# Seed Systems Assessment Tool

*Country Assessment Results - Nigeria*

Submitted by DAI Global, LLC

20 April 2021

Don Humpal and Melanie Bittle and with contributions from:
New Markets Lab, Agri Experience, Dr. Yilma Kebede, and Context Global Development

DAI
Shaping a more livable world.

# Contents

# Acronyms and Abbreviations

| | |
|---|---|
| A2Si | The Access to Seed Index |
| AATF | African Agricultural Technology Foundation |
| ABP | Anchor Borrowers' Programme |
| AIMS | Agricultural Inputs and Machinery Services |
| ADP | Agricultural Development Project |
| AECF | Africa Enterprise Challenge Fund |
| AGRA | Alliance for Green Revolution |
| APP | Agriculture Promotion Policy 2015-2020 |
| ARCN | Agricultural Research Council of Nigeria |
| AVISA | Accelerated Varietal Improvement and Seed System Delivery in Africa |
| BASICS | Building a Sustainable, Integrated Seed System for Cassava in Nigeria |
| BMGF | Bill and Melinda Gated Foundation |
| BPAT | Breeding Program Assessment Tool |
| CAGR | compound annual growth rate |
| CBN | Central Bank of Nigeria |
| CG | Consultative Group on International Agricultural Research |
| CGIAR | Consultative Group on International Agricultural Research |
| CIMMYT | International Maize and Wheat Improvement Center |
| COSEM-Riz | Consortium of Rice Seed Enterprises and Millers |
| CP&D | commercial seed production and distribution |
| ED | Executive Director |
| DIIVA | Diffusion and Impact of Improved Varieties in Africa |
| DUS | distinctness, uniformity, and stability |
| EBA | World Bank's Enabling the Business of Agriculture |
| ECOWAS | Economic Community for West African State |
| EGS | early generation seed production |
| EiB | Excellence in Breeding Program |
| FAO | Food and Agriculture Organization of the United Nations |
| FAOSTAT | Food and Agriculture Organization of the United Nations Statistics |
| FMARD | Federal Ministry of Agriculture and Rural Development |
| GES | Growth Enhancement Support program |

| | |
|---|---|
| GDP | gross domestic product |
| ha | hectares |
| IAR | Institute for Agricultural Research |
| IAR&T | Institute of Agricultural Research and Training |
| ICT | Information, communication technology |
| IITA | International Institute of Tropical Agriculture |
| ISTA | International Seed Testing Association |
| kg | Kilograms |
| MT | metric tons |
| MOA | Ministry of Agriculture |
| MOU | memoranda of understanding |
| NACGRAB | National Center for Genetic Resources and Biotechnology |
| NAERLS | National Agricultural Extension and Research Liaison Services |
| NAIP | National Agricultural Investment Plan |
| NARI | National Agricultural Research Institutes |
| NARS | national agriculture research and breeding effectiveness |
| NASC | National Agricultural Seed Council |
| NAQS | National Agriculture Quarantine Service |
| NCRI | National Cereals Research Institute |
| NIRSAL | Nigeria Incentive-Based Risk Sharing System for Agricultural Lending |
| NPC | national planning and coordination |
| NPT | national performance trials |
| NRCRI | National Roots Crop Research Institute |
| NSA | National Seed Authority |
| NSF | Nigeria Seed Fund |
| NSRM | National Seed Roadmap |
| NSSDF | Nigeria Seed Sector Development Fund |
| NVRC | National Variety Release Committee |
| OECD | Organization for Economic Co-operation and Development |
| OIC | Orange ISTA Certificate |
| OPV | open pollinated varieties |
| PASS | Program for Africa Seed Systems |
| PBR | Plant Breeders' Rights |
| PC | plot component |

| | |
|---|---|
| PLR | Policy, Legal and Regulatory Framework |
| PVP | Plant Variety Protection |
| QA | quality assurance |
| QC | quality control |
| R&D | research and development |
| RTB | root, tuber, and banana |
| SAH | semi-autotrophic hydroponic |
| SEEDAN | Seed Entrepreneurs Association of Nigeria |
| SeedSAT | Seed Systems Assessment Tool |
| SME | small and medium enterprise |
| SOP | standard operating procedures |
| SPS | sanitary and phytosanitary |
| SSOC | State Seed Organizing Committees |
| TASAI | The African Seed Access Index |
| TPE | total population of environments |
| tricot | triadic comparison of technology options |
| TVRC | Technical and Variety Release Committees |
| UQ | University of Queensland |
| WASIX | West Africa Seed Information and Exchange |
| WASP | West Africa Seed Program |
| YIIFSWA II | Yam Improvement for Income and Food Security in West Africa II |

# Executive Summary

SeedSAT is a new assessment tool under ***beta-development*** envisioned by the Bill and Melinda Gates Foundation (BMGF) to collaboratively undertake in-depth country seed system analysis with governments and other stakeholders leading to **investments that increase the delivery and use of improved varieties of seed**. The SeedSAT is intended to **build on, not duplicate,** the foundational knowledge, experience, and work in a particular country. Adding to that is the great body of work that is conducted by existing assessments such The African Seed Access Index (TASAI), World Bank's Enabling the Business of Agriculture (EBA), Breeding Program Assessment Tool (BPAT), and The Access to Seed Index (A2Si), among others. Combined this work outlines innovative pathways for seed system transformation and maturation.

The assessment is broken down into six thematic areas representing the interconnected stages of a seed system: 1) Policy, Legal and Regulatory Framework (PLR); 2) National Seed Quality Assurance (QA); 3) National Planning and Coordination (NPC); 4) National Agriculture Research and Breeding Effectiveness (NARS); 5) Early Generation Seed Production and Distribution (EGS); and 6) Commercial Seed Production and Distribution (CP&D). The tool design and beta assessment were conducted by international and host country subject matter experts relevant to each thematic area. The beta methodology was created in unison among the thematic area experts such that results of the assessment for area is guided by a vision, strategic objective, and indicator questions, and results in a set of bottlenecks and recommended interventions, however, the way each thematic area adapted the indicators and questions and the method for gathering the evidence was unique. The beta version of the tool was tested in Nigeria from 2019-2021 using four focus crops - **maize, rice, cowpea and cassava/yam**.

