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Progress Narrative

Use this form to provide updates to your foundation program officer regarding progress made toward achieving your project's stated outputs and outcomes.

The Progress Narrative must be submitted in Word, as PDFs will not be accepted.

General Information

Investment Title	Building an Economically Sustainable, Integrated Seed System for Cassava in Nigeria		
Grantee/Vendor	International Potato Center		
Primary Contact	Graham Thiele	**Investment Start Date**	November 5th, 2015
Feedback Contact[1]	Graham Thiele	**Investment End Date**	March 31st, 2020
Feedback Email[1]	g.thiele@cgiar.org	**Reporting Period Start Date**	January 1st, 2018
Program Officer	Lawrence Kent	**Reporting Period End Date**	December 31st, 2018
Program Coordinator	Jeanne Bridgman	**Reporting Due Date**	January 31st, 2019
Investment Total	$11,611,993.00	**Opportunity/Contract ID**	OPP1130642
Scheduled Payment Amount (If applicable)	$3,107,901		

[1] Feedback Contact/Email: The full name and email of the contact whom foundation staff queries for various surveys.

Submission Information

By submitting this report, I declare that I am authorized to certify, on behalf of the grantee or vendor identified on page 1, that I have examined the following statements and related attachments, and that to the best of my knowledge, they are true, correct and complete. I hereby also confirm that the grantee or vendor identified on page 1 has complied with all of the terms and conditions of the Grant Agreement or Contract for Services, as applicable, including but not limited to the clauses contained therein regarding Use of Funds, Anti-Terrorism, Subgrants and Subcontracts, and Regulated Activities.

Date Submitted	March 6th, 2019	**Submitted by Contact Name**	Maria Teresa Bellido
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Progress and Results

1. Progress Details

Provide information regarding the current period's progress toward achieving the investment outputs and outcomes as well as the work planned or anticipated for the next period. In addition, submit the Results Tracker with actual results as requested.

The progress details in this annual report for period III of BASICS is presented in the following sections:

Section A. BASICS Update for 2018: Overview

Section B: Key Achievements in BASICS in 2018

Section C: BASICS Update for 2018

- C1. Supply side development
- C2. Demand side development
- C3. Enabling environment development

Section D: Planned Work for the Next Period

SECTION A. BASICS UPDATE FOR 2018: OVERVIEW

The Building an Economically Sustainable, Integrated Seed System for Cassava in Nigeria (BASICS) project has progressed well in 2018 on the lines of the core objectives of the project as outlined in Figure 1.

The project started with the goals of (1) creating institutional mechanisms to sustainably produce quality certified breeders seed (BS), foundation seed (FS), and commercial seed (CS) and (2) improving the way seed and seed information reach the farmers and, conversely, how market feedback flows back to the research community so that market-preferred varieties are made available to help in appropriate variety replacement. BASICS has made good progress in all these areas. The updates reported here attempt to capture these developments, while also identifying some of the bottlenecks encountered and tasks to be accomplished in coming years toward realizing the project goals.

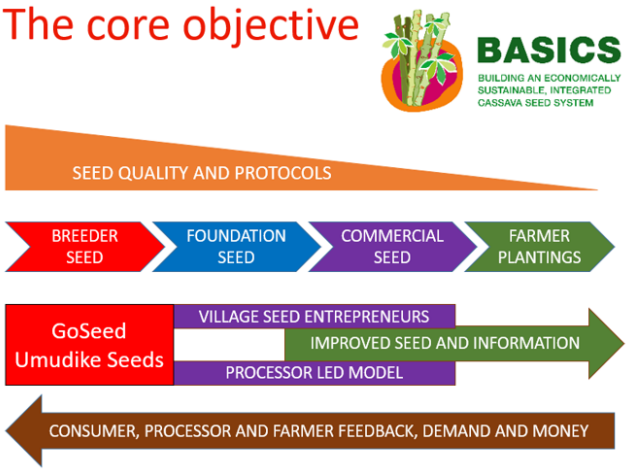

Figure 1 - BASICS schema

To ensure a planned and reliable supply of BS and FS—together referred to as early generation seeds (EGS)—two registered commercial entities came into being during the project: IITA GoSeed cassava and Umudike Seeds Private Ltd at the National Root Crops Research Institute (NRCRI). BASICS played an important role in the planning and launch of GoSeed cassava, providing financial support for both operational implementation and consultation on refining the business plan. Fittingly, during 2018 IITA GoSeed became the entity in Nigeria that has the highest acreage under BS multiplication, taking over the mantle from the International Institute of Tropical Agriculture (IITA). Having these two entities producing EGS in a commercial manner—more than 4,500 and 13,000 bundles of BS and FS, respectively, were sold) contributes to creating an economically sustainable seed system at the early stages (in Fig. 1, red and blue arrows). More information on both these entities is elaborated elsewhere in this report.

The rapid multiplication technology, semi-autotrophic hydroponics (SAH), is now an integral part of BS production, both at IITA and NRCRI. SAH-derived stems are also being produced on 2 ha at Shao Farms and Flour Mills Nigeria (FMN), one of the largest cassava processors in Nigeria. These EGS need to be further multiplied into CS to reach farmers. To ensure this in a sustainable manner, two commercial pilots initiated in 2016 were further developed (purple boxes in Fig. 1). As a result, more than 125 village seed entrepreneurs (VSEs) and three processors are working closely with the EGS providers to identify and multiply improved varieties (more than 23,000 bundles of CS sold by VSEs in the 2018 season) in order to change farmers' plantings from traditional and informal seed sources to traceable, quality certified improved variety seeds. The institutional and human capacities at the National Agricultural Seed Council (NASC) have been significantly enhanced in order to provide quality assurance, which is essential for all seed value chain actors to have faith in the whole system and to transact among themselves with confidence and consistency. Progress has also been made in the project mission of ensuring information about both improved varieties and high-quality seeds reaching farmers (more than 200,000 farmers reached by promotion campaigns; green arrow in Fig. 1). In addition, there has been progress in opening feedback loops between end-users and the research community (brown arrow in Fig. 1). This has been done through demo trials, including processing at factories for starch and high-quality cassava flour (HQCF), so that changes in the varietal development and dissemination are in response to market, farmer, and consumer feedback. For example, some varieties originally chosen to be multiplied in SAH labs for distribution were discontinued and new varieties introduced in the multiplication cycles, based on consumer preferences.

SECTION B: KEY ACHIEVEMENTS IN BASICS IN 2018

Breeder Seed Component (BSC)

- IITA GoSeed business plan finalized
- 4,556 bundles of certified BS and 13,326 bundles of FS sold in 2018
- Five new private FS producers identified and contracted under GoSeed
- Umudike Seeds Private Ltd, a dedicated seed entity established at NRCRI
- Apart from the three functional SAH labs, the technology being scaled to five countries under the Technologies for African Agricultural Transformation (TAAT) program, funded by the African Development Bank (AfDB) and BMGF, active enquiries have been received from Ghana and Vietnam. This will bring in economies of scale, thus reducing costs, increasing awareness, and resulting in greater adoption.

Processor-led Model (PLM) Component

- The Shao seed unit has produced about 200,000 plantlets with roughly 2 ha of commercial SAH plantlets transferred and established in the nursery.
- Two new processors signed up, Psaltry International Ltd (Psaltry) and Eagleson & Nito Concepts (Eagleson).
- Two pre-release, promising varieties from the NextGen Cassava project included in demand-creation trials in 2018 planting, which will help in variety replacement outcomes.

VSE Component

- More than 25,375 bundles of certified commercial cassava stems were sold by Catholic Relief Services (CRS) and NRCRI VSEs.
- More than 200,000 farmers have been sensitized on use of certified CS.
- VSEs have seen potential in seed business and have shown interest in expanding their business in coming seasons.
- Five chapters of the VSE network are fully functional and are helping make the VSE networks more robust and self-reliant.

Quality Seed Component (QSC)

- NASC Molecular Seed Testing Laboratory, a unique national facility inaugurated by the federal minister of agriculture, is operational.
- Cassava mosaic disease (CMD) virus prevalence at field level tested molecularly was not fully correlated with visual symptoms, showing the benefit of using a molecular test to intercept and reduce CMD viruses.
- Cassava Seed Tracker (CST) was adopted by NASC which has now asked for its scope to be expanded so that the National Seed Tracker (NST) covers other crop seeds. NASC also launched an e-Certification pilot that is enabled by the CST backend.
- The CST was publicly recognized in the Google Impact Challenge. This award comes with $125,000 cash award and mentoring by the Google team.

Project Management Unit (PMU)

- Actively supported development of the IITA GoSeed business plan and is doing the same for Umudike Seeds.
- Brought about a collaboration between research-academia-industry to study the seed-buying and -selling behavior, with Wageningen University (WU) and University of Ibadan, and inspired the Federal University of Agriculture, Abeokuta, Ogun Stata (FUNAAB) to establish a seeds unit.

SECTION C: BASICS UPDATE FOR 2018

The following section summarizes the key outputs and outcomes and categorizes them into supply side development, demand side development, and enabling environment development. The full component reports are compiled in Annex 1.

C1. Supply Side Development Update

All updates during the period in each component that are geared to or have contributed to increasing the supply of any

of the three classes of seed are included in this section.

A snapshot of the type of seed sold in 2018 and area planted for seed multiplication that will be ready for harvest in 2019 is provided in Table 1. The plantings in 2018 reflect a large increase in production of all seed types. Details about the varieties produced for each seed type are found in Annex 2.

Table 1. Certified seed production in Nigeria in 2018

Class of Seed	Certified Bundles Sold	Area Planted (ha)
Breeder seed	4,556	46
Foundation seed	13,326	32.85
Commercial seed	25,375	203.80

C1.1 BSC

IITA GoSeed business plan was developed with SAHEL Consulting (Sahel), chosen through a competitive bidding process. The final plan was submitted to IITA management for implementation; continued support from SAHEL is planned for 2 years. Umudike Seeds was registered as a private entity dedicated for EGS production and provision at NRCRI. In 2018 new learnings and progress were made in the use of SAH technology. Fungal infection caused significant losses and subsequent change in protocols that year. On the basis of market feedback, some of the varieties in the production mix were dropped and new varieties introduced in response to demand (see section on SAH below). In close collaboration with the NextGen Cassava project, the advanced lines that are being progressed for varietal release from this project have been introduced in the SAH lab for multiplication. Therefore the seed system is primed for rapid, widespread stem distribution of the chosen varieties as soon as the variety is officially released. A total of 4,556 BS bundles (IITA and NRCRI) and 6,990 FS bundles (NRCRI and Renescent) were sold in 2018. A total of 46 ha (IITA, NRCRI, and GoSeed) were planted in 2018 for multiplication of BS and 13.9 ha were planted for production of FS (NRCRI and GoSeed, not including Shao Farms).

SAH. Production in the SAH lab at IITA from January to December 2018 was lower than in 2017 for two reasons. First, production of TMEB117, IITA-TMS-IBA30572, and IITA-TMS-IBA980510 was phased out due to lack of demand for these varieties from the VSEs. Second, production was temporarily decreased in March 2018 to allow fumigation of the SAH lab and growth room in order to control fungal contamination caused by *Cladosporium sp*. Fungal contamination reduced availability of source plants for recutting. Various measures, including fumigation and complete sanitation of equipment and reagents, reduced infection; production recovered to the normal rate by June 2018. A similar infection was observed at Shao Farms through the plantlets sent from IITA lab. Learning from experience, the IITA team helped the Shao team evacuate the infected plantlets from the laboratory and provided technical advice to control the situation.

