%)	N/A	N/A	N/A
3.2 Adoption of endorsed varieties (%)	N/A	N/A	N/A
3.3 Number of seasons variety is recycled	N/A	N/A	N/A
3.4 Adoption of endorsed planting practice (%)	N/A	N/A	N/A
17 Average age of varieties used (years)	N/A	N/A	N/A
Ha under improved technologies or management practices (%)	10%	10%	10%

Planting practices

AGRA does not promote any particular planting practices for soybean in Ghana. Many soybean farmers did not remember how they had planted their soybean. The few farmers that were able to answer the question mostly indicated to have planted multiple soybean seeds per hole; with a spacing of 25 cm inter-row and 75 cm intra-row.

Fertiliser use

Table 72 presents the main indicators on fertiliser use. A small share of the households (12%) applied inorganic fertiliser. Application of fertiliser is higher among female- than male-headed households, yet this difference is not significant. In total, 10% of soybean-cultivated land was applied with fertilisers.

Table 72: Main indicators for the adoption and use of fertilisers

	All	Male-headed	Female-headed
3.5 Adoption of inorganic fertiliser (%)	12%	11%	17%
3.6 Adoption of endorsed fertiliser (%)	1%	1%	4%
3.7 Adoption of organic fertiliser (%)	2%	2%	1%
3.15 Area under inorganic fertiliser (%)	10%	10%	10%
5 Nitrogen application (kg/ha)	2.8	2.5	5.0
5.1 Phosphorus application (kg/ha)	0.8	0.7	1.5
5.2 Potassium application (kg/ha)	0.8	0.7	1.4
Average fertiliser use (Total N + P + K, kg/ha)	4.3	3.9	7.9

In Ghana, AGRA promotes the Yara legume fertiliser. Only 1% of households applied this endorsed fertiliser. Besides the endorsed fertilisers, NPK, ammonium sulphate and urea are also frequently applied to soybean crops. The most common NPK formula is 15-15-15, although NPK 23-10-5 is also widely used. Other fertilisers used for soybean are Yara Actyva and Muriate of Potash, but these are all applied in very small quantities.

On average, Yara Legume users applied 101 kg of Yara legume per hectare. On average, users of NPK utilised (114 kg/ha), ammonuim sulphate (89 kg/ha) and urea (93 kg/ha), despite these fertilisers not being endorsed.

Nitrogen is the macronutrient applied in the largest quantity (2.8 kg/ha), followed by phosphorous and potassium (both 0.8 kg/ha). Additionally, low quantities of the secondary macronutrient sulphur are applied on soybean-cultivated land in Ghana (see Table 73). The micronutrient zinc is also applied, albeit in a negligible quantity.

Table 73: Nutrients applied for soybean (kg/ha), main season

	All	Male-headed	Female-headed	sig
Nitrogen application (kg/ha), main season	2.8	2.5	5.0	**
Phosphorus application (kg/ha), main season	0.8	0.7	1.5	
Potassium application (kg/ha), main season	0.8	0.7	1.4	
Sulphur application (kg/ha), main season	0.9	1.0	0.6	
Calcium application (kg/ha), main season	0.0	0.0	0.0	NA
Magnesium application (kg/ha), main season	0.0	0.0	0.0	
Boron application (kg/ha), main season	0.0	0.0	0.0	NA
Zinc application (kg/ha, main season	0.0	0.0	0.0	
n	846	763	83	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
n = households that cultivated soybean

The most common source of information on fertiliser types is observation in the community (33%), or self-learning (51%). Only 2% of households received information on fertiliser type from their VBA. The majority of households have been applying fertiliser for between three and four years.

The most common fertiliser application method is top dressing, around four weeks after planting (49%) and dropping it by the seed around a week after planting (24%). Top dressing at other crop stages is also popular. AGRA does not promote any specific strategies for fertiliser application.

Only 2% of the surveyed households use organic fertiliser, most often in the form of manure (85%) or compost (31%) (see Table 74). Crop residues and granular fertiliser are applied as well, albeit by a small number of households. Information on organic fertilisers mainly comes from traditional knowledge. Most farmers (76%) obtain information on organic fertiliser from sources within the community, whilst only 8% received information on organic fertiliser use from their VBA. The large majority of farmers has used organic fertiliser for longer than five years.

Table 74: Types of organic fertiliser used for soybean (percentage of households per type)

Types of organic fertiliser	All	Male-headed	Female-headed	sig
Granular	8%	8%	0%	
Compost	31%	25%	100%	
Manure	85%	83%	100%	
Crop residues	8%	0%	100%	
n	13	12	1	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
n = households that applied organic fertiliser

Contrary to expectations, no substantial differences in productivity were found between fertiliser users and households that did not use fertiliser (see Table 75).

Table 75: Average soybean yield (kg/ha), by fertiliser use (yes/no), main season

Soybean yield (kg/ha), main season	All	No	Yes	sig
Mean	544.7	547.4	526.5	
Median	494.2	494.2	444.8	
n	719	628	91	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Pest management practices

Table 76 shows the percentage of households who have adopted pest management practices. Adoption of pest management practices is defined as the percentage of households applying pesticides, herbicides and/or fungicides. The table shows that 65% of soybean households used pest management practices.

Table 76: Adoption of pest management practices

	All	Male-headed	Female-headed
3.9 Adoption of pest-management practices (%)	65%	66%	55%

From all three types of agro-chemicals, herbicides are used most (65%), followed (at a distance) by pesticides (2%) (see Table 77). Fungicides were not applied by soybean-cultivating households.

Table 77: Percentage of households applying agro-chemical inputs for soybean, main season

	All	Male-headed	Female-headed	sig
Pesticide application, main season	2%	2%	2%	
Herbicide application, main season	65%	66%	53%	**
Fungicide application, main season	0%	0%	0%	NA
n	848	765	83	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

In most cases, agro-chemicals are applied to the entire land area. Of the total land area combined, 61% was treated with herbicides and 1% with pesticides (see Table 78). Herbicide use was higher among male-headed households.

Table 78: Percentage of total land used for soybean cultivation under agro-chemical inputs, main season

	All	Male-headed	Female-headed	sig
Percentage of total land area under pesticides, main season	1%	1%	2%	
Percentage of total land area under herbicides, main season	61%	62%	50%	**
Percentage of total land area under fungicides, main season	0%	0%	0%	NA
n	849	766	83	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

In most cases (81%), farmers applied herbicides before weeds emerge, whilst a third (36%) applied herbicides post-emergence (see Table 79). Both pre- and post-emergence herbicide application are endorsed by AGRA. Only 27% of households applied herbicides in both cases. Information on herbicides is more often (55%) obtained from fellow community members. No household received information on herbicides from their VBA. In addition to herbicide use, 95% of households apply weeding. On average, people proceeded to weeding 1.6 times per season.