**Assessment findings.** The Nigeria seed system for food and feed crops is driven by the demand for seed created by three forces: 1) the food consumption pressures of the largest consumer population on the African continent; 2) the national policy of import substitution to provide food security and to reduce pressure on its dwindling foreign exchange earnings; and 3) the corollary national thrust to diversify foreign exchange earnings through agricultural exports. Over the past 15 years, Nigeria has deployed a series of policies and programs to address these forces in ways that have shaped its seed system. These policies and programs started with direct pushes on production from subsidized supply on fertilizer and seeds for priority crops, with a major emphasis on rice, maize, and soybeans that stimulated a rapid growth in the number of seed companies and seriously stretched the national regulator's capacity to enforce standards. These programs have evolved through the Agricultural Transformation Agenda (2011-2015) to the now ending Agricultural Promotion Policy (2016-2020) to improve access to productivity enhancing inputs and assets; crowd in the private sector through financial risk-mitigation to provide inputs, services, and a market to contracted smallholders; and realign Federal Ministry of Agriculture and Rural Development (FMARD) and its agencies to be better supporters and regulators of farming and agribusiness. Where farmers have been able to access better inputs and market linkages through the policies and programs, project evaluations and survey research show substantial gains in productivity and incomes.[1] [2] [3] However, Food and Agriculture Organization of the United Nations Statistics (FAOSTAT)

[1] Iliyasu, I., & Lawal, S. 2020. Nigeria's Self-Sufficiency in Rice and Wheat: An Evaluation of Growth Enhancement Support Scheme (GESS) and Anchor Borrower Program (ABP). *Pakistan Journal of Humanities and Social Sciences, 8*(1), 1-9. https://doi.org/10.52131/pjhss.2020.0801.009

[2] O.E. Ayinde; O. Fatigun; K. Ogunbiyi; K. Ayinde; Y.O. Ambali. Assessment of Central Bank Intervention on Rice Production in Kwara State, Nigeria: A Case-study of Anchor Borrower's Program. 2018. Paper presented at the International Conference of Agricultural Economists, July 28-Aug 4, 2018. Vancouver, Canada.

[3] Wossen, Tesfamicheal, Tahirou Abdoulaye, Arega Alene, Shiferaw Feleke, Jacob Ricker-Gilbert, Victor Manyong and Bola Amoke Awoti. Productivity and Welfare Effects of Nigeria's e-Voucher-Based Input Subsidy Program World Development Vol. 97, pp. 251–265, 2017 0305-750X. 2017 http://dx.doi.org/10.1016/j.worlddev.2017.04.021

data[4] for the cassava, cowpea, maize, rice, and yam crops assessed by SeedSAT experts show that most of their gain in production has come from significant farmed area expansion over the 2010-2019 period.

Overall, in Nigeria, some farmers do have access to seed that meets market demand, is adapted to local conditions, and provides genetic gains in yields, however this is not translated into system-wide productivity gains. This assessment found the following drivers of change to be important to resolving bottlenecks in the system and finding a pathway to reach more farmers using market-oriented mechanisms and re-balancing public and private sector investment and support roles to where they are most effective. The drivers below are listed in order of relative importance and priority.

- Underfunding of the agriculture sector
- Need for improvement of the business enabling environment as a concurrent high priority
- Need for improvement of national quality assurance (QA) as a concurrent high priority
- Need for improved seed system coordination mechanisms
- Insufficient supply of early generation seed driven by inadequate data management and forecasting and lack of public and private investment
- Commercial seed supply is hampered by lack of profitability and scalable private investment
- Nascent and weak seed distribution channels leads to poor access to improved/appropriate seed for small holder farmers
- Lack of broad regional Seed Entrepreneurs Association of Nigeria (SEEDAN) representation of seed system actors

**Conclusion.** Nigeria is underinvesting in agriculture and in relative terms, it is investing even less in the seed system that supports the primordial element of the sector's potential productivity. The historical Consultative Group on International Agricultural Research (CGIAR) partner presence and strength coupled with development partner support to National Agricultural Research Institutes (NARI)s has made up some of the gap in its crop variety development programs, but the current budget allocations are eroding key capacities in early generation seed supply, quality assurance, and regulatory enforcement. Recent key policy reforms need implementation regulations and guidelines to make public and private sector investments feasible and ultimately competitive. While quality assurance and regulatory enforcement still need strengthening in their physical operations and across Nigerian territories to fulfill basic scientific QA functions, (the broadly empowered National Agricultural Seed Council [NASC] is trying to jump ahead into rapid scope expansion and scaling by training cohorts of third party licensed seed inspectors and samplers, moving to universal use of the SeedTracker system for all certified seed production, rolling out the SeedCodex scratch off patch and label for true-seeded crops. In addition, NASC will be tasked with designing and setting up a Plant Variety Protection (PVP) agency and developing varietal licensing procedures, designing and establishing a seed fund intended to defray NASC costs, building out a central seed bank for emergency seed replenishment, expanding public crop variety demonstration and promotion and growing into the West African Center of Excellence in Seed over a 5-year period. These set of combined activities may require a substantial budget increase when funds are already constrained, and capacities stretched. NASC will need to prioritize these investments and improving the cost accounting and budgeting allocation practices recommended in this assessment will help determine which programs are more effective. While the national agriculture research and breeding effectiveness (NARS) assessment was not completed, preliminary information gathered showed that there are new varieties released and some are popular. Completing the SeedSAT assessment will uncover the way forward in assisting the government with determining which new varieties to be prioritized. Finally, the private sector components of the seed system are growing in importance and need to expand further to reach a transformational level of activity in both seed production and distribution. Key gaps in access to finance at the seed producer and seed distributer levels need to be addressed if the private sector is going to reach beyond the limits to rural farmers with quality seed of improved varieties.

[4] http://www.fao.org/faostat/en/#data

# Introduction

The Seed Systems Assessment Tool or SeedSAT evolves from an initiative by the Bill and Melinda Gates Foundation to improve its engagement with government institutions that can either enable or constrict seed sector growth and maturation to scale the availability of quality seed of improved crop varieties to smallholder farmers. In 2019, an internal review of independent seed sector assessments and score cards, along with consultations with development partners and seed sector specialists, concluded that while certain gaps and deficiencies can be identified through independent assessments, and scorecards conducted by third parties help compare agricultural systems progress over time, key public institutions are often ill-equipped to translate scorecard recommendations into actionable implementation plans. The experience of the Breeding Program Assessment Tool (BPAT)[5], that works with research institutions to collaboratively self-assess, and develop reform breeding programs, led to the concept to develop a similar methodology to do a collaborative deep assessment of the current seed system state, and potential to improve the effectiveness of public institutions, and their ability to catalyze improvements in seed sector performance. SeedSAT is intended to integrate this deep level knowledge between the relevant BMGF and Alliance for Green Revolution (AGRA) teams, to better advocate with governments to improve their own performance, and to inform the development of future seed system investments to help them do so.