A new variety, CR36-5, was introduced because of its high dry matter (DM), from processing results in the demand-creation trials (DCTs) (see Table 7), and despite its moderate fresh yield. Shao found this to be an interesting variety and requested SAH plantlets for multiplication (at Shao, the initial production had focused on IBA980581). By the end of June 2018, IITA provided five additional varieties as SAH plantlets to Shao Farms: CR36-5, IBA011368, IBA980505, NR8082, and IBA07593.

IITA established a conservation nursery at Ago Owu to maintain several varieties, which can serve as a replacement source for tissue culture (TC), if needed. Of the 46 officially released varieties, 20 were selected and planted on a 0.1-ha plot/variety (Fig. 2).

At the NRCRI SAH lab, about 16,000 plantlets derived from 10 cassava varieties have been produced in the 18 months after the inception of the lab. Table 2 shows the distribution of SAH plantlets in the laboratory, field, transferred, and in transit to the fields.

Figure 2. IITA conservation nursery in Ago Owu.

Table 2. NRCRI SAH production in 18 months through December 2018

Cultivars	No. of Plantlets in SAH Lab	No. of Plantlets in Screenhouse	No. of Plantlets Sent to IITA	Plantlets Used for Experiments	Transferred to Foundation Seed Field	Field Evaluation Trial	Total
TMS-IBA010040	498	228	250	100	172	635	**1,248**
TMS-IBA980505	1,477	951	125	40	85	463	**2,678**
TMS-IBA980581	386	209	125	-	55	496	**775**
TMS-IBA070593 (Umucass45)	2,227	1,918	325	240	563	788	**5,273**
NR07/0220 (Umucass44)	205	119	-	-	-	-	**324**
TMS-IBA070539 (Umucass46)	908	230	-	-	-	-	**1,138**
TME419	210	46	-	30	-	-	**286**
NR8082	154	119	-	-	-	-	**273**
NR8083	657	92	-	-	-	-	**749**
CR36-5	578	160	-	-	-	-	**738**
Total	**7,300**	**4,072**	**825**	**410**	**874**	**2,472**	**15,954**

For the field evaluation of SAH-derived plants, data on pest and disease (CMD, cassava bacterial blight, cassava anthracnose disease, cassava green mite) and other agronomic traits (e.g., architecture and vigor) were collected over 9 months after planting and are being analyzed. During 2018 NRCRI has introduced additional varieties from their TC lab, including UMUCASS44 (NR070220), UMUCASS46 (IBA070539), and TME419. A total of 20 cassava varieties, TME419, IITA-TMS-IBA961632, IITA-TMS-IBA980505, IITA-TMS-IBA980581, NR87184, IITA-TMS-IBA974779, IITA-TMS-IBA010040, IITA-TMS-IBA30572, NR07/0220 (UMUCASS 44), IITA-TMS-IBA070539 (UMUCASS 46), NR8082, NR8083, TMS92B0068, NR030711, TMS-IBA011412 (UMUCASS 37), TMS011371 (UMUCASS 38), CR36-5, NR292-D, NR095-F and NR174-1, have been established in the TC lab at NRCRI to feed the SAH production plant (Annex 1, p. 9). Also, experiments are underway to optimize the plant-cleaning protocol. All these activities are designed to understand consumer preferences and then supply the demanded varieties through rapid multiplication.

GoSeed and Umudike Seeds. IITA GoSeed Cassava was registered in November 2017, and Umudike Seeds at NRCRI was registered in September 2018. These are two singularly significant innovations coming out of the BASICS project initiative to establish a robust mechanism for supplying EGS that is a primer for a sustainable seed system.

With active support and approval from the BMGF, $400,000 was set aside from project savings to help launch GoSeed. One half of this amount was earmarked for working capital and the remaining half to hire the services of a private agency to help develop and refine a business plan for the entity (Annex 3). Sahel was identified through a competitive bidding process to refine the IITA GoSeed Cassava business plan and to help implement it for 2 years. IITA GoSeed Cassava is mandated to develop a dependable mechanism for supplying EGS to support the Nigerian cassava seed system in a sustainable manner. As part of the business plan, strategic assets and responsibilities were planned for progressive transition from the BASICS project and the IITA breeding team to the company. As a result, 3,350 bundles from the 2017 production of BS were harvested and transferred to IITA GoSeed Cassava. Also, 1,500 bundles of biofortified varieties (IITA-TMS-IBA070593 and IITA-TMS-IBA070539) were sold to FMN. All these materials were certified by NASC and were derived from conventionally produced stems.

After harvest and sales of the conventionally produced BS materials in 2018, all subsequent stems used to multiply BS at GoSeed for 2018 were derived from SAH. At this point, all conventional stems have been phased out from the BASICS project. From SAH nurseries established in 2017, 1,000 bundles of SAH-derived stems were harvested in 2018 by ratooning at Ibadan and Ikenne. The stems were certified by NASC and planted at Ago Owu covering 18.56 ha of BS fields. In addition, GoSeed identified five outgrowers, Ere-Egwa Farm, Fstep Farm, Wadahi Farm, Universal Treasure Farm, and Graceyange Farm, to produce 23.3 ha of BS and 8.9 ha of FS of a number of varieties from conventional stems in 2018 (Table 3, compiled from IITA report, Annex 1).

Table 3. GoSeed EGS outgrower production

IITA GoSeed Cassava BS Establishment		
Location	**Variety**	**Area (ha)**
	IITA-TMS-IBA961632	4.5
	TMEB419	4.3
	IITA-TMS-IBA980581	2.5
	IITA-TMS-IBA980505	2.1
	IITA-TMS-IBA010040	1.4
	ITA-TMS-IBA070539	2
	IITA-TMS-IBA011412	0.7
	IITA-TMS-IBA070593	5.8
Abraka, Delta State		10.4
Ago-Owu, Oyo State		12.9
Total		**23.3**
IITA GoSeed Cassava FS Establishment		
Location	**Variety**	**Area (ha)**
	IITA-TMS-IBA980581	1.6
	TMEB419	2
	IITA-TMS-IBA961632	2.1
	IITA-TMS-IBA980505	1.65
	IITA-TMS-IBA010040	1.55
Kogi State		3.8
Benue State		5.1
Total		**8.9**

After formal incorporation of Umudike Seeds, the business planning, seed capital sourcing, and a similar transition planning as in IITA are the next important activities at NRCRI in 2019 and beyond. Umudike Seed has the backing at the highest levels at NRCRI. The executive director, Prof. Ukpabi, and the BASICS project head, Chiedozie Egesi, have identified and entrusted a dedicated staff member, Mark Tokula, to head the operations. On the basis of the demand by FS producers in 2019, NRCRI established BS multiplication plots of more than 4.14 ha in July 2018 at Amakama, Abia State (Table 4).

Table 4. NRCRI breeder seed production in 2018

S/N	Variety	Area Planted
1	TME419	1.60
2	IITA-TMS-IBA980505	0.05
3	IITA-TMS-IBA961632	0.05
4	IITA-TMS-IBA070539	0.04
5	IITA-TMS-IBA980581	0.10
6	IITA-TMS-IBA070593	0.70
7	IITA-TMS-IBA010040	0.80
8	IITA-TMS-IBA011412	0.80

To meet the demand for the 2019 planting season, some 5 ha of FS was established in 2018 at Amakama and Umudike production sites (Table 5). TME419 still is the dominant variety in demand for NRCRI, so BS production should help cover next year's demand for FS as well as for the next variety in demand, the yellow cassava IITA-TMS-IBA070593. These varieties are being promoted by CRS in a billboard campaign (see section on VSEs below).

Table 5. BASICS FS production at various locations in 2018

Varieties	Umudike (ha)	Amakama (ha)	Total Area Planted (ha)	No. of Fields
TME419	1.85	1.5	3.35	2
IITA-TMS-IBA980505	0.25	-	0.25	1
IITA-TMS-IBA070593	0.5	-	0.5	1
IITA-TMS-IBA980581	-	0.5	0.5	1
IITA-TMS-IBA011368	0.2	-	0.2	1
IITA-TMS-30572	0.2	-	0.2	1
Total	**3**	**2**	**5**	**7**

Field maintenance and security management such as fencing in the production fields were carried out to keep nomads and their cattle from damaging planting materials.

NRCRI has continued to collaborate with the licensed FS growers under the BASICS project (such as Renascent, Annex 4). Production of FS is also being implemented by a private sector seed producer to meet the demand for the next planting season in 2019.

C1.2 VSE component

In the 2017/2018 season, 103 VSEs established 131 fields for seed production, totaling about 107 ha with five improved varieties of cassava: IBA011368, TMEB419, IBA980581, IBA980505, and NR8082. The varieties were chosen based on farmer preferences observed from purchase trends during the previous season. The fields were inspected by NASC during the season; 81% (96 fields) of 118 fields that completed the certification exercise passed. The remaining 13 fields could not go through the entire certification process due to security challenges occasioned by the herders–farmers crises at affected locations. The 22 fields that did not pass certification were poorly managed by the VSEs due to either financial challenges or health issues. Other fields producing the TMEB 419 variety, however, had stems that were not true to type, exposing some problems with the FS supply. This issue has been highlighted to NRCRI and IITA and is being investigated. The SAH-derived stems flushing the system in the coming years is expected to address this issue of genetic purity along with that of sanitary purity.

In 2018, 14,229 bundles of certified planting materials were sold to farmers within and outside the state by 81 VSEs. This was a 260% increase over certified seeds sold in 2017. The 14,229 bundles sold represented about 88% of the total produced (16,140 bundles from approximately 80 ha) from all the certified fields for the year. Several factors accounted for the inability to achieve higher sales—chiefly the lingering herders–farmers conflict in Benue State and the low demand for the yellow variety as many farmers already had free or informal access to it through other programs (e.g., HarvestPlus). Yellow varieties, which appear to be growing in demand, accounted for about 28% of the season's VSEs' production. The herders–farmers crises affected sales because farmers were not going to their farms for fear of being attacked by herders, thus directly affecting demand for planting materials. This was also exacerbated by a drop-in cassava root prices, leading to lower demand for stems coupled with higher stem availability in the informal market due to the increased planting in the previous year and recycling of the stems by farmers. The yellow variety is now being produced in higher amounts at NRCRI, both in the SAH facility and in BS and FS fields. The fall in demand will be closely watched to determine whether it was the sum of different factors linked especially to incidents in 2018, or a longer lasting effect. This is an important learning experience in the project, as we expect that the demand for particular varieties will fluctuate (also affected by farmers then multiplying their own seed for a couple of cycles) and the effectiveness of the emerging seed system to adjust accordingly. There is a lag time between purchases of CS and adjustment of SAH and EGS production amounts. As the seed system matures, it will become easier to project sales further into the future, and thus plan the SAH and EGS production more effectively.

C1.3 PLM component

Figure 3. First SAH plantlet nursery at Shao Farms (0.45 ha).

Since the operationalization of the SAH lab at Shao Farms from September 2017, the lab has been rapidly scaling their multiplication activities. The Shao seed unit has reached about 200,000 plantlets of aggregate throughput with roughly 2 ha of commercial SAH plantlets transferred and established in the nursery. The first batch of SAH plantlets were transferred to the nursery in June 2018. The 13,776 plantlets transferred covered roughly 0.45 ha, with a planting density of 30,000 plantlets/ha (Fig. 3). At about 88% establishment rate of the nursery, a certain number of plantlets were not successfully established in the field. Moreover, there were issues of waterlogging and erosion, leading to further loss of plantlets. To prevent further loss of plantlets to erosion, a new nursery was established in a different location with roughly 1.8 ha with SAH plantlets. The new nursery is situated close to a borehole facility for manual watering. In addition, manual ridging and protective barriers have been incorporated around the sites to protect against erosion. Therefore, the processor is accumulating experience in utilizing the SAH to manage his source of clean material of different varieties and improving the field establishment of plantlets, which requires more handling than regular seed stem segments.