Another agro-chemical that is often promoted for soybean concerns inoculants. However, uptake of inoculants is very low in Ghana and none of the households in the survey indicated to have used inoculants in 2018.

Table 79: Timing of herbicide application for soybean (percentage of households per answer), main season

	All	Male-headed	Female-headed	sig
Pre-emergence	81%	82%	73%	
Post-emergence	36%	36%	34%	
n	550	506	44	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
n = households that applied herbicides

Post-harvest practices

Table 80 shows the main indicators on the post-harvest practices endorsed by AGRA with the purpose of minimising post-harvest losses. Various post-harvest practices are captured in four indicators. The adoption of endorsed post-harvest practices (indicator 3.10) is defined as the use of a sheet or tarpaulin at least once during soybean processing (drying and threshing). The adoption of improved storage facilities (indicator 3.11), measures the percentage of farmers storing soybean in silos or double liner hermetic storage bags (such PICS bags). Households use designated storage facilities (indicator 3.12) when they store soybean at farmers' organisations, private storage facilities, or through the warehouse receipt systems.

Table 80: Main indicators for the adoption of improved post-harvest practices

	All	Male-headed	Female-headed
3.10 Adoption of endorsed post-harvest practices (%)	15%	16%	14%

3.11 Adoption of improved storage (%)	2%	2%	1%
3.12 Use of designated storage facilities (%)	0%	0%	0%
3.13 Adoption of tablets to preserve quality of recycled seed (%)	3%	3%	0%*

Only 15% of farmers used a tarpaulin more than once during processing. Although the large majority of households lets their soybean dry in the field (94%), some (6%) chose to dry it after harvest. Table 81 shows that 12% of the households used a tarpaulin when drying soybean. This includes both households that did dry soybean in the field (and dried it again after harvest) and those who did not. In most cases (95%), households learned about tarpaulin use themselves, or from observation in the community. The majority (85%) of the households that used a tarpaulin have been doing so for more than four years.

Table 81: Use of sheeting when drying soybean (percentage of households), main season

Used tarpaulin for drying, main season	All	Male-headed	Female-headed	sig
Mean	12%	12%	11%	
n	839	757	82	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Most farmers (85%) still threshed their soybean manually. Amongst these households, tarpaulin use during threshing was low: only 12% (see Table 82). Again, the main source of household information on tarpaulin use is observation in the community (87%). The majority (89%) of households that use tarpaulins for threshing have been doing so over four years.

Table 82: Use of sheeting when threshing soybean (percentage of households), main season

Used tarpaulin for threshing, main season	All	Male-headed	Female-headed	sig
mean	12%	12%	12%	
n	709	634	75	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

When it comes to improved storage facilities, PICS bags (which are specifically designed for the storage of bean crops), are not (yet) widely used for soybean storage in Ghana. Only 2% of households stored their soybean in improved bags (Table 83). Due to the small share of households using PICS bags, the uptake of improved storage facilities is very low in Ghana (2%).

Table 83: Percentage of households using PICS bags for storage of soybean, main season

Usage of PICS bags, main season	All	Male-headed	Female-headed	sig
Mean	2%	2%	1%	
n	839	757	82	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

The use of preservative tablets that prevent losses in soybean seed stocks is equally low. Table 84 shows that only 3% of the sample makes use of tablets that prevent quality loss.

Table 84: Use of preservative tablets for soybean seeds, main season

Use of preservative tablets, main season	All	Male-headed	Female-headed	sig
Mean	3%	3%	0%	
n	245	216	29	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

All households made use of their own storage facilities to store their soybean (see Table 85) and as such, the uptake of designated storage facilities is 0%. This is most likely because soybean is a cash crop that is not consumed by the households themselves; which decreases the incentive to stock soybean for future consumption/selling. Designated storage facilities are therefore not very relevant for soybean, and they are not promoted by AGRA. For households using their own storage facilities, AGRA promotes stocking soybean on a platform, in case there is time between harvesting and selling soybean. Uptake of this practice is higher, with 72% of households indicating to have stocked soybean on a platform soybean before selling.

Table 85: Type of storage used for soybean (percentage of households per type), main season

	All	Male-headed	Female-headed	sig
Own storage	100%	100%	100%	NA
Farmer organisation storage	0%	0%	0%	NA
Warehouse receipt system	0%	0%	0%	NA
n	181	172	9	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%

8.7 Access to agricultural advisory extension support services (indicator 4)

Access to agricultural advisory extension support services is defined as the percentage of households that interacted with an agricultural extension officer during the previous 12 months. During these months, 34% of households were visited by an agricultural extension officer (see Table 86). On average, households that met with an extension officer were visited between two and three times.

Table 86: Main indicators for access to agricultural advisory support services

	All	Male-headed	Female-headed
4 Access to agricultural advisory extension support services	34%	35%	22%
4.1 Avg. no. of visits per year by agri. advisory extension support services	2.4	2.4	2.8
4.2 Received small seed pack (%) (additional indicator 4)	6%	6%	2%
4.3 Used small seed pack (%) (additional indicator 4)	94%	96%	50%
4.4 Distance to nearest agro-dealer (minutes)	30.6	30.5	31.4

Table 87 shows that extension officers were most often affiliated with the Ghanaian Government (68%), while 46% were affiliated with NGOs. Only 4% of extension officers were VBAs.

Table 87: Affiliation of extension service provider (percentage of households per provider)

Type	All	Male-headed	Female-headed	sig
Government	68%	67%	83%	
Company	8%	8%	17%	
NGO	46%	46%	44%	
Farmer promoter/VBA	4%	4%	6%	
Don't know	9%	10%	6%	
Other	0%	0%	0%	NA
n	286	268	18	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'

The most common extension method attended by the surveyed farmers is farmer field schools (see Table 88); 20% indicated to have engaged in these schools. Demonstration plots, mentoring by lead farmers and transfer of knowledge in the farmers' organisation were mentioned by 14%, 5% and 5% of households, respectively.