The effort included the design of the assessment tools, and collaborative work with the AGRA headquarters and country teams in Ethiopia and Nigeria to test and refine the beta version of SeedSAT by performing the systems assessments. This "learning by doing" was intended to refine the tool, standardize the survey and in-country engagement models, and develop a digitized toolkit that could be used to conduct assessments across the remaining AGRA/BMGF countries.

Nigeria was selected because it is the largest country in Africa, represents the largest national population of small farmers on the continent who are the global leaders in cowpea production and continental leaders in cassava and yam production. Nigeria has the distinction of a government driving hard to "reverse the resource curse" through a new Green Alternative economy policy that is focused on replacing food (rice, wheat, maize) and feed (maize, soybeans) imports with national production, while rebuilding its agricultural exports to reduce the nation's dependence on oil exports as its primary sources of foreign exchange. The scale and scope of its crop transformation efforts places enormous pressure on its seed system to deliver new varieties and large quantities of certified seeds each year. Nigeria also has an operationally autonomous National Agricultural Seed Council with a mandate covering most of the seed system as a policy maker, planner and coordinator, regulator, and promoter. At the beginning of the beta period, Nigeria also was on the verge of passing a reformulated NASC Act in 2019 and was near finalization of a 5-year strategic plan intended to prepare NASC to restructure and grow into the role of the regional center of excellence for seed systems in West Africa.

# SeedSAT Beta Version

SeedSAT is a new assessment tool under ***beta-development*** to collaboratively undertake in-depth country seed system analysis with governments and other stakeholders leading to **investments that increase the delivery and use of improved varieties of seed**. The SeedSAT is intended to **build on, not duplicate,** the foundational knowledge, experience, and work in a particular country. Adding to that is the great body of work that is conducted by existing assessments such The African Seed Access Index (TASAI), World Bank's Enabling the Business of Agriculture (EBA), BPAT, and The Access to Seed Index (A2Si), among others. Combined this work outlines innovative pathways for seed system transformation and maturation.

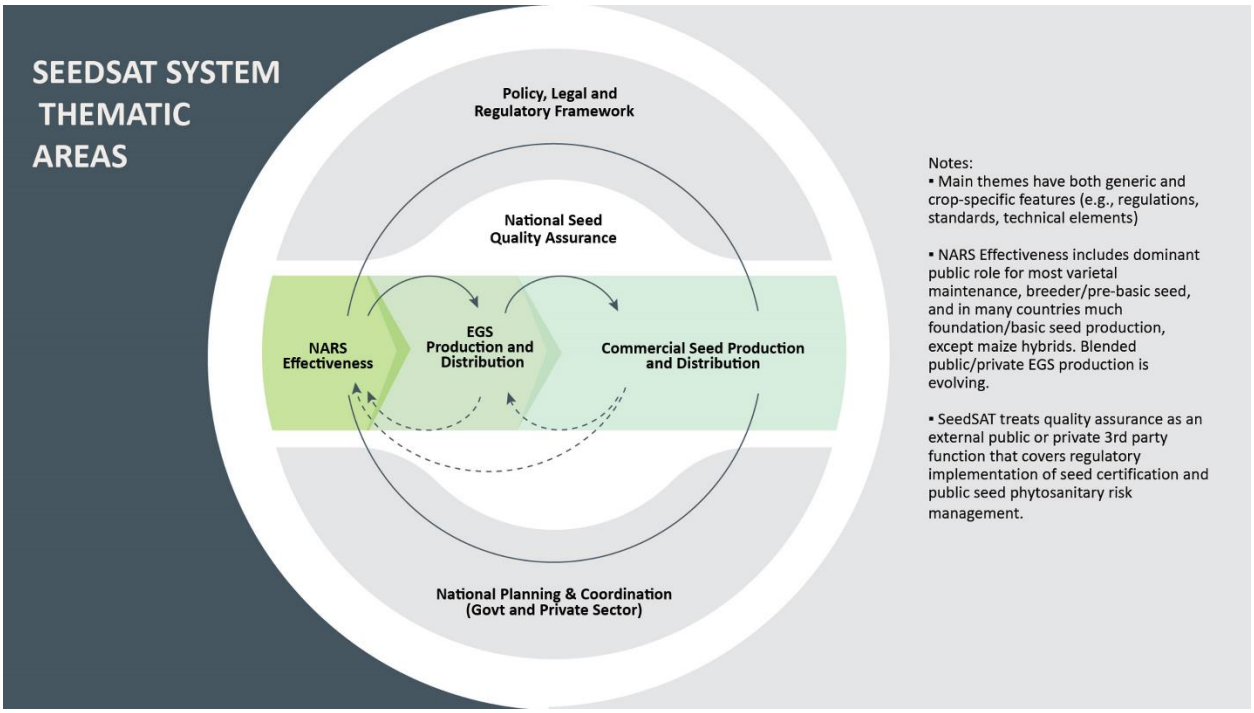
[5] See https://plantbreedingassessment.org/.

SeedSAT focuses on six "thematic areas" that make up the seed system which are:

1. Policy, Legal and Regulatory Framework (PLR)
2. National Seed Quality Assurance (QA)
3. National Planning and Coordination (NPC)
4. National Agriculture Research and Breeding Effectiveness (NARS)
5. Early Generation Seed Production and Distribution (EGS)
6. Commercial Seed Production and Distribution (CP&D)

Figure 1 displays a simplistic relational view of these thematic areas within the system.

*Figure 1: SeedSAT Thematic Areas*




**What SeedSAT IS.** SeedSAT incorporates a **system lens**, meaning it does not just assess one particular issue or event on its own, but it assesses those events and issues holistically as they relate to the overall structures, patterns, and relationships within the seed system and how those interactions affect the overall performance of the system. It leverages and aggregates existing information and utilizes **experts** who guide the process. SeedSAT relies heavily on **collaboration** with the country-level stakeholders and is therefore a qualitative and interactive process with those stakeholders. It **triangulates** information from all types of stakeholders, both public and private, to ensure we are getting a clear view of all the perspectives. SeedSAT considers each country's **unique seed system maturity stage** and is therefore meant to be **flexible** to **adapt** to the specific context of each country. The basis of comparison for SeedSAT is the vision of a healthy seed system, but within the context of each country's unique development stage and stated goals. SeedSAT is both a **guide** for how to conduct a seed systems assessment and a toolkit of templates, which includes some **digitized elements** to facilitate efficient information gathering, analysis, and making conclusions about the relative health of the seed system. The final output of SeedSAT that adds value is that it collaboratively identifies and facilitates agreement on the root cause of issues presented, to subsequently inform the design of proposed interventions and investments, and to **prioritize** and add high level **cost estimates** to those proposed interventions that can be use by public, private and donor investors in the seed system.