Another major goal in 2018 has been to supply new material of additional varieties to the seed unit at Shao Farms. Up until May, the technicians multiplied plantlets from the original breeder materials of TMS 980581 that they purchased from IITA in September 2017. An initial transfer of new materials was made in May with around 40 boxes of four new varieties with good processing qualities: IITA-TMS-IBA961632, TMEB419, CR36-5, and IITA-TMS-IBA070593 (a yellow variety). A fungal contamination manifested on the new materials, however; IITA was contacted and responded quickly by helping to identify and dispose of contaminated materials. In the second week of July 2018, IITA transferred another set of clean breeder material in SAH boxes.

In 2017, 4.5 ha of ratooned nursery stems planted with IITA source material and 26 ha of commercial production established with bundles received from the IITA-source nursery ratooned in 2017 were established at Shao Farms. The stems to be harvested from the 4.5 ha of ratooned nursery (estimated to plant 15–25 ha of commercial planting) and from the 26 ha (estimated to plant 100–120 ha of commercial planting) were both due for harvest in 2018. But the 26 ha were not harvested due to the transition of Shao management and the onboarding of new staff in positions that oversee harvesting activities. In addition, FMN had already sourced the planting materials for their commercial planting target of 750 ha prior to the harvest period of the BASICS seed plots. Consequently, Context Global Development (CGD) is working with the new farm leads of Shao Farms on planning to harvest and use of the stems from the two fields mentioned above, for viable planting material during the early part of the next planting cycle. In addition, when they harvest for roots, CGD will capture the data which will be added to other data collected over the years to refine a list of preferred varieties for both farmers and the processors in their respective locations.

CGD signed partnership agreements with two new processor companies, Psaltry and Eagleson (see Annexes 5 and 6). Through the first half of 2018, CGD and Sahel worked through the partnership development roadmap that was outlined for new partners in order to foster alignment on key objectives, demonstrate mutual commitment, and ultimately drive capital investment for a SAH-led seed multiplication business unit. CGD also worked with both processors on a business plan (GrowAfrica, Annex 7) and investment advisory support areas such as:

- Developing processor-specific pro forma financials
- Finalizing the investment case for presentation to internal and external funders
- Securing capital investment for lab and nursery establishment

The SAH lab site at both the new processors has been selected and readied. CGD is currently helping the processors obtain external funding to establish the labs at their respective sites. This learning will help inform how to bring in other

processors into the PLM component in the future, as innovative funding schemes will need to be developed. CGD and Sahel will continue working in 2019 to help Eagleson and Psaltry finalize the establishment and operation of the SAH seed business unit, training their technicians, and providing useful training material for effective lab operations (see Annex 1, pp. 28–29, and Annex 8) and managing their nursery establishment through specially developed Excel tools to help with lab scaling calculations (Annex 9). Shao Farms' SAH seed unit is already in operation, and it will continue to receive training on tools for cost budgeting, unit economics calculation, and throughput forecasting to commercial level. It is significant that two other processors are willing to invest and change their system to supply seed to their outgrowers. The set-up costs of a SAH facility are, however, too high for smaller scale processors.

C1.4 Quality seed component

There are a number of bottlenecks in seed system work, chiefly a lack of information on (1) who is producing certified seed, where, and in what quantities; (2) which seed varieties are being produced; and (3) what is the demand for such seeds. The Cassava Seed Tracker (CST) has made a significant headway in addressing this issue. A snapshot of seed production done under the BASICS project provided below using the CST platform not only highlights the progress made in the project, but also demonstrates its utility and importance (see IITA full report, Annex 1). This potential of CST was publicly recognized when it was chosen as one of the eight runners-up for digital tools in Nigeria in the **Google Impact Challenge** late last year. The CST team, led by Lava Kumar and Olusegun Ojo, received a $125,000 cash award at a ceremony in Lagos in November 2018, together with mentoring by the Google team.

Figure 4 depicts the number of fields under certification in 2016–2018 for each class of seed. Currently, only the seed fields under the BASICS project are being entered in this system. As NASC progressively adopts the CST and makes it mandatory for all registered seed producers and seed inspectors to enter their data into it, this information will help all the seed system stakeholders in planning and production.

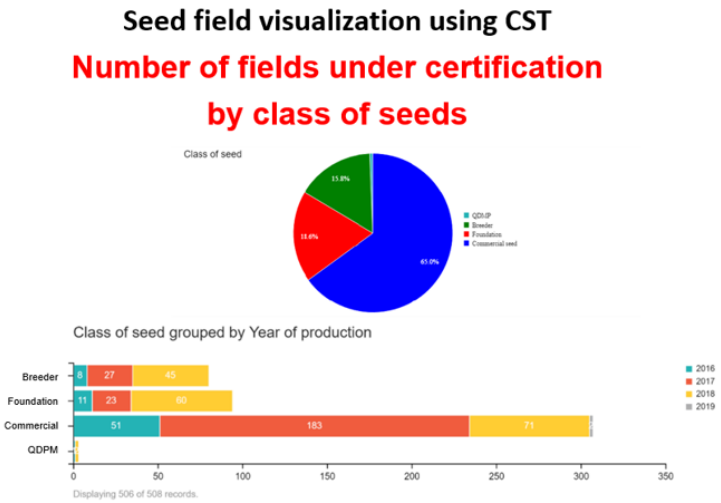

Figure 4. Number of fields under certification in 2016–2018 for each class of seed.

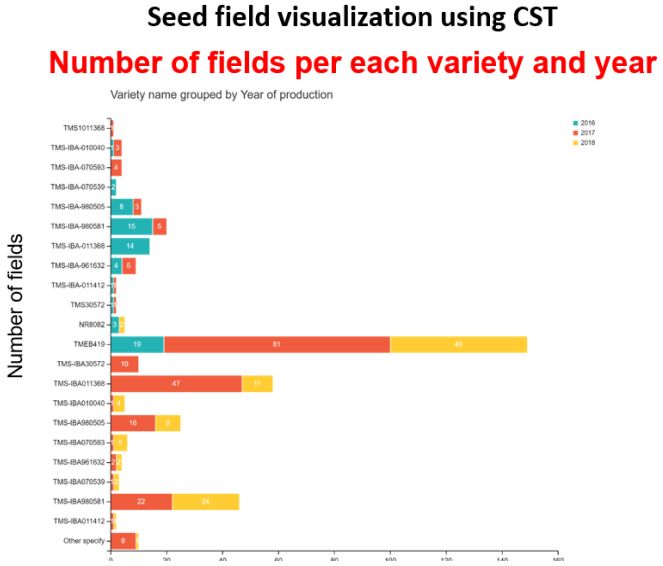

Figure 5. Number of certification fields registered on the CST per each variety and year.

Figure 5 shows the number of certification units (fields) registered on the CST for each variety. A study of this information gives us an idea of the relative demand between different varieties and the production trend for each variety over the years.

Figure 6 depicts the ability of the CST to be a fully translational platform (on a Google map, it shows the seed production plots). By clicking on these points, one can know the details of the variety grown and its characteristics and details about the seed producers. It even allows one to have a WhatsApp chat with the seed producer or place an online order for the seeds.

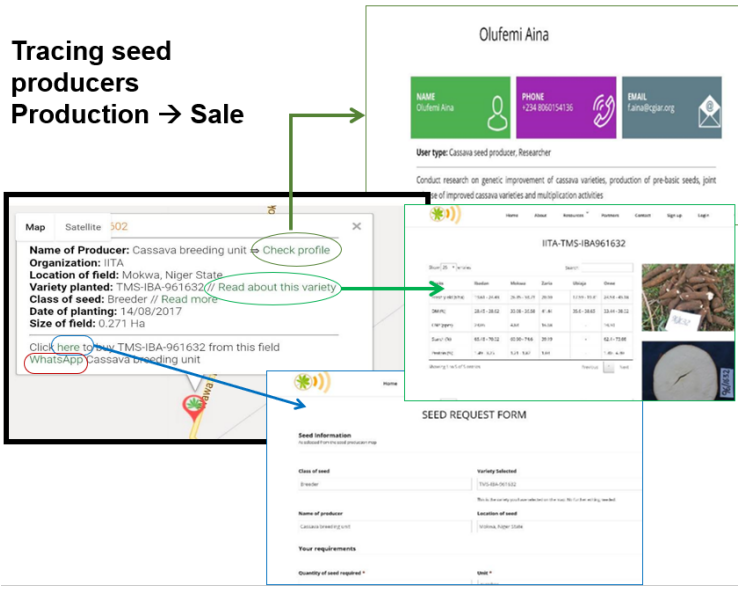

Figure 6. The CST and some of its possible applications as a translational platform.

NASC and the Ministry of Agriculture in Nigeria are excited about the CST. NASC itself has publicly announced plans to use the platform to roll out e-certification for seeds in Nigeria and has advanced its plans to be a leader in the seed sector serving not only Nigeria but also more broadly West Africa. In part through the encouragement of the BASICS project, NASC has increased its aspirations to take the seed system to the next level. Consequently, personally signed letters of appreciation for BASICS were received from the Hon. Federal Minister for Agriculture, Mr. Audu Ogbeh, and the director general of NASC (Annexes 10 and 11).

The major focus for Fera in 2018 was the progression of the BS certification standard comprising:

- Development of the molecular laboratory for seed testing at NASC
- Prevalence of CMD viruses in the cassava fields and associated with symptoms; genetics of CMD tolerance and farm system
- The tabling of a proposed series of recommendations on the setting of the BS standard for NASC
- Development of the molecular laboratory for seed testing at NASC

The establishment of NASC's molecular seed testing facility represents a significant achievement (Annex 12). This facility started with four very run-down rooms. NASC is to be highly commended for investing in a total refurbishment. Other significant milestones then became possible with the arrival of the equipment, its commissioning, and operation. In parallel to this building of infrastructure, Fera has worked tirelessly to share their skills and knowhow with NASC staff. All parties were rightly proud when the facility was opened by the Honorable Minister of Agriculture and Rural Development, Chief Audu Ogbeh, in a well-publicized public event.

In November the facility achieved its primary aim with the testing of three BS fields for CMD viruses. Importantly, the piloting of the BS test encompassed the collection and transport of the samples. This required some innovation in how to take and package the field samples so that they arrived safely at the NASC laboratory. In partnership with IITA, a full and challenging experience of field sampling was worked through following a protocol that had previously been piloted by Fera and NASC and seen as appropriate for the BS certification standard. This largely worked, but more experience in its implementation will undoubtedly realize improvements. A key observation, but obvious to those practiced in cassava cultivation, was that cassava grows very tall and presents a mass of stems that is hard to penetrate once the canopy closes. Discussion with experienced inspectors and plant breeders determined that the last realistic time to 'walk' a cassava field was from 6–9 months, depending on the variety, and that this marked the latest that a sample for testing for CMD virus could be realistically obtained. A cassava stand may grow on for a year prior to stem harvesting, which leaves a window for CMD virus infection after the test of 3–6 months. We recognize that this is a concern, but we can do little to manage it. Interestingly, it also highlights a question as to the feasibility, or purpose, of the current field inspections that are close to harvest and what these are measuring.