Table 88: Type of extension method used (percentage of households per method)

Method	All	Male-headed	Female-headed	sig
None	69%	68%	82%	***
Farmer field schools	20%	21%	12%	*
Demonstration plot	14%	14%	11%	
Technology packages	4%	4%	1%	
Mentoring by lead farmers	5%	5%	5%	
Transfer of knowledge within farmer organisations/training of trainers	5%	6%	4%	
Support by farmer promoter	4%	4%	1%	
Don't know	2%	2%	1%	
Other	3%	4%	0%	*
n	849	766	83	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'

Another aspect of advisory extension services is the distribution and use of promotional seed packs. Table 86 shows that only 6% of households received a small seed pack. The uptake of the promotional seed packs is 94%. An interesting result is the difference in uptake between male- and female-headed households. Uptake among female-headed households is 46 percentage points lower. This difference is large and highly significant.

Generally, appreciation of the seed packs is high, with 78% of the households that planted the seeds reporting to appreciate them. Table 89 shows that farmers mainly appreciate the seeds for their yields and taste. Other appreciative aspects that were also frequently mentioned include (short) maturing time (31%) and tolerance to diseases (11%).

Table 89: Variety traits that are positively appreciated in the promotional soybean seed pack (percentage of households per trait)

Soybean variety traits	All	Male-headed	Female-headed	sig
Yields	83%	83%	N/A%	
Taste	42%	42%	N/A%	
Maturing time	31%	31%	N/A%	
Tolerance to diseases	11%	11%	N/A%	
Tolerance to pests	8%	8%	N/A%	
Conservation (storage time)	8%	8%	N/A%	
Appreciated by buyers (market)	8%	8%	N/A%	
It was free	8%	8%	N/A%	
Colour	6%	6%	N/A%	
Only variety available	6%	6%	N/A%	
Tolerance to droughts	3%	3%	N/A%	
It was subsidised	3%	3%	N/A%	
Don't know	3%	3%	N/A%	
Other	6%	6%	N/A%	
n	36	36	0	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'
n = households that appreciated the seeds from the promotional seed pack

Access to agricultural extension services also includes distance to the nearest agro-dealer, which is based on travel time. As can be seen in Table 90, the average travel time is 31 minutes. When visiting the agro-dealer, households most often go by motorbike or foot (indicated by 37% and 35%, respectively), followed by bicycles (17%) and cars (9%). A sub-group (n=131) of soybean farmers reported the distance in kilometres; on average, they live 7.2 km away from an agro-dealer.

Table 90: Average travel time to agro-dealer (minutes)

Distance to agro-dealer in minutes	All	Male-headed	Female-headed	sig
Mean	30.6	30.5	31.4	
Median	20.0	25.0	20.0	
n	604	550	54	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

8.8 Access to formal financial services (indicator 13)

Table 91 shows that 14% of the surveyed households have access to formal financial services. This means that 14% has access to at least one bank account, a formal agricultural loan, or an agricultural insurer. This indicator thus only includes access to formal financial services, provided by formal financial institutions, and excludes access to informal financial services such as from village money lenders, relatives, or saving groups

Table 91: Main indicators for access to formal financial services

	All	Male-headed	Female-headed
13 Access to formal financial services (%)	14%	15%	10%
13.1 Bank account (%)	13%	13%	7%
13.2 Agricultural loan (%)	2%	2%	2%
13.3 Agricultural insurance (%)	0%	0%	0%

Assessing the three components of this variable, it can be seen that the most accessible financial service is a bank account. Fourteen percent of households have at least one bank account. Much lower, at 2%, is loan access. And none of the households took out agricultural insurance in 2018. Households were not familiar with crop insurance.

While only 2% of the farmers received a loan through a formal arrangement (banks, microfinance institutions, savings and credit cooperatives or mobile money), in total, 13% accessed a loan in 2018.

Table 92 shows the types of loan providers that are being used, and demonstrates that 16% of loans were provided by formal financial institutions (bank or MFI). But more common are informal financial loans via family or friends, and village savings and loans groups.

Table 92: Types of loan providers (percentage of households per provider)

Loan providers	All	Male-headed	Female-headed	sig
Family or friends	59%	59%	57%	
Village money lender	3%	2%	7%	
VSLA/ISLC/VICOBA (informal savings and loans group)	21%	21%	21%	
MFI	11%	11%	14%	
Bank	5%	5%	0%	
Other	4%	4%	0%	
n	109	95	14	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'
Excluding households that did not take loans

8.9 Post-harvest losses (indicator 6)

Post-harvest losses are measured by the amount of soybean that was lost after harvesting as a share of total production.

Table 93: Main indicator for post-harvest losses

	All	Male-headed	Female-headed
6 Percent of post-harvest losses (%)	1%	1%	0%

Table 93 shows that post-harvest losses are low; the average of 1% indicates that almost no soybean was lost post-harvest. The majority of the sample (87%) did not lose any soybean post-harvest. Losses of the remainder of the sample were low at, on average, 9.5 kg. While interpreting this data, it should, however, be kept in mind that post-harvest losses are typically difficult to estimate for farmers, as losses are typically not measured.

8.10 Access to market information (indicator 37)

The percentage of soybean farmers that has access to formal channels of market information (SMS, radio, television, internet and the farmer's organisation) is 0% (see Table 94).

Table 94: Main indicator for access to market information

	All	Male-headed	Female-headed
37. Access to market information through formal channel (%)	0%	0%	0%

Farmers do, however, use informal channels to acquire market information. Table 95 shows that, amongst farmers that sell their soybean, market information is mainly acquired on the market itself (68%), from buyers (54%) and from other farmers (27%).

Table 95: Sources of market information used by farmers (percentage of households per source)

Source of market information	All	Male-headed	Female-headed	sig
Buyer	54%	53%	58%	
Farmer to farmer	27%	27%	30%	
Market	68%	68%	67%	
Other	1%	1%	0%	
n	708	644	64	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'

8.11 Sales channels (indicator 33)

Table 96 shows the main indicators for farmers' sales channels. It includes information on sale through structured trading facilities/arrangements, as well as information on farmers' clients.