**What SeedSAT IS NOT.** SeedSAT is not a standardized, turnkey, fully digitized tool as it does not automatically generate results once information is gathered and entered, rather it requires rigorous expertise to customize the elements of the tool that are then used to evaluate results and make recommendations that are unique to each country context. Because the assessment is unique to each country, the assessment results are not comparable to other countries and the tool is not intended to provide a ranking. While there may be scores generated for specific objectives under each thematic area, there is not be an overall dashboard of aggregated scores. And finally, the results of the assessments are not public. Reports and findings are considered propriety to the host-country institutions, AGRA, the Bill and Melinda Gates Foundation, and select respondents (such as for EGS and commercial entities).

**Beta version and country testing.** This handover report describes the **beta (or exploratory)** version of the SeedSAT tool, which was developed between **November 2019 and March 2021**. After an initial landscaping and design period, the beta version of the tool was developed and modified through a staged process and in close collaboration with representatives from two countries based on their advanced work in seed systems improvements to date: **Ethiopia and Nigeria**. Throughout the beta time period, the SeedSAT team gathered information for the assessment, but also on the assessment design, taking into account feedback from country representatives on the assessment process and format. Elements of the beta tool were digitized, tested, and adapted throughout the beta period. However, the assessment is intended to be as interactive with representatives as possible, with only a few pre-established surveys and document requests digitized. Final reports and assessments will be available online based on secured granted access. Finally, the beta version is intended to inform future versions of the tool that will include improvements based on feedback from AGRA, BMGF, host country stakeholders, and thematic areas exports throughout the process. It is intended that future versions will be rolled out to additional countries in Africa what AGRA has a presence.

**SeedSAT beta team.** The SeedSAT beta version was guided by a consortium of expert partners as follows:

- DAI, National Planning and Coordination, project management and technical guidance;
- New Markets Lab for Policy, Policy, Legal and Regulatory Framework;
- Agri Experience, National Seed Quality Assurance;
- Dr. Yilma Kebede, National Agriculture Research and Breeding Effectiveness;
- Context Global Development, Early Generation and Commercial Seed Production and Distribution;
- AGRA is a co-designer, tester, and primary conduit within each beta country; and
- Bill and Melinda Gates Foundation provided funding and overall technical guidance.

**Vision of a health seed system.** The overall vision of a healthy seed system is one in which is one in which farmers grow modern varieties of crops that have product profiles that are responsive to market and consumer demands that are also adapted to their environments to ensure resilient and high yields. It is also a system that includes:

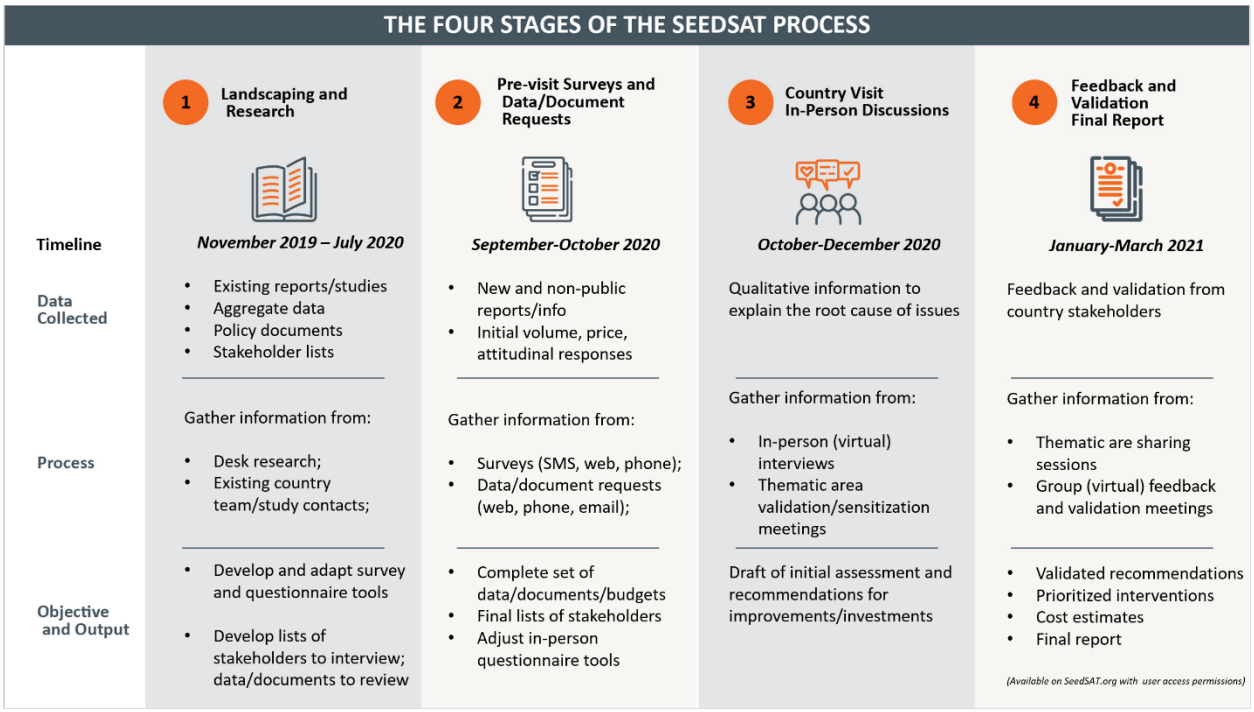
- A regular supply of domestically bred and imported crop varieties at a pace that matches market demand and that gives farmers choices;
- Healthy competition among public and private producers of the various stages of seed production to supply the market that are accountable for quality standards;
- An appropriate blend of public and private engagement AND investment to ensure that early stage and food security crops that are not yet profitable are not neglected;
- Seed subsidies (if used) are used carefully to temporarily bridge new market development and market failures for short periods of time.

Each thematic area has developed a vision that incorporates elements that are necessary to obtain the overall vision, which are highlighted in the Assessment Results section below.

**Focus crop selection.** For purposes of the beta testing, BMGF, AGRA, and the experts chose five focus crops - **maize, rice, cowpea, cassava and yam**. Nigeria is the world's largest producer and consumer of cowpeas and yams. It is the largest producer and consumer of cassava in Africa and largest consumer of rice and maize. These crops are a subset of the national strategic crops that are supported under Nigeria's Agricultural Promotion Policy (APP). Taken together they align with the SeedSAT intent to assess crops that are grown by very large numbers of smallholder farmers, and provide a balance between cereal, legume, and root and tuber crops.