In 2019 activities at NASC and the laboratory must now center on ensuring that all the current BS fields are tested for CMD viruses. Beyond the obvious gain in reducing CMD virus levels in seed, other benefits will accrue from testing. The data on CMD tests will serve to benchmark field prevalence levels and begin to inform on an optimal CMD virus threshold

to be set at the current time, such as other vegetatively propagated crops. The laboratory has been purposefully designed so that it is versatile to look at different crops and diseases. An activity in 2019 is to help NASC develop a business plan that realizes the fuller use of the molecular capacity and can ensure its financial viability. To this end, NASC and Fera have connected with Agra to explore additional support options.

Prevalence of CMD viruses in the cassava fields, and associated with symptoms, genetics of CMD tolerance and farm system. At the outset of BASICS, and in setting the BS standard, we recognized that there were significant knowledge gaps with respect to CMD and CMD viruses that needed to be addressed. Studies to date on 40 fields and ~4,000 leaf samples (collected by NRCRI) have substantially addressed many of these needs. The reports on the development of loop mediated isothermal amplification (LAMP) (Annex 13) and virus prevalence (Annex 14) present some of the most robust data realized on this disease. These data for the first time demonstrate the reliability of visual CMD identification, identifying a significant population of plants that, although visually are CMD free, are actually infected with the virus. We further show that CMD severity is a poor proxy for CMD virus load. These two observations critically point to the justification for a molecular test. Table 6 (taken from Annex 14) provides an analysis of the 'volume' of virus that is removed from a certified seed system by CMD virus testing when employing a threshold of 5% or 10% prevalence for rejection. These are some of the first data to show such a direct benefit in virus-load control, from a molecular test deployed in seed certification.

Table 6. Effect of thresholds for rejection on mean virus infection in certified fields

Threshold	Inspection and Testing Type	Costs			Effect
		Fields Inspected (%)	Avg. Tests/Field	Avg. Probability Rejection (%)	Mean Infection in Accepted Fields (%)
No Control	**None**	**0**	**0**	**0**	**6.3**
10%	Symptoms	100	0	2.0	6.3
	Symptoms, 12 pools	100	11.8	16	3.5
	Symptoms, 30 pools	100	29.5	16	3.4
5%	Symptoms	100	0	15	5.1
	Symptoms, 12 pools	100	10.2	32	2.0
	Symptoms, 30 pools	100	25.6	32	2.1

The other major finding by these studies was the indication that in a CMD-tolerant field with CMD virus, a higher proportion of infected plants will show no visual symptoms of CMD when compared with a susceptible counterfactual. However, certified seed and farmer-kept seed were not compared on the same varieties, which created a bias. Therefore, the influence of CMD genetics and farming system cannot be separated out.

In the report on setting a BS standard (Annex 15), we consider the importance of this finding and introduce the terms 'cassava ecosystem' and 'co-existence' of breeder-improved, CMD-tolerant varieties and farmer-maintained CMD-susceptible landraces. Therefore, it is important to ensure breeder-improved, CMD-tolerant varieties are within measured and low levels of CMD virus.

The tabling of a proposed series of recommendations on the setting of the BS standard for NASC. All the above works toward the establishment of a BS certification standard for cassava. Parallel to the gains made in CMD virus detection and understanding of prevalence has been the potentially disruptive SAH technology for plantlet production. This method stands to provide a 'clean-start' for BS production, with SAH plantlets effectively carrying the same level of phytosanitary assurance as can be achieved with TC. The inclusion of this technology into the BS standard is now central to BASICS; many partners undertake SAH production or receive SAH plantlets.

A BS standard represents a significant undertaking that is contextualizing new knowledge of CMD virus risk and a new system of production. A fuller appreciation of the concept of a cassava ecosystems and co-existence is also critical, where tolerant and susceptible varieties are to be cultivated. Accordingly, the report provided as Annex 15 is not necessarily comprehensive, nor are all parties likely to agree. It is presented as something to be considered for broader consultation that will be required and led by NASC. The proposed BS standard has additional certification requirements, to deal with different levels of SAH-derived material. This matter applies whether the plantlets themselves, or stems developed from them—either in the field or in a screenhouse—include CMD level standards.

Third-party seed certification. A workshop held during 2018 with Fera, CRS, NASC, and NRCRI. Under consideration was third-party seed certification and what effects such practices will have, in the context of reporting and accountability, and in terms of who the third-party agents may be and the financial basis they would operate on. However, it also served to underline the distance to be covered. If BASICS is to make serious gains on this activity, we will require significant buy-in and prioritization from a breadth of partners. In the current year the seed legislation that encompasses third-party legislation has not been passed. And although this delay was not caused by the inclusion of third-party certification, this further detracts from the intended piloting activity.

C2. Demand Side Development Update

Demand for each class of seed is a derived demand—in other words, only if farmers buy CS in decent quantities would CS entrepreneurs have a viable business opportunity, which would in turn create a viable business opportunity for the EGS players. The dynamic, integrated interplay of the demands for the three classes of seed together determines the viability and functional sustainability of the overall seed system, while informing which varieties to disseminate and what new traits are demanded by the different market segments for variety replacement. Each project component had activities to develop the demand side in their respective area of influence.

The PMU collaborated in a study to determine seed supply systems in three communities in Nigeria (Akwa Ibom in South-South, Imo in Southeast, and Benue in North Central regions), together with seed systems researchers from WU Research, draft report, Annex 16). The study identified and characterized different types of informal cassava seed suppliers and seed markets, showing a large variation in the types of actors, including formal ones, involved in the different seed systems (formal, project based, and informal). Different formal actors operate in and between these seed systems, playing a role as facilitators between supply and demand of stems and providing direct linkages to the informal sector. Most sampled seed sellers can be categorized as *farmer sellers* (i.e., farmers who engage in the production of roots and sell stems as a by-product as a small contribution to their income). The findings, which are only illustrative, suggest that an intervention and strategy to improve cassava seed systems need to be tailored to farmers' needs. In addition, to improve availability and access of planting material, interventions need to tap into and make use of existing informal and formal functioning systems and actors. A publication is expected by mid-2019 and is undergoing final refinements and consultations between BASICS and WU Research teams.

C2.1 BSC

The BSC had most of its interventions at EGS level. It had project activities at technological, institutional, and market-levels, such as creating awareness, building capacities, market messaging, and so on.

Seed source comparison trial. A demonstrable and consistent value proposition for the farmers to buy certified seed is at the core of a sustainable seed system. BASICS is promoting the certified stems of three classes (BS, FS, and CS) produced through conventional stem propagation methods and SAH technology. This is the first instance of production of cassava planting material through SAH for stem production in Africa which ensured genetic purity and virus-free plantlet production.

A study was undertaken that compared plants generated from conventional stems with that of those generated from SAH plantlets and SAH-derived stems and certified and uncertified BS. (Annex 17 provides the trial designs and findings). Trials in Ikenne and Mokwa established well but, owing to poor establishment of SAH plants, the trial site in Umudike was discontinued. The main findings of the trials are summarized as follows:

- Establishment rate of all the stem sources (BS, SAH-stem, and control) were better than the SAH plantlets.
- Location and genotype had significant impact on growth and vigor compared with stem source. Plants in Ikenne performed better than Mokwa, which is located in the derived savanna agroecology.
- Significant effect of cultivar and location was observed on the root number and root yield. But source of stem per se was not significant, which implies that all stems sources performed equally well.
- DM content was not affected by location, genotype, or stem source.
- Root yields of certified and uncertified stems of CMD (type-2) resistant cultivars are similar. However, this trial used seeds from researchers' fields, including the uncertified control, and thus may not be the best comparison with farmer conditions. Stems harvested from this trial were used to establish a second-year trial in 2018 as a sequential

trial to determine the performance of reused stems. Therefore, a repeat trial of the same stem types planted in 2018 but including seed taken from farmers' fields should provide a better comparison (trial design, Annex 17). At this time, preliminary results suggest that there may not be a yield improvement for certified seed for varieties that are CMD resistant. A farmer-kept seed, however, needs to be used as the control. For susceptible varieties, this would have to be examined, as the CMD impact on yield is expected to be stronger.

VSEs versus FSS seed source comparison trial. A preliminary report from a previous study to compare the performance of seed from the VSEs and seeds from famer-saved seed (FSS) indicated similar yields from VSE and FSS seed. This tended to suggest little or no yield advantage from growing certified cassava seed. However, the trial was not replicated, and the seed sources were varied, thus preventing reliable conclusions. Consequently, in October 2017 a new trial was set up (two locations in Benue State). The trial aimed to compare the effects of certified seed from registered VSEs against FSS from neighboring farms (seven each) on yield of TME419 and three improved varieties (all are CMD resistant, Annex 18). The field trials were established using a randomized complete block design with three replications. Comparison between VSE and FSS seed within each location indicated that, contrary to expectation, the FSS performed better than the VSE seed in the mean fresh root yield. This trend was observed also when comparing each variety separately (Fig. 4, Annex 18). For more robust conclusions, results for a second season with harvest in 2019 will be incorporated into the analysis. Nevertheless, for CMD-resistant varieties, preliminary results seem to suggest that FSS can perform as well as clean seed (or better). This may not be the case for CMD-susceptible varieties. In any case, this trial shows that CMD-resistant varieties are able to disseminate in the cassava production landscape and resistance maintains the yield potential under the farmers' field conditions. The BASICS seed system is an important dissemination pathway for these improved varieties.

DCTs. DCTs are a joint activity between IITA and CGD and are being reported by IITA. Three DCTs have been established at Shao Farms, one each in 2016, 2017, and 2018; the first two have been harvested to date. One DCT each has been established and harvested at Psaltry and Eagleson. DCTs established in 2017 were harvested in 2018 at six locations in five states in Nigeria: Ikenne (Ogun State); Ago-Owu (Osun State); Ilorin-Shao Farm (Kwara State); Ado-Awaye Psaltry Farm (Oyo State); Iseyin Eagleson Farm (Oyo State); and Lokoja Crest-Agro (Kogi State). For the 2018/2019 season DCTs have been established in seven locations, one additional to the above ones at FUNAAB, Abeokuta in Ogun State.

Fresh root yield across all six locations for most varieties showed similar behavior across locations except at Shao, where performance was uniformly low for all varieties. The highest stem harvest was at Ago Owu, followed by Ikenne. The Psaltry (Annex 19), Eagleson, and Shao environments did not favor high stem yield. DM and starch content showed a consistent trend across the locations, with CR36-5 performing the best for both the traits, followed by IBA961632 (Annex 1, pp. 10–15). Mean fresh root yield of each variety across the locations ranged from a low of 18 t/ha for IBA070593 to a high of 39 t/ha for IBA980505. Starch content ranged 17–21% and DM content was observed between 28% and 34%. The overall ranking of varieties considering all traits is represented in Table 7.