Table 96: Main indicators on farmers' sales channels

	All	Male-headed	Female-headed
33 Sale through structured trading facilities/arrangements (%)	**1%**	**1%**	**0%**
33.1 Selling to traders/middlemen (%)	84%	84%	81%
33.2 Selling to consumers (%)	8%	8%	5%
33.3 Selling to friends/neighbours (%)	0%	0%	0%
33.4 Selling to aggregation centre (%)	0%	0%	0%
33.5 Selling to farmer organisation (%)	0%	0%	0%
33.6 Selling to wholesalers (%)	5%	5%	2%
33.7 Selling to processors (%)	1%	1%	2%
33.8 Selling to retailers (%)	14%	14%	17%
33.9 Selling to company (undefined) (%)	1%	1%	0%
33.10 Selling to institutional buyers (%)	N/A	N/A	N/A

A household is considered to sell through a structured trading facility when they sell at least part of their harvest through a formal contract. Only 1% of farmers sold their harvest under a formal contract in 2018. Only two households received inputs (seed and fertiliser) on credit as part of these contracts. Households selling soybean through contracts seem to receive higher prices for their soybean, and therefore, higher revenues. However, due to the small number of households selling soybean through contracts in this sample, no statistically valid claims can be made on this.

Table 96 shows that farmers' clients are mainly traders or middlemen (84%), retailers (14%) and consumers (8%).

8.12 Value of incremental sales as a result of AGRA (indicator 10)

The value of incremental sales as a result of AGRA cannot be determined yet as only one round of data collection has been completed. Therefore, total revenues from soybean sales are reported as a baseline value. Revenues were calculated by multiplying the quantity sold (in kg) by the common price received per kg. Values were converted to kilograms in case quantities were reported in different units.

The average revenue generated from selling soybean is US$108 (Table 97).

Table 97: Value of incremental sales as a result of AGRA

	All	Male-headed	Female-headed
10 Value of incremental sales as a result of AGRA (crop revenue in US$)	107.8	111.7	69.3

The total value of production among farmers which had sold part of their harvest is on average US$181 per household (Table 99).

Table 98: Crop value (GH₵) of soybean produced

	All	Male-headed	Female-headed
Average value of production in GH₵	838	859	601
n = households that sold soybean			

Table 99: Crop value (US$) of soybena produced

	All	Male-headed	Female-headed
Average value of production in US$	181	186	130
n = households that sold soybean			

Total revenues from soybean sales in GH₵ are shown in Table 100. Revenues received by male-headed households are significantly higher than those of women-headed households.

Table 100: Sales value (total revenue) of soybean sold, main season – calculated variable (IO5.3 – 36) – KIT indicator 10

Revenue from sales of soybean, main season (GH₵)	All	Male-headed	Female-headed	sig
Mean	498.0	515.7	319.9	***
Median	320.0	335.0	210.0	
n	706	642	64	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
n = households that sold soybean

The difference in revenues between male- and female-headed households is not caused by a price difference for soybean. All households received, on average, GH₵1.3/kg (see Table 101).

Table 101: Price received for soybean (GH₵)

Common price received for soybean (GH₵/kg), main season	All	Male-headed	Female-headed	sig
Mean	1.3	1.3	1.3	
Median	1.3	1.3	1.3	
n	606	560	46	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
n = households that sold soybean

Instead, the difference in revenue arises from quantities. On average, male-headed households sell larger quantities. Table 102 shows that male-headed families sell higher shares of their harvest. Additionally, since male-headed households produce more soybean (as was shown in Section 8.5), male-headed households also sell larger quantities in absolute terms.

Table 102: Allocation of soybean harvest (%)

	All	Male-headed	Female-headed	sig
Soybean used for consumption (% of harvest), main season	20%	19%	26%	*
Soybean kept for seed (% of harvest), main season	4%	4%	4%	
Soybean given away (% of harvest), main season	3%	3%	3%	
Soybean used as payment for inputs (% of harvest), main season	2%	2%	2%	
Soybean bartered or exchanged for goods (% of harvest), main season	0%	0%	0%	
Soybean sold (% of harvest), main season	62%	62%	61%	
Post-harvest losses of soybean (% of total harvest), main season	1%	1%	0%	*
n	737	664	73	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Part III: Small & medium enterprise survey

9 SME performance

9.1 Introduction

AGRA considers SMEs as important drivers of growth. They account for up to 90% of all businesses in sub-Saharan African markets. In many agricultural commodity value chains, SMEs also take up many of the downstream activities of processing, storage, transportation, wholesale and retail that are necessary to send farmers' produce to the end market.

An important pathway for change of the PIATA programme is supporting the development of SMEs operating in, and providing support services to, agricultural value chains. AGRA works to stimulate both demand and supply sides of technical assistance and financial products for SMEs.

Core interventions focus on:

- Identifying high-potential SMEs and supporting them with business and technical advisory services to scale up operations. These advisory services involve a performance-based model, which requires them to produce business plans and achieve results through effective support to SMEs;
- Matching grants for emerging medium-sized aggregation/storage businesses in under-served areas where smallholder farmers are increasing their yields, and marketing greater surpluses;
- Providing access to working capital finance for SMEs;
- Influencing the ecosystem within which SMEs operate by supporting the development of business, enabling goods and services such as packaging, commodity handling and processing machinery, as well as payment processing services and market data.

To assess changes in the performance of SMEs benefitting from the AGRA-PIATA programme, a rapid survey instrument was designed and baseline data collection was implemented; both are reported on here.

In the design of the monitoring tool, the following needs were taken into consideration:

- A rapid and affordable tool to monitor SME performance;
- A tool which can be tailored to different SMEs, but still allows comparison and use across very different types SMEs;
- A tool which can be used for very different sizes SMEs, including micro enterprises;
- A tool which can monitor SME performance change over time;
- A tool which can offer an immediate overview of SME performance;
- A tool which is simple, openly accessible, and can be implemented across countries by enumerators with a reasonable level of education

To meet all of the above demands, KIT developed a simple SME performance scorecard.

9.2 Methodology

Performance dimensions

The scorecard for SME performance is based on monitoring four dimensions of performance:

- Business resilience: indicates the ability of the SME to adapt to disruptions while maintaining business operations, employment and assets. Variables used to determine business reliance are:
    - Years in business
    - Number of services offered
    - Diversity of clients
- Financial stability: indicates the financial health and access to financial services of an SME. The variables used to determine financial stability are:
    - Estimated total annual turn-over
    - Proportion of capital need covered with formal credit
    - Capital investments made over the last three years
- Human capital: indicates the education level and gender diversity of the SME workforce. The variables used are:
    - The proportion of staff having received a form of tertiary education
    - The proportion of staff with a permanent contract
    - The proportion of casual workers
    - The proportion of women among staff with a permanent contract
- Technology/assets: indicates the SME assets and investments in research and development (R&D). The variables used are:
    - Investments in R&D
    - Value of buildings
    - Value of equipment

For all of the above indicators, four levels are predefined, either numeric or descriptive, and representing progression. The number one represents the lowest score and four the highest. In a way, the highest level represents what could be considered the desired state of the SME for that particular variable. The average of the scores gives the total score for each dimension. Performance scorecards are presented in Annex 3. An overview of all SME indicators and associated descriptive statistics is presented in Annex 4.