**Stages of Assessment.** The assessment was conducted over four stages displayed in Figure 2. The beta version included additional time to design the process and the toolkit of templates, which included some digitized elements, however there were significant delays due to travel limitations and restrictions on in-person meetings during the COVID 19 pandemic (March 2020-February 2021). Most of the surveys, interviews, and meetings were conducted virtually with expert teams located in various time zones in the U.S. and Africa, which limited the times of day that these activities could occur. Additionally, there was political and social unrest in Nigeria that resulted in restricted access to the internet for participants and restricted travel and access to lab facilities respectfully which further delayed assessment activities.

*Figure 2: SeedSAT Four Stages*




**Scoring.** SeedSAT by design is not intended to develop aggregated scores neither by strategic area, nor for a particular country or selection of crops. The use of aggregate scores at those levels may overly simplify and average unique positive and negative results within a given thematic area and opportunities and constraints might therefore be missed or neglected. The TASAI and EBA indices provide aggregated scores, while SeedSAT provides the "deep dive" to discover the root causes behind those scores. Experts did, however, use scoring represented by varying Likert scales (-2 to 2; 0 to 3; or 1 to 4) to help the assessor determine the overall health of an objective or indicator question, but these scores are not intended to be aggregated. Regardin the varying scales used, in some cases, this was due to the expert's determination of the best way to rate the performance given the distinct and nuanced aspects of that area, while in other cases, the experts were adapting to analysis and scoring that had already been done such as for the ratings and rankings presented for CP&D. For PLR, there are only scores for a small subset of

indicator questions and for EGS and CP&D there are no overall scores, and only colors on some areas like the overall capacity of the seed production and distribution system. While the scores in each thematic are not meant to be aggregated, the reader should instead, attribute the associated colors with the assessed health of the system in the following ways:

- **Red:** Very insufficient, unsatisfactory, non-compliant, non-existent, No;
- **Orange:** Insufficient, unsatisfactory, somewhat compliant;
- **Yellow:** Moderately sufficient, satisfactory, compliant;
- **Green:** Sufficient, good, compliant and implemented well, Yes.

The scores and colors for the strategic objectives and indicator questions can be found in the assessment details provided in Annex II.

**High-level costing.** Cost estimates for the recommended interventions are very high-level based on the expert's experience and knowledge of implementing similar activities; there are not detailed budgets or line items with units, rates, and quantities that support them. Each thematic area provides information on what the estimate covers and what it does not cover. In some cases, specific steps or elements of what will make up the cost are provided. More detailed cost estimates will have to be determined by the investor and will be based on decisions that must be made between the investor and the beneficiary (i.e. think specifications of equipment, number of staff to be trained, etc.). In the case of the EGS and CP&D interventions, costs estimates have not been provided by the experts. Costing details can be found in Annex III.

**Implementation during COVID 19.** Due to COVID-related travel restrictions in 2020 and 2021, it was not possible for the international expert assessment team to visit the country in person, and it is important to understand that this presented a considerable challenge in studying and assessing each thematic area. All efforts were made to overcome this challenge by conducting interviews and workshops virtually and by utilizing local perspectives and experience, but it is possible that the lack of first-hand observation and in-person discussions has resulted in errors and omissions. The subsequent in-person validation process was therefore an important step in finalizing assessment results and prioritizing recommended interventions.

**Assessment confidentiality.** The SeedSAT reports are intended for use by the Bill and Melinda Gates Foundation and AGRA to distribute to host country stakeholders at their discretion. The SeedSAT team followed strict confidentiality protocols with interviewed stakeholders and used a "Chatham House rules" approach. Quotes contained in the assessment results are non-attribution and **the contents of this assessment are considered confidential and not for broad distribution.**

# Nigeria Assessment Results

SeedSAT is a tool that guides experts and host country stakeholders and institutions through a rigorous, interactive, and iterative process to arrive at assessments that that are customized to the specific context of the host country. This section describes the overall approach the experts took while designing and implementing the tool and the high-level assessment bottlenecks identified and expert recommended interventions. In addition, the section describes the results of the SeedSAT Validation Workshop held in Abuja on March 4, 2021, that include participation of public, private, and development partner stakeholders, in-person and virtually. The workshop included facilitated breakout discussion sessions aimed to first validate the findings – in other words determine if the bottlenecks and interventions were accurate and if there were any that were missing; and second to prioritized the interventions based on level of impact (high, medium, low) to the system and relative ease of implementation (high, medium, low). NARS was not validated because the in-person interview portion of the assessment could not be completed within the time frame allotted for beta implementation. Assessment results do not therefore exist for NARS.

## SEED SYSTEM ASSESSMENT SUMMARY

The Nigeria seed system for food and feed crops is driven by the demand for seed created by three forces: 1) the food consumption pressures of the largest consumer population on the African continent; 2) the national policy of import substitution to provide food security and to reduce pressure on its dwindling foreign exchange earnings; and 3) the corollary national thrust to diversify foreign exchange earnings through agricultural exports. Over the past 15 years, Nigeria has deployed a series of policies and programs to address these forces in ways that have shaped its seed system. These policies and programs started with direct pushes on production from subsidized supply on fertilizer and seeds for priority crops, with a major emphasis on rice, maize, and soybeans that stimulated a rapid growth in the number of seed companies and seriously stretched the national regulator's capacity to enforce standards. These programs have evolved through the Agricultural Transformation Agenda (2011-2015) to the now ending Agricultural Promotion Policy (2016-2020) to improve access to productivity enhancing inputs and assets; crowd in the private sector through financial risk-mitigation to provide inputs, services, and a market to contracted smallholders; and realign FMARD and its agencies to be better supporters and regulators of farming and agribusiness.

Where farmers have been able to access better inputs and market linkages through the policies and programs, project evaluations and survey research show substantial gains in productivity and incomes.[6] [7] [8] However, FAOSTAT data[9] for the cassava, cowpea, maize, rice, and yam crops assessed by SeedSAT experts show that most of their gain in production has come from significant farmed area expansion over the 2010-2019 period. Average area expansion has increased at a rate of four percent each year for cowpeas to eight percent each year for rice and yams, while the FAOSTAT data shows that average growth rates in yield have been flat or negative over this time span, although with substantial year-to-year variation. As long as yield gains are on average flat or negative, and imports are banned or heavily constrained by foreign exchange shortage, fast crop area expansion will continue in step with Nigerian growth in population and food consumption.[10]