Table 7. Ranking of all varieties considering all traits

Variety	Rank
IBA961632	1
TMEB419	2
CR36-5	3
IBA950289	4
IBA980581	5
IBA980505	6
IBA010040	8
IBA30572	9
IBA070593	10
IBA070539	11
IBA011368	12

The DCTs over 2 years showed that, considering all traits, IBA961632, TMEB419, and CR36-5 ranked the best and are in large production numbers in SAH (see Table 2) and also in the IITA BS and FS outgrower production schemes (Table 3). Biofortified variety IBA011368 ranked the lowest (with lower FS production, Table 5, and not in the NRCRI SAH

production nor the BS production). The top varieties have consistently higher starch yields across locations, with the top-ranked variety having higher root yields. The yellow varieties are ranked lower, due to lower DM content. The DCT-harvested roots from Shao were sent for processing into gari. On the basis of the percentage of gari yields from the peeled roots, the best performing varieties were TMEB419 and IBA980581 (Annex 1). IBA010040, IBA30573, and IBA950289 did not give favorable gari yields. Out of the 1o varieties harvested from the DCTs in 2017, IBA980581 had the lowest starch content and is least desirable by the processor. However, smallholder farmers were impressed by the yield performance of IBA980581 during field demos, as is reinforced by the percentage of gari yield. Worth noting is that IBA980581 has an irregular stem architecture that makes it unsuitable for mechanical planting. The processors are particular about the varieties that best suit their processing needs. So, varietal preferences are a complex decision. Promoting the high-ranking varieties through the seed system may gain traction due to potential benefits to both farmers and processors. The August–December period was seen to be appropriate for harvest to obtain high DM percentage.

A DCT was established in Eagleson and Nito Concepts farm in late 2017 and harvested in October 2018. Eagleson's primary processing commodity is HQCF, and the harvested roots were processed into HQCF to determine the best varieties that suit their processing needs. The results of the data showed that IBA010040 has the best percentage of flour yield from the roots harvested. Though roots weighed less than IBA980505, the processed flour from the roots was higher. The other varieties that performed well were IBA980581 and IBA961632. CR 36-5 had a high root weight, but with the processing into HQCF it showed high water retention as the weight of flour was about eight times less than the root weight. The yellow cassava variety and IBA950289 also did not perform well. SAH production for Eagleson HQCF will need to be adjusted accordingly.

The new 2018–19 DCTs were established at the three processor partners' farms: FMN's Shao, Psaltry, and Eagleson. At Shao Farms the DCT compares the performance of improved SAH-derived stems vis-à-vis conventional stems, local landraces, and SAH plantlets. The DCTs at Eagleson and Psaltry compare SAH-derived stems with conventional ones. This comparison will help build the case for using planting materials originating from SAH-anchored multiplication systems (see Annex 1, pp. 34–36, for a description of the trial designs). The varieties included in these trials across the three processors also include two unreleased varieties from the NextGen project: these are experimental varieties in final stage of breeder/selection testing. These varieties were included in the 2018 DCTs following IITA's recommendations (see Annex 1, pp. 34–35, for the list of varieties and their attributes).

C2.2 VSE component

More than 200,000 farmers were reached during the year through a combination of market day promotions, airing of radio spots/jingles, launch of component website, distribution of flyers and project promotion at meetings, and the like that were organized to promote the VSEs and create a brand for their products. Fifty-one market day promotions were held by CRS and partners during the year across the operational local government authorities (LGAs) through which over 18,000 farmers were directly reached. During the reporting period, 115 radio spots were aired in collaboration with three radio stations across the state. They include a number of 15-min. discussions and phone-in sessions that attracted calls during and after the program. The callers were mainly male farmers, about 90% from Benue and the rest from neighboring Taraba, Kogi, and Nasarawa states. The queries could broadly be arranged into eight categories:

- Seeking more information about the cassava varieties being advertised
- Where to buy the stems
- To know more about the project
- How the stems are sold and at what price
- How much would a hectare of stems be worth
- How long it takes for the cassava varieties to reach full maturity
- Where to buy the type of cassava that heals diabetes
- For those who already have cassava, could the project buy their roots

Furthermore, the project continued its networking activities with government and other programs to create demand and increase sales of certified planting materials. Also, a website (www.cassavastems.com) for the VSE component of the project was launched by CRS. The site provides information about the project, the VSEs (including those managed by

NRCRI), and information about their fields such as varieties available, location, and contact details. To further increase the visibility of the project, billboards were installed across the state to promote TMEB 419, IBA011368, IBA980505, IBA980581, NR 8082, and IBA30572 varieties and further create demand for them. All of these varieties, except NR 8082, are in FS field production by NRCRI (Table 5) to supply the VSEs. In the 2018 season, low demand for IBA011368 was observed because of a glut of the variety owing to promotion and sales by HarvestPlus field agents, meaning that many farmers already had access to it and/or were recycling it. This issue will apply to all biofortified varieties that are being promoted through HarvestPlus. BASICS will have to coordinate with HarvestPlus to see how to best enable VSEs and FS producers to participate in the marketing of these varieties.

These combined efforts have contributed to increasing farmer knowledge about the VSEs and availability of certified improved seeds, which contributed to the sale of 14,229 bundles of certified stems during the year. CRS Nigeria country program had developed a radio messaging system to provide useful information to existing and new cassava growers. In addition, CRS leveraged this by continuing the collaboration with Viamo (formerly HNI) and Airtel Nigeria, to broadcast messages on cassava agronomy and business basics to farmers in Nigeria and progressively adding the VSE component to it. Anyone registered with Airtel in Nigeria, irrespective of the type of phone used, is able to access the messages free of charge at the time needed. The messages are in English and major local languages (Yoruba, Ibo, Hausa, and Pidgin), thus providing cassava agronomy and business skills to a wide spectrum of farmers. User information from Airtel in 2017 revealed that 7,554 farmers accessed the cassava menu. Though the user data for 2018 are still being compiled, CRS expects increasing number of users due to consistent creation of awareness on its use by CRS and Airtel.

C2.3 PLM Component

This topic is covered in IITA's DCT subsection as this activity was jointly conducted by IITA and CGD.

C3. Enabling Environment Update

A well-functioning seed system needs to facilitate transactions between the buyers and sellers of certified stems. This enabling environment that the Project has tried to foster is comprised of a combination of supportive policies, human capacities and partnerships, institutional mechanisms and platforms to bring the stakeholders together.

C3.1 BS component

IITA and NRCRI are playing an important role in catalyzing behavior change of all players in the seed system. Frequently, IITA is approached by various state governments from other countries for supply of seeds. An important behavior change that BASICS has been advocating is to link seed orders by different organizations to the actual seed producers. The government of Taraba (Nigeria) approached IITA for more than 5,000 bundles of TMEB 419 stems for distribution. They were connected to CRS VSEs and the sale happened through them. Consequently, a transaction involving CS producers took place, and the next step would be to convince the projects and governments to directly link buyers and sellers.

SAH or any other technology needs wider implementation and awareness to be able to reduce unit costs (which stand now at about $0.10/plantlet) through economies of scale and to enhance its adoption. IITA's wider reach has facilitated adoption of SAH in yam, and it is being implemented in other countries through other projects like TAAT. This portends well for the technology adoption. CGD has developed tools for seed unit production forecasting and operational budgeting. Both are undergoing continued refinement in order to plan future seed flows and track operational costs to drive to better understanding of unit economics.

C3.2 VSE component

Community-based seed entrepreneurs can hope to survive only in two situations: (1) if the small seed entrepreneurs coalesce and enjoy the benefits of scale through collaboration or (2) they develop economies of scale in their own operations though larger acreages. BASICS is working on both these angles.

To enhance small seed entrepreneurs, coalesce through collaboration, CRS continued to provide capacity strengthening to the leaders and members of the VSE network. The leaders participated in training on Markets and Rural Transformation (SMART Skills), a CRS training program covering farmer group organization, financial education, and marketing basics (Annex 20). The post-test results of the trainings revealed that about 60% of the participants showed improved knowledge of the seed system. They also participated in training on use of the CST provided to the implementing-partner field officers. The other members benefited from the step-down trainings conducted by them with support by the network

leaders. Furthermore, CRS facilitated the self-review and adoption of the constitution of the union by members of the network. At their first congress meeting new executives were elected to run the network's activities for the next 2 years, reflecting skills learned in the SMART training. The meeting was attended by 99 (26 women) VSEs. The new executive is comprising two women and 7 men. The network's capacity was also assessed during the year; findings are being incorporated into activities with the aim of further strengthening the network in the new year. CRS facilitated the setting up of an office and engaging an office manager to improve how the network runs its activities in the state. This type of cassava stem farmer organization is novel and is slowly taking root, with the backstopping provided by BASICS.

For economies of scale for individual seed producers, BASICS will be looking to incorporate mid-sized seed entrepreneurs into the project going forward. For this an expert consultant in 2019 will study the mid-sized producers involved in the informal seed market and how to bring them into the formal seed system.

C3.3 PLM component

The underlying premise of a PLM is that a processor has commercial interest in developing an outgrower model; provide appropriate planting material in a sustainable manner; and agronomically backstop them to ensure a reliable, steady, staggered, and appropriately priced supply of quality roots for processing. Apart from a financial case for the processor to engage in an outgrower model, the processor has to develop capacities in multiplying the required quantities of the FS and CS, either in-house or in partnership with seed entrepreneurs. Initiatives in all these areas have been ongoing and are still a work in progress.

CGD, in collaboration with Sahel, has conducted outgrower research with the three processor partners (Psaltry, Eagleson, and Shao Farms) to understand both the dynamics of the existing outgrower schemes and the ways of improving the existing structure and building a sustainable outgrower model that could be replicated. Sahel conducted interviews with the management teams at the processors, met with lead farmers to discuss the benefits and tradeoffs of the outgrower models, and hosted FGDs with some of the outgrowers in each production area (Fig. 7). The survey guide for the outgrower research covered four primary areas: farmers' demographics, service structure, terms and contracts, and contribution dynamics. (The detailed reports from these studies are provided as Annexes 21 and 22.)

Figure 7. Eagleson outgrower farmers after the FGDs in Iseyin.

In the Eagleson model, the 150 farmers under the scheme participate in a government program through Eagleson to incentivize production of cassava and reduce risk through a tripartite input risk-sharing model (see Fig. 8).

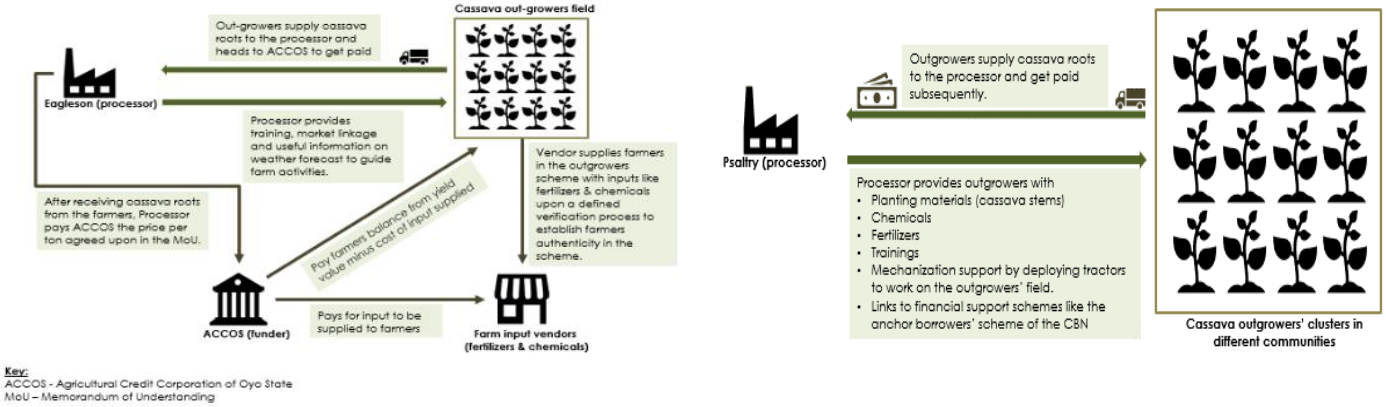

Figure 8. The tripartite input risk-sharing model.