Sampling

Sampling was carried out among SMEs benefitting from AGRA support only as SMEs not benefitting are not expected to be willing to answer questions about the performance of their enterprise. Also, the objective is monitoring the performance improvement of SMEs receiving support from AGRA, over time.

The targeted sample in each country consisted of:

- Commercial seed producers
- Seed companies
- Traders
- Processors
- Agro-dealers
- Input supply companies

Randomly sampling was performed using a list of SMEs provided by AGRA, and validated with the local AGRA team. The sample distribution of SME types was only considered a guideline, and adapted based on the investment portfolio of AGRA in each country.

In Ghana, only 19 SMEs were identified as receiving AGRA support; 15 out of the 19 SMEs participated in the survey. The sample was composed of nine seed companies; two input companies and three agro-dealers (aggregators, processors, or transporters). More information about the SMEs participating in the survey can be found in Annex 5.

9.3 Performance dashboard

This section summarises the average performance per category of SME sampled through performance dashboards. A colour coding is used to indicate performance (red, score 1-2), average performance (orange, score 2-3) and good performance (score 3-4). A similar scoring has been calculated for each separate SME, but is too much information to present in this report.

The data presented are to be interpreted as a baseline of performance of the selected SMEs benefitting from AGRA interventions.

Seed companies

The summary results for the nine seed companies are presented in Figure 18. For business resilience, they achieved an average score. This is mainly due to the fact that they are young enterprises. The enterprises offer diversified services, three on average, mainly consisting of sales and the production of improved or certified seeds or foundation seeds (see Table 110 in Annex 4). The companies show a good level of market risk diversification since they deal with four different types of clients on average (see Table 109 in Annex 4). The financial stability of the seed companies is good, with average annual turnover of around US$358,535 (see Table 103 in Annex 4). They also have good access to formal credit (see Table 112).

The seed companies declared two business investments on average in the last three years, mainly in training, expansion of land area or storage systems (see Table 111 in Annex 4). With regard to human capital, there is room for improvement. It may be beneficial for these SMEs to recruit a more permanent and skilled work force. The score for technology is average due to a low level of investments in R&D over the last three years.

Figure 18: Seed companies' performance scorecard

Input companies

Only two input companies have been included in the sample, for results for which are presented in Figure 19. The average business resilience score is average, indicating that there is room for improvement. The low value is due to the fact that these SMEs are quite new, having only been in business for five years on average (see Table 104 in Annex 4). Service information was available for one company, which mainly sells inputs (seeds and chemicals) and provides wholesale and country-wide distribution (see Table 110 in Annex 4). On average, these SMEs interact with three different types of clients showing a good degree of market risk diversification (see Table 109 in Appendix). Their average financial stability score is good with an average annual turnover of around US$41,456 (see Table 107 in Annex 4). They also have good access to formal credit, with 50% declaring to get the majority of credit from formal credit institutions (see Table 112 in Annex 4).

The input companies have made two business investments on average in the last two years, mainly in R&D and in building expansion (see Table 111 in Annex 4). With regards to human capital, the performance is average; there is room to employ more skilled and female employees. The average score for technology is poor due to low technology investments.

Figure 19: Input companies' performance scorecard

Agri-value chain actors

Four agri-value chain actors were sampled; more specifically, two processors and two aggregators. The summary results are presented in Figure 20. The SMEs have an average score for business resilience as they are quite new enterprises. They have been in business for almost four years on average (see Table 104 in Annex 4). The enterprises offer three services on average, mainly aggregation, mechanisation and transport or transformation. They interact with three different types of clients, on average, showing a good degree of market risk diversification (see Table 109 in Annex 4). The financial stability is good. Only two indicators out of three were used in the final scoring (use of formal credit and number of investments) since information on total annual turnover was missing. The SMEs have good access to formal credit, with 75% declaring to get the majority of credit from formal institutions (see Table 112 in Annex 4).

The four SMEs have made three business investments on average in the last three years, mainly in staff training, equipment upgrading and building expansion (see Table 111 in Annex 4). Performance regarding human capital is average; there is room to employ more skilled and female employees. The average score for technology is low, signalling that there is scope for improving technology investments.