The increase in farmed area adds to production and agricultural GDP, but it also increases the planting requirement for seed and other inputs, labor, farm implements and/or mechanized services. NASC is charged with seed demand estimation across a wide range of crops and currently estimates a potential seed demand of 429,000 MT. NASC also made an early 2021 projection of commercial certified seed availability of about 101,000 MT, creating a calculate gap of 328,000 MT. The gap is hypothetical because *effective demand* for certified seed - the amount of certified seed by crop and variety that farmers are willing to buy to plant during the current production year – is not known. Just under half the sales of certified seed are made to institutional buyers – federal and state governments, NGOs, and donor projects – that at least partly mask the nature of the demand from farmers. There are signs that certified seed demand may be significantly larger that available supply. Hybrid and open pollinated variety (OPV) maize and rice seed of popular varieties are targeted by sellers of fake seed who supply cleaned and sorted grain in bags that resemble those from true seed companies, or refill empty bags from certified seed

[6] Iliyasu, I., & Lawal, S. 2020. Nigeria's Self-Sufficiency in Rice and Wheat: An Evaluation of Growth Enhancement Support Scheme (GESS) and Anchor Borrower Program (ABP). *Pakistan Journal of Humanities and Social Sciences*, *8*(1), 1-9. https://doi.org/10.52131/pjhss.2020.0801.009

[7] O.E. Ayinde; O. Fatigun; K. Ogunbiyi; K. Ayinde; Y.O. Ambali. Assessment of Central Bank Intervention on Rice Production in Kwara State, Nigeria: A Case-study of Anchor Borrower's Program. 2018. Paper presented at the International Conference of Agricultural Economists, July 28-Aug 4, 2018. Vancouver, Canada.

[8] Wossen, Tesfamicheal, Tahirou Abdoulaye, Arega Alene, Shiferaw Feleke, Jacob Ricker-Gilbert, Victor Manyong and Bola Amoke Awoti. Productivity and Welfare Effects of Nigeria's e-Voucher-Based Input Subsidy Program World Development Vol. 97, pp. 251–265, 2017 0305-750X. 2017 http://dx.doi.org/10.1016/j.worlddev.2017.04.021

[9] http://www.fao.org/faostat/en/#data

[10] P.A.J. van Oorta, K. Saito, A. Tanaka, E. Amovin-Assagba, L.G.J. Van Bussel, J. van Wart, H. de Groote, M.K. van Ittersum, K.G. Cassman, M.C.S. Wopereis. Assessment of rice self-sufficiency in 2025 in eight African countries. Global Food Security 5(2015):39-49

producers with grain and sell it. Seed of the most popular "mega" varieties of rice, like Faro 44, 66, and 67, book and sell quickly.

Overall, in Nigeria, some farmers do have access to seed that meets market demand, is adapted to local conditions, and provides genetic gains in yields, however this is not translated into system-wide productivity gains. This assessment found the following drivers of change to be important to resolving bottlenecks in the system and finding a pathway to reach more farmers using market-oriented mechanisms and re-balancing public and private sector investment and support roles to where they are most effective. The drivers below are listed in order of relative importance and priority.

**Underfunding of the agriculture sector.** Nigeria's high level commitments to CAADP have reinforced large initiatives to boost agricultural production built out of the experience of Agricultural Development Projects (ADP) at state and river basin levels, with coordinating support from FMARD through the Agricultural Transformation Agenda, Special Presidential Initiatives, and the Agricultural Promotion Policy. Production priorities from large agricultural development programs around Nigeria's import substitution and export goals; the multi-year import restrictions on rice, poultry and other foods; the choice of strategic crops to support; and the financial instruments that are put in place to support crop production and input supply all contribute to increased demand for seed. The public sector role is heavy as an institutional market maker for inputs and services, but public resources have declined from the time that the first national CAADP and National Agricultural Investment Plan (NAIP) commitments were made to devote 10 percent of the public budget to agriculture to generate an six to seven percent agricultural sector GDP growth annually. Agriculture sector budgetary commitments have declined from five to six percent of national budget to just under two percent of the national budget. Flat or fluctuating budgets erode institutional assets and human capacities as operating costs inflate, research requirements grow, seed demand expands, and long-standing needs to maintain, upgrade, and intensify seed quality assurance and regulatory enforcement increase. Core public sector capacities still need to be reinforced and strengthened, especially as Nigeria seeks to increase the role of the private sector in early generation seed production and distribution, increase the development of third party inspection services, and seeks to shift more of the financing and financial risk burden to seed companies for certified seed production and distribution.

**Need for improvement of the business enabling environment as a concurrent high priority.** Nigeria's policy, legal, and regulatory (PLR) environment recently underwent significant changes, with passage of the NASC Act in 2019. Among other things, the NASC Act, which streamlines processes involved in the development, production, distribution and trade of seed; defines institutional mandates; aligns Nigeria's seed regulatory system with regional seed rules under the Economic Community for West African States (ECOWAS); and establishes stricter penalties for offences such as the sale of counterfeit seed. Nigeria also has a relatively new National Seed Policy (2015) and a new Agricultural Policy (2020). These measures all lay out an improved policy, legal, regulatory, and institutional framework for seed in Nigeria, and both public and private stakeholders have heralded these developments as significant steps in creating a vibrant market for high-quality seed. However, while these new measures are commendable, stakeholders have signaled that it is too soon to determine the full impact of these changes, particularly the NASC Act, on the seed market. Moreover, regulations are yet to be developed under the NASC Act, and, in the meantime, the 2016 Guidelines for Registration and Release of New Crop Varieties in Nigeria and 2017 NASC Guidelines for Registration of Seed Producers or Companies and Seed Fields in Nigeria continue to apply to variety release and registration and certification, respectively; in some cases, inconsistency exists between these older measures and the new NASC Act. In addition, the Nigerian National Assembly passed the legal framework on Plant Breeders' Rights (PBR), with a Plant Variety Protection (PVP) in March 2021, which will need operationalization through the establishment of regulations, procedures, and guidelines. To alleviate public funding constraints, such as funding for the National Variety Release Committee (NVRC), it is imperative that plans to create hybrid funding options are accelerated. Currently, the legal infrastructure for trade and

SPS is weak, and relevant institutions lack the capacity to conduct risk based SPS assessments. Interventions would include acquiring the right equipment and building the skills to conduct risk assessments, as well as updating the national pest list to reflect national and regional quarantine and phytosanitary conditions and make the process of risk assessment more predictable, especially for the private sector. Finally, NASC currently has insufficient capacity to implement anti-counterfeiting measures contained in law, which will have to be addressed to make the system operational. These legal reforms are essential to ensure the relevant public sector and private sector investments profitable and sustainable.