In the Psaltry model, the 1,390 farmers (Fig. 9) under the scheme grow cassava on their individual farms, which are established within an approximately 80-km radius from Psaltry's processing facility. Psaltry provides inputs like fertilizers, chemicals, funds for weeding, and mechanization support to its outgrowers. Psaltry also helps train farmers within its outgrowers scheme to enhance performance through exposure to best farming practices in cassava production.

Figure 9. Psaltry outgrower farmers after the FGDs in Iseyin.

Shao Farms conducted a pilot outgrower scheme in 2017/2018 comprising 40 farmers. Shao provided input and finance to support farmers and removed the produce at the end of the planting season at an agreed price prior to field establishment.

The three processors under the PLM use different outgrower models, which need to work well both for the processor and for the outgrowers. The further analysis of the strengths and weaknesses in each of these models will be important to support the building of the Nigerian cassava seed system.

In 2019 CGD will continue to build relationships with potential outgrower and/or contract farmers (via harvest promo days and demo plots) and work to develop outgrower models for future contract growing and supplying stems to the three processor partners.

Another important behavior change in the processing arena being promoted by CGD is a move toward thinking in terms of starch yield per hectare as opposed to root yield per hectare. This helps both the farmers and the processors as the price of roots is determined by the starch content.

C3.4 Quality seed component

Information asymmetry and high transaction costs are major gaps in the seed system. Potential buyers and sellers do not know how to reach each other. There is a lack of information on the market needs in terms of variety, quantity, time, location, and price. The CST addresses many of these gaps in the seed system and is bringing together the farmers, seed producers and the quality regulators for ease of doing business.

The piloting of Seed Tracker (ST) for cassava seed systems use as the CST in the BASICS project has provided good exposure and momentum for the ST. Costs and licenses for customizing other project uses are covered by the respective projects. These projects are briefly described below:

- ST was adopted for the BEST cassava seed system project use in Tanzania, including piloting of e-cassava certification using ST by the Tanzania Official Seed Certification Institute.
- ST was adopted for mapping and promoting cassava-peel entrepreneurs of a ‘waste to wealth’ project, funded by the CGIAR Research Program on Roots, Tubers and Bananas (RTB), using cassava peels in Nigeria. The ST was adopted as ‘Cassava Peel Tracker.’
- EMBRAPA expressed interest in adopting ST for managing cassava seed systems in Brazil, an expression of interest in that regard was communicated to IITA, and the ST team was invited to Brazil for discussion to develop “Reniva Tracker,” EMBRAPA and IITA teams are working to develop a work plan and memorandum of agreement for starting this work, mostly likely in April 2019.
- The AfDB-funded TAAT Cassava Compact project expressed interest in adopting ST as a ‘TAAT Cassava Tracker’ platform for promoting community entrepreneurs involved in preparation of gari, chips, flour, stem production, and other cassava products. This project will cover three countries in 2019 and eventually all the cassava compact countries of TAAT. This work is expected to begin in April 2019.
- ST adopted for ‘IITA GoSeed’ inventory tracking and seed production management system. The prototype is under validation by the IITA GoSeed.
- Other potential projects in view include adoption of ST for CIP-managed sweetpotato and potato.
- The ST team is also working to integrate ‘Nuru,’ an artificial intelligence-based cassava virus disease recognition app developed by Penn State University and IITA. The integration will result in highlighting cassava seed fields to the Nuru app users to identify seed sellers close to their location. Similarly, ST users can benefit from the Nuru diagnostic app.

All these innovations based on ST demonstrate the flexibility of the program to fit various needs of the users. A

remarkable event for the CST was its recognition as one of the 12 winners of the Google Impact Challenge Award, for which each winner received a $125,000 award.

C3.5 PMU

The PMU has actively supported institutional changes, enhanced human capacities, developed and promoted partnerships, brought together stakeholders, and encourage the integration between different classes of seed producers. Thus, the PMU helps in variety production planning and variety replacement outcomes. PMU has also been working closely with NASC and the federal Ministry of Agriculture for advocating enabling policies for vegetatively propagated crops like cassava. The PMU has also contacted the Alliance for a Green Revolution in Africa to explore synergies for working to bring about national-level policy support.

The PMU has actively promoted cross-project collaboration with the African Cassava Agronomy Initiative, the Cassava Weed Management Project, and other mission-aligned projects. A partnership it supported between NRCRI and the Market Development in Niger Delta (MADE) project, funded by the Department for International Development, has resulted in more than 500 new VSEs established by MADE. This partnership was initiated by meetings between the PMU and the MADE project to discuss how to improve productivity in cassava-processing value chains. MADE appreciated the value of the VSE model to support the farmers and processors involved in its project. MADE thus entered into an agreement with NRCRI to help them establish a VSE model. MADE organized the identification and training of VSEs (groups of 15–20) through so-called 'Master VSEs,' via commercial relationships. BASICS is following up on how these VSEs are performing; it will explore cross-learning with its own VSEs.

SECTION D: PLANNED WORK FOR THE NEXT PERIOD (2019)

VSE COMPONENT

- Training/capacity strengthening of VSE network and strengthening linkages with agro-dealers
- Awareness creation and promotion among farmers in Benue State
- Training of VSEs and monitoring of establishment of new VSE fields
- Engagement and training of new mid-sized cassava seed entrepreneurs
- Collaboration with NASC for certification of VSEs fields including testing of third-party certification
- Establishment and management of demo plots and analysis of results from past demos

PLM COMPONENT

- Finalize the establishment of the SAH labs at Eagleson and Psaltry
- Train technicians and ensure full operation of the labs
- Target of producing 500,000 SAH plantlets by end of 2019
- Harvest the 4.5 ratooned nursery stems that was planted with IITA source materials (~1,000–1,500 bundles, estimated volume able to plant 15–25 ha of CS) for replanting on-farm or with multipliers/outgrowers and harvest of the 26 ha of CS fields for replanting on-farm or sell to multipliers/outgrowers (estimated to produce stems for 100–120 ha of commercial area)
- Formalize approach for outgrower schemes with the processor partners, coordinate the outgrower groups, and conduct training sessions with the farmers
- Arrange Harvest Demo Days at processor partners for DCTs planted in 2018

QUALITY SEED COMPONENT

- CMD LAMP diagnostics and field prevalence assessment
    a. Produce peer-reviewed paper on the development and validation of the CMD virus LAMP assay
    b. Complete the CMD virus testing of 2018 field samples (~800) by LAMP and real-time polymerase chain reaction methods; analyze data, alongside data of 2017 and write up findings for peer-review publication
- BS
    a. Support NASC as required in the testing of BS for CMD, including demonstration of test proficiency
    b. Support NASC with the consultation and drafting of the BS standard

- Third-party certification
    a. Support the development of curriculum and training material for third-party inspectors

PMU

- Compile study with a consultant (Jeff Bentley) to identify mid-sized informal seed entrepreneurs and develop a strategy to incorporate them into the formal seed system, while helping improve their business.
- Support operationalization of Umudike Seeds.
- Compile data on seed sales and develop production projections for all seed types for the most demanded varieties, for specific users.
- Further study the seed markets in Nigeria to explore how the learnings in BASICS can leverage with the public and private sector players to create more scalable and sustainable models across the seed value chain.
- Pro-actively advocate for low-touch, third-party certification.
- Plan and organize the annual review and planning meeting 2019.
- Develop an idea note, develop it into a full proposal, and submit it to the donor for funding support for a second phase.
- Continue to manage the project and include the monitoring and evaluation and seed flow coordination.

2. Project Adjustments

For each outcome or output that is behind schedule or under target, explain what adjustments you are making to get back on track.

BS component: So far, none of the outputs or outcomes for 2018 is behind schedule; rather most are beyond target.

VSE component: See table below.

Outcome/Output	Indicator	Target	Actual	Status	Proposed adjustment(s)
Output 10.1.1: Farmers understand the cassava varieties most suitable for the market demanded products	# of awareness creation activities (disaggregated by type)	• 4 market day promos in each of 18 LGAs • Production and erection of 100 banners/sign boards • Functional website (CRS)	• Market day promotions were held in 51 locations across 17 LGAs in the state. • 115 radio spots were aired on 3 radio stations covering the state and neighboring states. • The 30 banners produced have been installed. • The website (www.cassavastems.com) is still active.	Under target	The project team has planned to increase the reach to locations yet to be covered in some LGAs in 2019.
Output 10.1.2: Farmers are aware of VSEs and the varieties promoted by the VSEs	Changes in farmers' knowledge about and attitude toward varieties promoted	10% over Year 1	Data from 2017 survey indicated that 68% of sampled farmers know about at least one of the improved varieties promoted.	Behind schedule	Data for 2018 are being collected and would be available in early 2019

PLM component:

- **Signing partnership agreement with two additional processors**. The initial agreement was to sign a partnership agreement with one additional processor in 2018, but CGD signed two additional processors (Eagleson and Psaltry) after several rounds of vetting. As a result, the provision of the licensing fees for the operationalization of the SAH lab for an additional processor was borne by CGD, since the project only covered the licensing fee for two processors.
- **Funding constraints of the two additional processors.** CGD supported Eagleson by developing a business plan to support their donor-funding request from GrowAfrica (Annex 7). Eagleson was eventually awarded the grant but owing to internal roadblocks with the GrowAfrica funding structure, the funds have yet to be disbursed. CGD is providing matching funds for the establishment costs of the SAH lab at Eagleson, with milestone provisions to operationalize the lab in the first half of 2019.

  Psaltry had initially planned on internally funding the establishment of their lab and nursery. However, with several unrelated operational challenges and need to expand their facilities, Psaltry required external funding. CGD and Sahel

have worked with Psaltry to support their grant proposal. Currently, they are in the last stages of vetting; we hope it will be awarded by Q1 2019.

The establishment of the SAH labs at both processor facilities has now been pushed to 2019.

- **Harvest of 4.5 ha FS2 and 26 ha of CS1 production at Shao Farms.** In 2017, 4.5 ha of FS2 stems planted with IITA source material and 26 ha of CS1 production established with bundles received from the 2017 ratooned IITA-source nursery were established at Shao Farms. The stems harvested from the 4.5 ha of FS2 is estimated to be able to plant 15–25 ha for commercial replanting on-farm or with multipliers/outgrowers. The 26 ha was expected to yield enough stems for replanting 100–120 ha of CS2. These plots were, however, not harvested because of transitions in Shao management and the onboarding of new staff in positions that oversee harvesting activities. CGD is working with them for harvesting stems to be used in the coming planting season. When they harvest for roots, CGD will capture the data, which will be added to other data collected over the years to refine a list of preferred varieties for both farmers and the processors in their respective locations.
- **Coordinating Harvest Demo Days following the 2017 DCT harvest.** Attendance of farmers at the Harvest Demo Days was not coordinated for the 2017 DCT harvest, since the varieties harvested in the DCT are the same as the 2016 DCT (which also had a Harvest Demo Day). Additional coordination of DCT harvest timing with IITA is also required to be able to conduct harvest showcases. The 2018 DCT harvest saw a significant difference in the varieties and planting materials used. Shao did a four-source testing of planting material (conventional stems, SAH stems, SAH plantlets, and farmer landrace). Whereas at Eagleson and Psaltry there was a two-source testing of planting material (conventional stems and SAH stems). This would provide a basis for comparison for the farmers, whereas CGD ensures Harvest Demo Days are held around these harvests to get farmer buy-in and acceptance of improved varieties and SAH stems.
- **Conduct on-site training with pilot multipliers for their trial plots of foundation planting material from the nursery (or SAH plantlets from the lab).** The site training for pilot multipliers has not been done yet due to the transition of FMN management. The focus is on restructuring its outgrower schemes into two channels: stem multipliers and contracted root producers. We expect that stem multipliers will be located closer to Shao Farms, and root producers are organized around the Thai Farms's processing facility. CGD has been in frequent communication with the Thai Farms factory manager and expects to be involved in outgrower operations in 2019 as a result. Once the scheme approach has been formalized by management, the process of training their chosen multipliers would take effect.