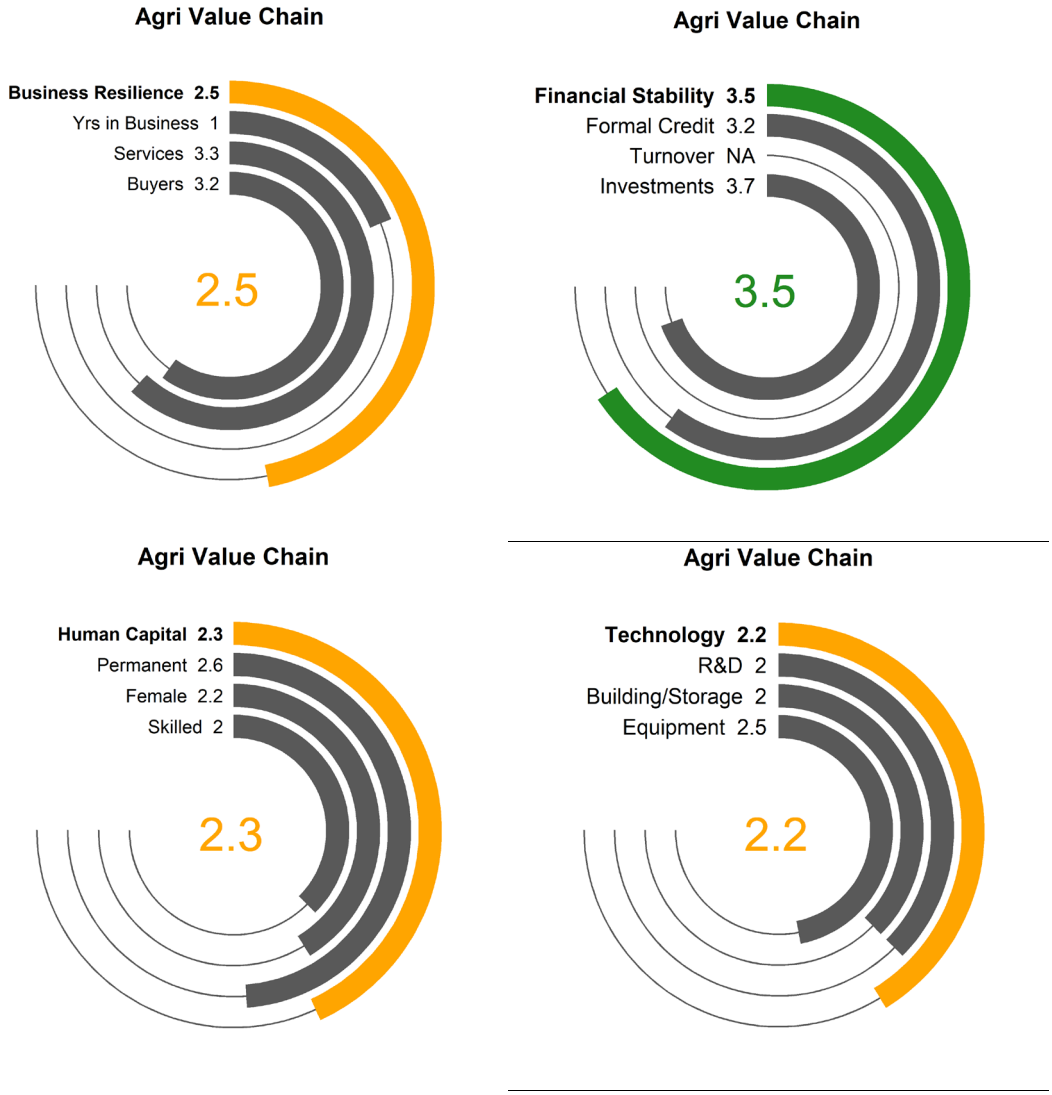

Figure 20: Agri-value chain actors' performance scorecard

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Annex 1. List of interviewees

Organisation	Respondent	Department/function	Date	Topic discussed	Relation to AGRA
AGRA	Dorothy Effa	Programme manager	24 May 2019	State capability and policy	AGRA
AGRA	Forster Boateng	Interim regional head	24 May 2019	State capability and policy	AGRA
Wumpini agrodealer	Issahalzu Issah	Shop manager	25 May 2019	Seed system	
Kukobila Farms	Issa Seidu	Farm manager	25 May 2019	Seed system	Grantee
Heritage Farms	Alhaji Zakaria Iddrisu	Owner	25 May 2019	Seed system	Grantee
Ariku seed company	Martin Ariku	Owner	26 May 2019	Seed system	Grantee
ASNAPP	Edmund	Regional coordinator	27 May 2019	Seed system	Partner
Farmers	Tindan Savelugu	Farmer group	27 May 2019	Seed system	beneficiaries
CSIR-SARI	Gloria Boakyewaa Nicholas Ninju Denwar	Plant breeders	27 May 2019	Seed system	Grantee
Farmers	Nyeko Savelugu	Farmer group	28 May 2019	Seed system	Beneficiaries
Farmers	Yong, Savelugu	Farmer group	28 May 2019	Seed system	Beneficiaries
SIU Tamale	Fatima	Seed inspector	28 May 2019	Seed system	none
Independent consultant	John Manful	-	29 May 2019	Seed system	Expert
MOFA/DCS	Seth Osei-Akoto	Director	29 May 2019	Seed system	Government
TASAI	workshop	workshop	30 May 2019	Seed system	Stakeholders
NASTAG	Augusta Clottey Thomas Havor Yacouba Idrissa	Executive secretary National president Consultant	31 May 2019	Seed system	
MOFA/DCS	Solomon Gyan Ansah	Deputy director	03 June 2019	Seed system	Government
MOFA/PPRSD	Erik Quaye	Deputy director	03 June 2019	Seed system	Government
MOFA/PPMED	Angela Dannson	Director	03 June 2019	State capability and policy	Government
NSC	Josiah Wobil	Chair	04 June 2019	Seed system	
Kreditanstalt fuer Wiederaufbau (KfW	Kofi Atta-Agyepong		04 June 2019	State capability and policy Finance	Partner

development bank)					
MOFA/agricultural extension services	Paul Siameh	Deputy director	04 June 2019	Extension	Government

Annex 2. Data dictionary main indicators

Indicator	Definition
G2: Average number of months of adequate household food provision	The average number of months of adequate household food provision.
G6: Wealth assets index score	The DHS household wealth index is a composite measure of a household's cumulative living standard. It is composed of data on asset ownership, materials used for housing construction, and types of water access and sanitation facilities. Wealth index values typically range between -2 and 2, with 0 being on the centre of the distribution.
G6.1 Share of households in first wealth quintile (%)	The share of households in the first wealth quintile (based on the country average).
G6.2 Share of households in second wealth quintile (%)	The share of households in the second wealth quintile (based on the country average).
G6.3 Share of households in third wealth quintile (%)	The share of households in the thirds wealth quintile (based on the country average).
G6.4 Share of households in fourth wealth quintile (%)	The share of households in the fourth wealth quintile (based on the country average).
G6.5 Share of households in fifth wealth quintile (%)	The share of households in the fifth wealth quintile (based on the country average).
IWI International Wealth Index	The International Wealth Index (IWI) is the first comparable asset based wealth index covering the complete developing world. It is based on data for over 2.1 million households in 97 low and middle income countries. Based on DHS household wealth index variables.
1. Average yield (kg/ha)	The average harvest quantity of the crop in the main season (kg) divided by the amount of land on which the crop is cultivated (ha) per farm household. In case respondents reported production and cultivated area in different units, conversions to kilogrammes and hectares were made respectively.
3. Rate of application of target improved productivity technologies or management practices (indicator 14)	The percentage of farm households using improved varieties or inorganic fertiliser.
3.1 Adoption of improved varieties (%)	The percentage of farm households using improved OPVs or hybrids. Farm households cultivating varieties that could not be classified were counted as not using improved varieties.
3.2 Adoption of endorsed varieties (%)	The percentage of farm households using varieties that are endorsed by AGRA and its partners.
3.3 Number of seasons variety is recycled	The average number of seasons the variety has been recycled.
3.4 Adoption of endorsed planting practice (%)	The percentage of farm households using the specific spacing of seed as promoted by AGRA and partners.
3.5 Adoption of inorganic fertiliser (%)	The percentage of farm households applying inorganic fertiliser.
3.6 Adoption of endorsed fertiliser (%)	The percentage of farm households applying fertiliser endorsed by AGRA and its partners.