**Need for improvement of national quality assurance as a concurrent high priority.** Assessment results indicate that QA in Nigeria suffers from significant deficiencies in equipment, adherence to processes and procedures, logistic support, which underpins the ability to conduct seed field inspection and sampling, and staff capacity and training, in addition to other challenges. Key institutional issues contributing to these deficiencies are lack of operational autonomy to fully execute regulatory duties, insufficient funding and investment plans, insufficient stakeholder dialogue, and lags in developing operational regulations after the passage of the new Seed Act in 2019.

The assessment does not recommend a high prioritization for e-certification and licensing of outside inspectors. While these are important and viable steps for systems that are already delivering basic QA at a scientifically valid and reliable level, even if only on a limited basis at a few laboratories or with a small number of crops, they are not valid steps for immature QA systems to take. For a QA system such as Nigeria's, the scientific basics of QA must first be put in place at the national level and at several key regional locations. Once this is done, these sites can serve as training, replication, and audit sites for other QA field offices and laboratories, in addition to the work of third-party inspectors. It then also becomes possible to digitize the procedures once they are done properly, with scientific validity. Absent having several key sites operating properly, there is risk of digitizing erroneous processes and/or licensing third-party inspectors without any way to train them adequately, monitor their performance, and determine the continued validity of their licenses. Without a strong base of operations, digitization will simply lead to greater efficiency of inaccurate processes, and without a strong reference lab and technical audit capacity, fast roll-out of third party inspection will simply lead to more people who are authorized to carry out the inaccurate processes. None of these improvements can be carried out in the absence of a clear operating mandate for NASC and NAQS, and the ability to make scientifically valid decisions that will not be overridden by the political economy. NASC already has legal autonomy, but it does not yet have the strong operating autonomy for regulatory enforcement that is required to fulfill its legal mandate.

**Need for improved seed system coordination mechanisms.** Throughout the assessment and at the validation workshop, Nigerian stakeholders and leaders pointed to the need to improve coordination among international organizations and donors who play important roles in research and development, early generation seed, and agricultural development programs that shape seed demand. NASC already represents an apex body with authority for public sector planning and coordination, but it is already underfunded for its core regulatory functions, and needs to rally support to help establish regular, two-way dialogue between public and private sectors in the seed industry with federal and state bodies; ensure that regular public-private meetings are held, with joint agenda setting to include industry funding issues, seed demand forecasting and production planning, EGS demand and allocation issues; design and establishment of the Nigeria Seed Sector Development Fund (NSSDF); its One-Stop Information Shop; and to establish regular feedback channels for meeting discussions and follow-up.

**Insufficient supply of early generation seed driven by inadequate data management and forecasting and lack of public and private investment.** Evidence shows that demand for certified seed is much larger than current production, however the seed system consistently fails to respond. Many seed companies state that they cannot access enough high-quality early generation seed (EGS) to increase supply. The assessment found that the Nigerian EGS is a patchwork of donor-funded, CG-facilitated,

NARI, and private structures that operate independently. While NASC has the mandate for seed demand forecasting and seed production planning, it is not yet successfully fulfilling its coordination role with the range of stakeholders that need to be engaged to accurately forecast demand and supply gaps including plant breeders, research institutes, seed companies, farmer associations, donors and development organizations. Recent donor-supported initiatives have meaningfully increased the volume of EGS for the following crops: maize (private producers and a BMGF-sponsored startup foundation seed company); rice (private producers and AfricaRice); cowpea (Accelerated Varietal Improvement and Seed System Delivery in Africa [AVISA]); yam (Yam Improvement for Income and Food Security in West Africa II [YIIFSWA II] and AfricaYam); and cassava (Building a Sustainable, Integrated Seed System for Cassava in Nigeria [BASICS] I & II). This is important because for EGS of less profitable seed crops, the cost to the agricultural system of underproducing is often higher than overproducing. But because seed production decisions are made at an institutional level, within the context of their unique priorities, capabilities, and resource bases, volumes produced are often less than would be optimal for the whole system. However, ensuring that an optimal level of breeder and foundation seed is produced requires more funding of the public sector producers of breeder seed and more reasonable sources of working capital for private sector producers of EGS. The need for increased public funding to create public goods and ensure quality assurance and more flexible sources of working capital to scale production are recurring themes in this assessment. Private sector investment in EGS is also hampered by licensing requirements limiting seed companies to producing only one class of seed, which is reducing the growth potential of firms that have this capacity and can provide the seed more efficiently than the public sector.

**Commercial seed supply is hampered by lack of profitability and scalable private investment.** In Nigeria, certified seed (or commercial seed) is produced by private seed companies (99 percent) and community-based organizations or Agricultural Development Projects (ADP) (1 percent). The commercial seed market in Nigeria is consolidated for hybrid maize, more fragmented for OPV maize and rice, and currently inconsequential for cowpea, yam, and cassava. There are a handful of multinational seed and crop protection companies (such as Bayer, Corteva, and Syngenta), regional seed companies (such as the SeedCo Group), and national seed companies (such as Premier Seed Nigeria Ltd., Value Seeds Ltd., Techni Seeds Ltd., Da-Allgreen Seeds Ltd., Nwabudo Agro Seeds & Inputs Co. Ltd., Green Agriculture West Africa Ltd., among others) that produce commercial seed of scaled volumes. There are hundreds of small seed companies that produce less than 200 MT of seed annually that need both technical and seed business management enhancement.

Both large- and small-scale companies' core business is to produce and sell certified maize and rice seed to institutional buyers (47-48 percent), farmers (23-28 percent), agrodealers (21-27 percent), and other channels (3 percent)[11]. Due to the high cost of production of foundation and certified seeds, private seed companies have generally focused on already established markets with popular varieties to reduce risk and realize quick returns. As a result, more remote agricultural areas have often been overlooked because of the high costs of farmer education and the limited number agrodealers[12].

The main institutional buyers of certified seed are federal and state ministries of agriculture, other institutions, and programs that procure seed include Fadama (Hausa term for irrigable land), the Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL), and the Central Bank of Nigeria (CBN)[13]. Given the large proportion of sales to institutional buyers, which are secured through tenders and executive-to-executive relationships, combined with the lack of resources to conduct demonstration trials, extension services, and promotional activities, there is neither the incentive nor means for seed companies to increase farmer awareness and purchase consideration of new, improved

[11] Michael Waithaka, Mainza Mugoya, Adesola Ajayi, Folarin Okelola, Krisztina Tihanyi. 2019. Nigeria Brief 2018 - The African Seed Access Index. Available at: tasai.org/reports.
[12] Nigeria Early Generation Seed Study, Country Report by Feed the Future: Building Capacity for African Agricultural Transformation Project (Africa Lead II) for the United States Agency for International Development, August 2016.

varieties at scale. A consistent policy that funds farmer awareness campaigns and marketing of public varieties is needed.