Quality seed component

During 2018 some activities did not advance such that a greater focus could be given to establishing the specification and capability to implement a BS certification standard (i.e., documenting the evidence base and innovation for a BS standard as a recommendation to NASC and to develop the capability for CMD testing at NASC).

Activities that were not developed include:

- **Activity 1.1.2: Three NASC staff to visit Fera for 2 weeks.** The merits of progressing this activity became unclear with the low level of traction for the third-party seed certification. The visit was seen as an opportunity to develop some of the third-party protocols and curriculum. NASC has a significant reaming budget and it is their choice whether they wish to make a training visit to Fera in 2019. This activity would need to be fully costed and is currently not budgeted for by Fera in 2019.
- **Activity 1.1.3: Cultivar diagnostic test.** Although this capability is seen as important in determining the levels of off-types in a field, it remains a lower priority. It is also seen as technically challenging. A linkage to the NextGen Cassava project could present a better path for this innovation.
- **Activity 1.2.2: Use of third-party seed certification services.** A very productive workshop between Fera, NASC, NRCRI, and CRS was held mid-year that substantially set the ground for a pilot of the third-party scheme. But ultimately this activity has not advanced to the extent of any on-the-ground activity. The responsibility for writing up and publicizing the workshop's findings has yet to be completed by Fera (Julian Smith). The delay in a prompt follow-up on the workshop has contributed to the lack of traction with partners; however, there seems to not be a strong pull for third-party services from the VSE leads.

  Now with major gains made on the BS standard, the pilot of a third-party certification service is rescheduled for 2019. In observing the VSE ground-level activity that this activity requires, it is evident that Fera is limited in the extent it can be hands-on with this activity and will need strong cooperation from NASC, NRCRI, and CRS. The mechanism for this

collective buy-in needs to be agreed with the PMU.

3. Geographic Areas to Be Served

Provide the most updated list of countries and sub-regions/states that have benefitted or will benefit from this work and associated dollar amounts. If areas to be served include the United States, indicate city and state. Reflect both spent and unspent funds. Add more rows as needed. More information about Geographic Areas to Be Served can be found here.

Location	Foundation Funding ($)
Nigeria: districts of Oyo, Ogun, Osun, Kwara, Abuja, Cross Rivers, Akwa Ibom, Imo, Abia, Benue, Anambra, Niger, and Eketi	4,172,128

4. Geographic Location of Work

Provide the most updated list of countries and sub-regions/states where this work has been or will be performed and associated dollar amounts. If location of work includes the United States, indicate city and state. Reflect both spent and unspent funds. Add more rows as needed. More information about Geographic Location of Work can be found here.

Location	Foundation Funding ($)
Nigeria	3,892,615
UK	279,513
Total	**4,172,128**

5. Feedback for the Foundation

Provide one to three ways the foundation has successfully enabled your work so far. Provide one to three ways the foundation can improve.

Extensive engagement and encouragement by BMGF on the establishment of EGS were helpful in making IITA GoSeed and Umudike Seeds a reality. Flexibility by BMGF in allowing for project savings to be reallocated has allowed us to hire a good consultant to help in GoSeed business planning and for the PMU to buy a car that is helping in field visits.

6. Global Access and Intellectual Property

If your funding agreement is subject to Intellectual Property Reporting, please click the following link to complete an Intellectual Property (IP) Report.

If not, please acknowledge by typing "N/A": _____

To delegate permissions to another member of your project team or for any questions regarding the Intellectual Property Report, please contact GlobalAccess@gatesfoundation.org.

7. Regulated Activities

Do you represent that all Regulated Activities[1] related to your project are in compliance with all applicable safety, regulatory, ethical and legal requirements? Please mark with an "X":

___x___ N/A (no Regulated Activities in project)

_____ Yes

_____ No (if no, please explain below)

Are any new Regulated Activities[1] planned which were not described in any documents previously submitted to the foundation? Please mark with an "X":

__x____ No

_____ Yes (if yes, please explain below)

1 Regulated Activities include but are not limited to: clinical trials; research involving human subjects; provision of diagnostic, prophylactic, medical or health services; experimental medicine; the use of human tissue, animals, radioactive isotopes, pathogenic organisms, genetically modified organisms, recombinant nucleic acids, Select Agents or Toxins (www.selectagents.gov), Dual Use technology (http://export.gov/regulation/eg_main_018229.asp), or any substance, organism, or material that is toxic or hazardous; as well as the approvals, records, data, specimens, and materials related to any of the forgoing.

8. Subgrants

If your grant agreement (not applicable to contracts) is subject to expenditure responsibility and permits you to make subgrants to organizations that are not U.S. public charities or government agencies/instrumentalities, please complete the Subgrantee Checklist and attach a copy with this progress narrative for each such subgrantee.

Financial Update

The purpose of the Financial Update section is to supplement the information provided in the "Financial Summary & Reporting" sheet in the foundation budget template, which reports actual expenditures and projections for the remaining periods of the grant. This section is a tool to help foundation staff fully understand the financial expenditures across the life of the project. Together, the Financial Update section and budget template ("Financial Summary & Reporting" sheet) should provide a complete quantitative and qualitative explanation of variances to approved budget.

Note: If you are using an older version of the budget template, this information could be in a different location in your template.

1. Summary

Briefly describe how total project spending to date compares against the budget and how your assumptions may have changed as the project progressed.

The cumulative project expenditure at the end of Y3 stands at $7,006,850, which is 60% of the full project budget. The project recorded a total expenditure of $3,209,954 in Y3, including indirect costs with an overall burn rate of 77% (see table below).

Organization	Budget Year 3(US$)	Actual Expenditure (US$)	Balance (US$)	Burn Rate (%)
IITA	1,422,688	939,210	483,478	66
CRS	975,786	737,329	238,457	76
FERA	279,513	315,015	(35,502)	113
CONTEXT	556,890	408,098	148,792	73
PMU-RTB	514,459	445,161	69,298	87
Subtotal	**3,749,336**	**2,844,813**	**904,523**	**76**
Indirect costs	422,792	365,141	57,651	86
Grand total	**4,172,128**	**3,209,954**	**962,174**	**77**

The total carry-over from Y3 is $962,174. This amount has been reallocated to Y4 and the Y5 no-cost extension (NCE) period. During the third annual review and planning meeting scheduled for March 2019, the work plans for Y4 and the Y5 NCE period will be discussed and agreed. The NCE is intended to allow for considering the assessments from the cassava seed production fields planted in 2019 that will be ready for harvesting.

In general, most of the field activities scheduled in 2018 were carried out as planned. The setup of the molecular laboratory that was carried over from Y2 was completed this year at NASC in Abuja, where the federal minister of agriculture commissioned it in a widely publicized event.

IITA: BS component. The cumulative expenditure in the BS component in the first three years of the project stands at $1,736,685 (78% of the budgeted amount) (see table below):

Total Budget ($) Y1–Y3	Total Expenses ($) Y1–Y3	Balance ($)	Burn Rate (%)
2,220,163	**1,736,685**	**483,478**	**78**

The burn rate for Y3 implementation stands at 66%, with a total expenditure of $939,210, including indirect costs (see table below).

Category	Approved Budget Y3 ($)	Expenditures Y3($)	Balance ($)	Burn Rate (%)
Personnel	194,126	147,222	46,904	76
Travel	24,955	25,144	(189)	101
Consultants	100,000	39,847	60,153	40
Equipment	91,132	-	91,132	-
Other Direct Costs	216,194	298,929	(82,735)	138
Sub Awards	674,130	330,285	343,845	49
Subtotal	**1,300,537**	**841,427**	**459,110**	**65**
Indirect Cost	122,151	**97,783**	24,368	**80**
Grand Total	**1,422,688**	**939,210**	**483,478**	**66**

The expenditure is lower than the Y3 budget largely due to delays in procuring two project vehicles. This is partly due to a policy change in Nigeria that actively discourage vehicle imports and challenges in allocating funds to NRCRI on account of delays in reporting and contracting, leading to lower sub-grant disbursement.

- **Personnel**: This budget line was underspent by 24% mainly because the seed system manager was upgraded to an internationally recruited staff (IRS) some months into the year under review (although her salary as an IRS was budgeted for the full year). Additionally, one of the field staff was absorbed by GoSeed as their in-kind contribution whereas the staff member was budgeted for the project the whole year. The exchange rate stabilized at around 360 Naira to a dollar as against just less than 200 Naira to a dollar at the time the project was approved. This means that the Naira-denominated national staff salaries continue to provide savings in dollar terms.
- **Travel**: Travels were conducted as planned due to the scaling up of travel-related activities visiting locations where the trials are sited in Nigeria.
- **Consultants:** Sahel was hired as a consultant to help with GoSeed business planning, but only 40% of the fees for this year were paid because the contract was awarded later in the year under review. The remaining amount has been carried over into the next year for payment.
- **Capital Equipment**: We have yet to implement this budget. Processes to purchase a 14-t cargo vehicle to cart cassava stems started in the year under review through IITA's supply chain unit. But this has been slow due to the challenges experienced in importing vehicles. We plan to conclude the purchase in Q1 of 2019.
- **Other Direct Costs**: Execution rate for this line is 138%. In the year under review, there were increased activities in relation to DCTs and field establishment and maintenance of SAH materials beyond IITA's campus. In addition, we had deployed the CST as well as promoted SAH technology and operations at different fora. These increased activities resulted in the over-expenditure in this category.
- **Sub-awards**: The burn rate is at 49%, mainly due to delays in reporting and contracting between NRCRI and IITA.

CRS: VSE component. The cumulative burn rate for the first three years is at 87% with a total expenditure of $1,582,172 (see table below).

Total Budget ($) Y1–Y3	Total Expenses ($) Y1–Y3	Balance ($)	Burn Rate (%)
1,820,630	**1,582,172**	**238,458**	**87**

The burn rate in 2017 for CRS is 76%, with an expenditure level of 737,329 against a budget of 975,786 (see table below).

Category	Approved Budget ($)	Expenditures Y3 ($)	Balance ($)	Burn Rate (%)
Personnel	290,936	248,986	41,950	86
Travel	65,598	60,795	4,803	93
Consultants	9,061	-	9,061	0
Equipment	-	-	-	0
Other Direct Costs	149,205	54,528	94,677	37
Sub Awards	332,500	246,922	85,578	74
Subtotal	**847,300**	**611,232**	**236,068**	**72**
Indirect Cost	128,486	126,097	2,389	98
Total	**975,786.00**	**737,328.67**	**238,457.33**	**76**

We have a burn rate variance of 24% due to the following reasons:

- **Personnel:** The burn rate is at 86%. This was due to the continued high exchange rate of Naira to the dollar and the fact that CRS pays local staff in Naira.
- **Consultants:** The planned consultancy services started late in the year. The expenditure will be reflected in the 2019 financial reporting.
- **Other Direct Costs:** This budget line had a low burn rate of 37%. The major activities pending under this line include those to be undertaken for the VSE network and achievement of other project outputs such as continuing awareness creation activities and replacement of billboards.
- **Sub-awards:** Execution rate was 74%. The underspending was largely due to the consistent high exchange rate and the fact that CRS partner budgets are denominated in Naira. All planned project activities were fully implemented. The carry-over is included in the projections for Y4 and the Y5 NCE period.