Indicator	Definition
3.7 Adoption of organic fertiliser (%)	The percentage of households applying organic fertiliser.
3.8 Adoption of inoculants (%)	The percentage of households applying inoculants.
3.9 Adoption of pest-management practices (%)	The percentage of households applying pesticides, herbicides or fungicides, or a combination of the three.
3.10 Adoption of endorsed post-harvest practices (%)	The percentage of households making use of a tarpaulin while drying and/or threshing their harvest.
3.11 Adoption of improved storage (%)	The percentage of households making use of improved storage facilities, such as PICS bags or silos.
3.12 Use of designated storage facilities (%)	The percentage of households storing their produce using storage at the farmer's organisation, a warehouse receipt system, or private storage.
3.13 Adoption of tablets to preserve quality of recycled seed (%)	The percentage of households using tablets to preserve the quality of their seed stock.
Additional indicator 2: Hectares under improved technologies or management practices (%)	The total land area under improved varieties or inorganic fertiliser as a share of the total land area on which the crop is cultivated.
3.14 Area under improved varieties (%)	The total number of has under improved varieties (hybrid or OPV) as a share of the total land area on which the crop is cultivated.
3.15 Area under inorganic fertiliser (%)	The total number of has on which inorganic fertiliser is applied for the cultivation of the crop as a share of the total land area on which the crop is cultivated.
3.16 Area under pesticides (%)	The total number of has on which pesticides, herbicides, or fungicides were applied for the cultivation of the crop as a share of the total land area on which the crop is cultivated.
4. Access to agricultural advisory extension support services (indicators 16)	The share of households that is visited by an agricultural extension agent during the last 12 months.
4.1 Average number of visits per year by agricultural advisory extension support services	The average number of visits by an agricultural extension agent during the last 12 months among farm households that have been visited at least once.
4.2. Received small seed pack (%) (additional indicator 4)	The percentage of households that received a promotional seed pack.
4.3 Used small seed pack (%) (additional indicator 4)	The percentage of households that used the seeds from the promotional seed pack received.
4.4 Distance to nearest agro-dealer (minutes) (additional indicator 1) (indicator 15)	The average distance to the nearest input supplier in minutes. Considers only households that could estimate this in minutes. Households that could only report this in distance are reported separately.
5. Nitrogen application (kg/ha)	The average amount of nitrogen (in kg) applied per ha of land on which the crop is cultivated.
5.1 Phosphorus application (kg/ha)	The average amount of phosphorus (in kg) applied per ha of land on which the crop is cultivated.
5.2 Potassium application (kg/ha)	The average amount of potassium (in kg) applied per ha of land on which the crop is cultivated.
Average fertiliser use (Total N + P + K, kg/ha) (Indicator 21)	The average sum of nitrogen, phosphorus and phosphorus (in kg) applied per ha of land on which the crop is cultivated.

Indicator	Definition
6. Percent of post-harvest losses (%) (indicator 22)	The share of harvest that is lost and thus not consumed, stored, given away, sold, bartered, or used as payment in kind.
10. Value of incremental sales as a result of AGRA (crop revenue) (US$)	The revenues from selling the crop, converted from local currency to US$ by using the 2018 average exchange rate.
13. Access to formal financial services (%)	The percentage of households that have access to formal financial services (either a bank account, a loan, or insurance)
13.1 Bank account (%)	The percentage of households that have a bank account.
13.2 Agricultural loan (%)	The percentage of households that took a loan from a formal financial institution in 2018. Formal financial institutions include banks, microfinance institutions, savings and credit cooperatives and mobile money.
13.3 Agricultural insurance (%)	The percentage of households that took crop insurance in 2018.
17. Average age of varieties used (years)	The average age of varieties used (in years).
33. Sale through structured trading facilities/arrangements (%) (indicators 30)	The sale through structured trading facilities or arrangements is defined as the number of households selling their harvest through formal contractual arrangements as a percentage of the total number of households selling at least some of their harvest.
33.1 Selling to traders/middlemen (%)	The percentage of farm households selling their harvest to traders/middlemen.
33.2 Selling to consumers (%)	The percentage of farm households selling their harvest to consumers.
33.3 Selling to friends/neighbours (%)	The percentage of farm households selling their harvest to friends/neighbours.
33.4 Selling to aggregation centre (%)	The percentage of farm households selling their harvest to aggregation centres.
33.5 Selling to farmer organisation (%)	The percentage of farm households selling their harvest to farm organisations
33.6 Selling to wholesalers (%)	The percentage of farm households selling their harvest to wholesalers.
33.7 Selling to processors (%)	The percentage of farm households selling their harvest to processors.
33.8 Selling to retailers (%)	The percentage of farm households selling their harvest to retailers.
33.9 Selling to company (undefined) (%)	The percentage of farm households selling their harvest to a company (in an undefined sector).
33.10 Selling to institutional buyers (%)	The percentage of farm households selling their harvest to institutional buyers.
37. Access to market information through formal channel (%)	The share of farm households receiving market information through formal channels (SMS, radio, television, farmer's organisation).

Numbering according to the terms of reference. In parenthesis numbering of AGRA's Theory of Change

Annex 3. Performance scorecard

Table 103: Business resilience performance scorecard

Business resilience		Performance category 1	Performance category 2	Performance category 3	Performance category 4
Years in business	Ranges (Years)	1-5	5-10	10-15	>15
	Score	1	2	3	4
Number of services	Ranges (#)	1	2	3	>3
	Score	1	2	3	4
Number of buyers	Ranges (#)	1	2	3	>3
	Score	1	2	3	4

Table 104: Financial sustainability performance scorecard

Financial sustainability		Category 1	Category 2	Category 3	Category 4
Percentage use formal credit	Ranges (%)	0%	0%-33%	33%-66%	>66%
	Score	1	2	3	4
Annual turnover (US$)	Ranges (thousands)	1-10	10-25	25-50	>50
	Score	1	2	3	4
Number of investments	Ranges (#)	0	1	3	>3
	Score	1	2	3	4

Table 105: Human capital performance scorecard

Human capital		Category 1	Category 2	Category 3	Category 4
% Female	Ranges (%)	0%	0%-33%	33%-66%	>66%
	Score	1	2	3	4
% Skilled	Ranges (%)	0%	0%-33%	33%-66%	>66%
	Score	1	2	3	4
% Permanent	Ranges (%)	0%	0%-33%	33%-66%	>66%
	Score	1	2	3	4
% Casual	Ranges (%)	0%	0%-33%	33%-66%	>66%
	Score	1	2	3	4

Table 106: Technology performance scorecard

Technology		Category 1	Category 2	Category 3	Category 4
Investments in R&D	Ranges (#)	0	-	-	1
	Score	1			4
Building storage	Ranges (#)	0	-	-	1
	Score	1			4
Equipment	Ranges (#)	0	-	-	1
	Score	1			4

Annex 4. SME descriptive statistics

Table 107: General SME characteristics

General SME Characteristics	Seed Companies	Input Supply Companies	Agri Value Chain
Years of business	3.88 (0.92)	5 0	3.75 (0.5)
Average number of commodities			
*Commercialized/traded***	3.33	-	2 (1)
*Processed***	-	-	1.33 (1.52)
*Transported***	-	-	1 (1)
Commodities commercialized/traded			
Maize	55.56%	-	50%
Soybean	22.22%	-	25%
Cassava		-	25%
Rice	22.22%		
Permanent staff	13.25 (8.08)	10.5 (6.36)	26.66 (14.04)
Casual staff	123.12 (120.20)	10.5 (3.53)	125 (195.25)
Total annual turnover (USD)	358535 (644462)	41456 (27637)	NA
Observations	**9**	**2**	**4**

*Standard Deviation in parenthesi.Standard Deviation in parenthesis. *Incomplete information for Annual Turnover. Detailed information: Agri-Value Chain: Obs total annual turnover: 0%; Seed Companies: Obs total annual turnover: 66%; Input Supply companies: Obs total annual turnover: 100%. ** Info available for three observations.*

Table 108: SME employees

Employees	Seed Companies	Input Supply Companies	Agri Value Chain
Permanent Staff	13.25	10.5	26.66
	(8.08)	(6.36)	(14.04)
Casual Staff	123.12	10.5	125
	(120.20)	(3.53)	(195.25)
% Female(over total)	61%	33%	27%
% Skilled(over total)	7%	19%	15%
*Annual Salary Permanent (USD)**	25676 (28620)	13818 (6514)	54170 (60883)
*Annual Salary Casual (USD)**	35267 (40311)	7830 (4560)	12897 (13028)
*Daily Wage Casual (USD)**	11.72 (17.26)	9.21 (0)	2.82 (2.33)

*Standard Deviation in parenthesis. *Incomplete information for Annual Salary and Daily wage. Detailed information reported below.*
Agri-Value Chain: Obs salary permanent workers: 75%; Obs salary casual workers 50%; Obs daily wage 75%; Seed Companies: Obs salary permanent workers: 66%; Obs salary casual workers 55%; Obs daily wage 77%; Input Supply companies: Obs salary permanent workers: 100%; Obs salary casual workers 100%; Obs daily wage 100%

Table 109: SME buyers

Buyers	Seed Companies	Input Supply Companies	Agri Value Chain
Projects, programs and government	100%		75%
Farmer organizations, coops, associations	100%	100%	75%
Individual buyers / producers	100%	100%	100%
Traders, input suppliers, wholesalers	100%	100%	75%
Average number of buyers	4 (0)	3 (0)	3.25 (1.5)
Observations	**9**	**2**	**4**

Standard Deviation in parenthesis

Table 110: SME services

SME Services	Seed companies
Variety development	22%
Breeder seed production	11%
Production of early generation seed / foundation seed	55%
Production of improved / certified seed	100%
Production of noncertified seed	0%
Sales of improved / certified seed	100%
Sales of noncertified seed	0%
Sales of early generation seed / foundation seed	25%
Average number of services provided	2.88 (0.60)
Observations	**9**

SME services	Input companies
Retail (sales) of improved/certified seed	100%
Retail (sales) of chemical fertilisers and pesticides	100%
Advisory services/extension	
Import of inputs	
Wholesale and country-wide distribution	100%
Manufacturing of inputs	
Average number of services provided	3 (-)
Observations	**1**

SME Services	Agri Value Chain
Aggregation of farmer production (transport, bulking and storage)	100%
Agri-food processing (transformation of produce)	66%
Transport	66%
Mechanization	100%
Average number of services provided	3.33 (0.57)
Observations	**3**

Table 111: SME investments

Investments	Seed Companies	Input Supply Companies	Agri Value Chain
Expansion of land area	77%	50%	50%
Expansion of buildings and/or storage	77%	50%	50%
Upgrading of equipment	88%		75%
Research & Development			25%
Training of staff	55%	100%	100%
Increase / injection for working capital	33%		25%
No Investment			25%
Average number of investments	3.33 (1.11)	2 (1.4)	3.5 (1.29)
Observations	**9**	**2**	**4**

Table 112: Percentage of credit from formal sources

Access to formal credit	Seed Companies	Input Supply Companies	Agri Value Chain
0%			
<10%			25%
10-25%	11%	50%	
25-50%	11%		
50-75%	22%		25%
75%-90%	11%	50%	50%
>90%	44%		
Observations	**9**	**2**	**4**

Table 113: AGRA support services

AGRA Services	Seed Companies	Input Supply Companies	Agri Value Chain
Grant	100%		50%
Loan/Credit			
Training	33%	50%	
Technical Assistance	44%	50%	25%
No Service		50%	25%
Average Number AGRA Services	1.77 (0.83)	1 (1.41)	0.75 (0.50)
Observations	**9**	**2**	**4**

Standard Deviation in parenthesis

Annex 5. SMEs participating in the survey

Seed companies	Input companies	Agro-dealers
Antika Seeds	Agyaaku Farms and Trading Company Ltd	Amanting Agro Processing Company Ltd
Ariku Company Ltd	Wumpini Agrochemicals Limited	Sahel Grains Limited
Agyaaku Farms and Trading Company Ltd		Savannah Farmers Marketing Company
Amanting Agro Processing Company Ltd		Yedent Agro Group of Companies
Brucknor Farms		
Heritage Seeds Company Ltd		
Kukobila Nasia Farms Limited		
M&B Seed and Agro Services Ltd		
Pee Farms		
Sparkx Ghana Limited		
Volta City Farms		
Wumpini Agrochemicals Limited		