Context: PLM component. The overall execution rate for the three years is at 90%, with a total expenditure level of $1,199,307 (see table below).

Total Budget ($) Y1–Y3	Total Expenses ($) Y1–Y3	Balance ($)	Burn Rate (%)
1,329,436	**1,199,307**	**130,129**	**90**

The implementation rate for Y3 is 77%, with an expenditure level of $426,761 against a budget of $556,890 (see table below).

Category	Approved Budget ($)	Expenditures Y3 ($)	Balance ($)	Burn Rate (%)
Personnel	89,217	79,682	9,535	89
Travel	60,784	43,886	16,898	72
Consultants	318,528	218,208	100,320	69
Equipment	-	-	-	0
Other Direct Costs	16,468	13,092	3,376	79
Sub Awards	-	-	-	0
Subtotal	**484,997**	**354,868**	**130,129**	**73**
Indirect Cost	71,893	71,893	71,893	100
Total	**556,890**	**426,761**	**202,022**	**77**

The implementation rate variance of 23% was due to the following reasons:

- **Personnel:** The execution rate was 89%. The variance was mainly because of a 5-month sabbatical (unpaid) leave for Will Rogers, CGD program manager for BASICS, starting on 1 November 2018–31 March 2019. These costs were budgeted in the project for a whole year. The reserve fund on this line item will be needed to support personnel cost in Y4 and the Y5 NCE period.
- **Travel:** The rate stood at 72%. The variance under this budget line is attributed to the final payment on CGD's 2018 H2 subcontract with Sahel, which was done after the November 30th close of 2018 program budgets.
- **Consultants:** This budget line is at a burn rate of 69%. Like travel-related activities, actual consultant costs are below budget, in large part due to the final payment on CGD's 2018 H2 subcontract with Sahel occurring after the November 30th close of 2018 program budgets.
- **Other direct costs:** The burn rate is at 79%. The variance is due to the decision that was made to split the second and third processor licensing fees over Y3 and Y4; therefore only part of the licensing fee was paid in the year under review.

FERA: Quality seed component. The overall expenditure burn rate for three years stands at 106% with an overall expenditure level of $ 596,192 as indicated in the following table.

Total Budget ($) Y1–Y3	Total Expenses ($) Y1–Y3	Balance ($)	Burn Rate (%)
560,689	**596,192**	**152,563**	106

The burn rate for Y3 stands at 113%, mainly due to over-expenditures in personnel and travel-related budget lines (see table below).

Category	Approved Budget ($)	Expenditures Y3 ($)	Balance ($)	Burn Rate (%)
Personnel	63,738	90,516	(26,778)	142
Travel	14,872	30,354	(15,482)	204
Consultants	-	-	-	0
Equipment	100,000	105,241	(5,241)	105
Other Direct Costs	100,902	88,904	11,998	88
Sub Awards	-	-	-	0
Subtotal	**279,512**	**315,015**	**(35,503)**	**113**
Indirect Cost	-	-	-	0%
Total	**279,512**	**315,015**	**35,503**	**113**

- **Personnel and Travel budget**: The execution rates were 142% and 204%, respectively. These over-expenditures were attributed to the intensity of the activities required to bring the NASC molecular facility into operation. Additional resources in relation to establishing laboratory were acquired. Julian Smith also had to attend the laboratory opening, which was unplanned (though his attendance was critical).
- **Capital equipment expenditure for the laboratory**. The burn rate for this line is at 105%. The variance was due to a higher setup and shipping costs, which were not anticipated at the time of budgeting.
- **Other direct cost**: The execution rate is 88%. The variance is due to shifting of the third-party seed certification activity to 2019.

PMU: The total burn rate is 87%, with a variance of 13% in Y3 (see table below).

Category	Approved Budget ($)	Expenditures Y3 ($)	Balance ($)	Burn Rate (%)
Personnel	279,889	251,926	27,963	90
Travel	40,000	40,198	(198)	100
Consultants	35,000	15,134	19,866	43
Equipment	38,000	46,816	(8,816)	123
Other Direct Costs	121,570	91,088	30,482	75
Subtotal	**514,459**	**445,162**	**69,297**	**87**

The variance is as a result of the following explanations:

- **Personnel:** The execution rate is 90%. The variance under this line is due to exchange rate differences between Naira to the dollar for two staff (project accountant and M&E officer) who receive their salaries in Naira (NRS staff).
- **Consultants:** The execution rate is 43%, as some of costs were incurred later in the year and will be reflected in the 2019 reporting.
- **Equipment:** Execution rate is 123%. The variance was due to the unexpected demurrage costs incurred due to the holdup of just over 1 year of the project car at the Nigerian port due to some policy issues.

The proposed forecast for Y4 and Y5. The overall carry-over from Y3 has been distributed in Y4 and in the Y5 NCE period as per the proposed budget shown in the table below.

Category	Y1 Executed ($)	Y2 Executed ($)	Y3 Executed ($)	Y4 Forecast ($)	Year 5 NCE ($)	Total ($)
Personnel	138,929	297,930	251,926	307,878	137,500	1,134,163
Travel	8,796	48,994	40,198	60,000	30,000	187,988
Consultant	13,475	28,784	15,134	40,000	20,000	117,393
Equipment	-	-	46,816	-	-	46,816
Other Direct Costs	18,020	120,024	91,088	125,000	66,875	421,007
Sub Awards	973,915	1,722,127	2,399,652	2,492,774	844,083	8,432,551
Subtotal	**1,153,135**	**2,217,859**	**2,844,813**	**3,025,652**	**1,098,458**	**10,339,918**
Indirect Cost	136,090	289,812	365,141	335,561	145,471	1,272,075
Total	**1,289,225**	**2,507,671**	**3,209,954**	**2,918,371**	**1,243,929**	**11,611,993**

The main considerations for this proposal are:

- **Personnel Cost**: The budget forecast for Y4 was maintained as earlier planned.
- **Travel line** has been increased to $60,000. Several monitoring activities are envisaged to increase in Y4 for this period, which will be toward the end of the project with the balance moved to the possible Y5 NCE period.
- **Consultant:** We maintained the forecast for Y4 and projected $20,000 to the possible Y5 NCE period.
- **Other Direct Cost**: We have increased this line item from the initial figure of $98,524 in Y4 to a forecast of $125,000 and moved the balance of carry-over in the Y5 NCE period.
- **Sub-awards**: A large amount of carry-over has been reallocated to subaward budget line item for Y4 and a Y5 NCE period.

2. Latest Period Variance

Provide explanation for any cost category variances outside the allowable range. Explain causes, consequences for the project, and mitigation plans if relevant. Report whether or not approval for the variance has been obtained from your Program Officer.

Note: "Latest period variance" compares actuals to previous projections for the period. See "Financial Summary & Reporting" sheet in the foundation budget template for calculated variance. If you are using an older version of the budget template, this information could be in a different location in your template. Allowable variance is defined in your grant agreement.

The significant variances are explained below:

IITA: BSC. There was significant overspending in other direct cost budget line with execution rate of 138% due to increased activities in relation to DCTs, field establishment, and maintenance of SAH materials beyond the IITA campus. There were also increased activities to the deployment of CST and the promotion of SAH technology and operations at different fora. The budget limit, even with this over expenditure, is still within the approved budget with a carry-over reallocated to Y4.

CRS: VSE component. CRS recorded a very low burn rate of 37% in the line item of other direct cost. The major activities pending under this line item includes the ones to be undertaken for the VSE network and achievement of other project output such as continuous awareness creation activities and replacement of billboards. The balance has been reallocated to Y4.

Context: PLM component. This component performed generally well with an overall variance of 23%, which was attributed to low expenditure under travel and consultant due to the final payment on CGD's 2018 H2 subcontract with Sahel occurring after the November 30th close of the 2018 program budget. The balance has been carried forward to the next period.

FERA: QSC. Personnel, Travel and Equipment budget lines execution rate were beyond the required limit by 42%, 104%, and 5%, respectively. The variance was attributed to the intensity of the activities required to bring the NASC molecular facility into operation in the case of personnel and travel. The equipment budget slightly increased as a result of a higher setup and shipping cost, which were not anticipated at the time of budgeting. Though these budget lines were exceeded, the actuals were still within the acceptable budget limit for the year.

PMU. The variance was mainly due to the demurrage costs for the project car that was imported and was held up at the Nigerian port due some policy change. This resulted in an overrun of 23% over the budgeted equipment costs. The overall expenditure across the project is still within the budget, and the savings are carried over to Y4 and Y5.

3. Total Grant Variance

Provide explanation for any cost category variances outside the allowable range. Explain causes, consequences for the project, and mitigation plans if relevant. Report whether or not approval for the variance has been obtained from your Program Officer.

Note: "Total grant variance" compares actuals plus current projections to the budget. See "Financial Summary & Reporting" sheet in the foundation budget template for calculated variance. If you are using an older version of the budget template, this information could be in a different location in your template. Allowable variance is defined in your grant agreement.

N/A

4. Sub-awards (if applicable)

Use the chart to provide the name(s) of the sub-grantee(s) or subcontractor(s), actual disbursement for this reporting period, total disbursement to date from the primary grantee to sub-awardee, total spend to date by the sub-awardee and total contracted amount.

Note: The total of actual disbursements for this reporting period should equal the actual Sub-awards expenses reported on the "Financial Summary & Reporting" sheet in the foundation template for this reporting period. If you are using an older version of the budget template, this information could be in a different location in your template.

Organization	Actual Disbursement for This Reporting Period ($)	Total Disbursed from Primary Awardee to Sub to Date ($)	Total Sub-Awardee Spent to Date ($)	Total Contracted Amount ($)
IITA	1,046,257	2,075,049	1,736,685	3,251,360
CRS	654,646	1,620,630	1,582,173	2,708,030
Fera Science Ltd	219,424	505,831	596,192	690,000
Context	429,821	1,216,057	1,199,307	1,799,308
Total	**2,350,148**	**5,417,567**	**5,095,695**	**8,554,097**

5. Other Sources of Support (if applicable)

List and describe any sources of *in-kind* project support or resources received in the reporting period.

Note: Names of the other sources of funding and their contributions (U.S.$) should be included in the budget template on the "Financial Summary & Reporting" sheet in the foundation budget template in the Funding Plan table. If you are using an older version of the budget template, this information could be in a different location in your template.

N/A

Describe how interest earned and/or currency gains were used to support the project.

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For Foundation Staff to Complete

Analysis (required if contingent payment or PO assessment differs from grantee/vendor assessment)

Progress Analysis

Include analysis of significant project variances and key learnings that may inform portfolio discussions for progress against the strategic goals.

Budget and Financial Analysis

Include analysis of unexpended funds or over expenditures. Refer to the Unexpended Grant Funds Policy for options available when recommending how to handle unexpended grant funds, or reach out to your primary contact in GCM.

Scheduled Payment Amount	$
Carryover Amount	$
Recommended Payment Amount	$

Approver Comments (if applicable)

Name	Title	Date Approved

Comments