National seed companies are capital constrained and unable to obtain investment and working capital for seed production operations and managing inventory. Many seed companies lack funds to buy back seed from outgrowers, forcing outgrowers to sell seeds as grain. Also, commercial bank loans are extremely difficult to obtain and carry high-interest rates, which inhibits the growth potential of existing companies and discourages would-be entrepreneurs from entering the seed sector. Credit risk guarantees for seed producers to incentivize investment and low-interest seed buyback working capital for raw seed purchases would help to sustainable increase seed investments. Further, some seed companies have substantial outstanding payments due (accounts receivable) from FMARD and state governments for seed delivery under the GES. These need to be cleared so that CBN will permit them to borrow money again.

**Nascent and weak seed distribution channels leads to poor access to improved/appropriate seed for small holder farmers**. While institutional buyers and larger seed companies run their own distribution channels, agrodealers are an important link in the seed supply chain, as they provide smallholder farmers with access to inputs such as seeds, fertilizers, and plant protection products. Agrodealers are the most important distributors of OPV (mainly maize, rice, and soybean) and hybrid seeds produced by local private seed companies, typically buying products from seed companies at a 10 percent discount and selling them at the company price, earning a 10 percent profit margin[14]. Their primary source of working capital is family, and they cite high cost of seed and inadequate cash to pay suppliers as top constraints to selling more seed. Given the constraints on the public budget, agrodealers in rural areas are likely to be the ones who reach smallholders in remote location. They will need preferential access to credit for inventory management and investment to meet regulatory requirements to quality as agrodealers with NASC, and support to improve their management capacity.

**Lack of broad regional SEEDAN representation of seed system actors.** Seed producers are represented by the SEEDAN whose combined membership represents a large volume of the certified seed production of cereals and legumes in the country, although without the market concentration seen in many other African states. SEEDAN is viewed by members as an active and effective advocate for the interests of seed companies with NASC and Nigerian policymakers, but also an organization that is less than democratic in its governance and management, and in need of improving resource mobilization, communication, and broader industry promotion. SEEDAN strongly aligns with the import substitution agriculture and trade policy of the national government, opposing the importation and distribution of certified seed of staple food crops that is permitted by the ECOWAS regional harmonized seed regulations. This is not an unusual stance in the larger states of West Africa or more generally across the continent. This assessment recommends investment in SEEDAN to support the design and development of commodity working groups and regional representation, support to refine and advance its advocacy agenda on public funding of NARIs for breeder seed supply of public varieties, removal of seed class operating restrictions (not technical capacity standards) on seed companies, national policy on CG center production of certified seed, PVP implementation, seed demand and supply information, and public variety promotion and marketing, along with development of a functioning website. Development partners may need to carefully examine whether there is a natural fit between SEEDAN and the needs of the embryonic root and tuber EGS and commercial seed companies, or other vegetatively propagated crops (VPC), beyond the traditional incorporation of Irish potato in seed associations. VPC seed companies and related organizations may need representation more through commodity associations that operate throughout their value chains, making common cause with SEEDAN on policy and regulatory issues that affect their memberships.

[14] Nigeria Early Generation Seed Study, Country Report by Feed the Future: Building Capacity for African Agricultural Transformation Project (Africa Lead II) for the United States Agency for International Development, August 2016.

**Note concerning national agriculture research and breeding effectiveness.** The SeedSAT experts were unable to complete this component of the assessment due to lack of timely response and engagement from the Nigeria crop-specific breeding programs before the beta period ended. The information gathered during the first stages, however, can still be useful. A regional expert has been trained in how to complete this step and the international expert assigned to the beta assessment stands ready to provide additional support to complete the overall assessment, though this will require funding under AGRA. Results of this assessment would determine if the structures, staff, capacity, skills, infrastructure, etc. are in place to properly meet the demands of market and produce the genetic gains that will help grow the sector.

**Conclusion.** Nigeria is underinvesting in agriculture and in relative terms, it is investing even less in the seed system that supports the primordial element of the sector's potential productivity. The historical CG partner presence and strength coupled with development partner support to NARIs has made up some of the gap in its crop variety development programs, but the current budget allocations are eroding key capacities in early generation seed supply, quality assurance, and regulatory enforcement. Recent key policy reforms need implementation regulations and guidelines to make public and private sector investments feasible and ultimately competitive. While quality assurance and regulatory enforcement still need strengthening in their physical operations and across Nigerian territories to fulfill basic scientific QA functions, (the broadly empowered NASC is trying to jump ahead into rapid scope expansion and scaling by training cohorts of third party licensed seed inspectors and samplers, moving to universal use of the SeedTracker system for all certified seed production, rolling out the SeedCodex scratch off patch and label for true-seeded crops. In addition, NASC will be tasked with designing and setting up a PVP agency and developing varietal licensing procedures, designing and establishing a seed fund intended to defray NASC costs, building out a central seed bank for emergency seed replenishment, expanding public crop variety demonstration and promotion and growing into the West African Center of Excellence in Seed over a 5-year period. These set of combined activities may require a substantial budget increase when funds are already constrained, and capacities stretched. NASC will need to prioritize these investments and improving the cost accounting and budgeting allocation practices recommended in this assessment will help determine which programs are more effective. While the NARS assessment was not completed, preliminary information gathered showed that there are new varieties released and some are popular. Completing the SeedSAT assessment will uncover the way forward in assisting the government with determining which new varieties to be prioritized. Finally, the private sector components of the seed system are growing in importance and need to expand further to reach a transformational level of activity in both seed production and distribution. Key gaps in access to finance at the seed producer and seed distributer levels need to be addressed if the private sector is going to reach beyond the limits to rural farmers with quality seed of improved varieties.

# NATIONAL QUALITY ASSURANCE

## Vision

National governments want to ensure that farmers are receiving high quality seed from the formal and intermediate sectors, yet often do not: 1) have proper quality assurance regulations in place, and/or, 2) do not implement or assure implementation of their existing quality assurance regulations well, resulting in low quality seed for farmers. A healthy seed system is one in which farmers have confidence that formal and intermediate sector seed in the market meets labeled quality standards, and actively patronize the brands with the highest quality seed of the varieties they want to plant; and one in which seed companies work to exceed quality standards and view the regulator as their partner in this quest. Effective regulatory quality assurance will incorporate the following:

- Collaborative design and oversight of effective and affordable processes that are fit-for-purpose, including authorizing and auditing third-party inspectors, to ensure that seed producers and

merchants are supplying their customers with seed that meets best practice standards for seed quality and phytosanitary testing;
- Proactive focus on engaging seed producers and merchants in a continuous cycle of seed quality improvement through training, coaching, process oversight and improvements, and timely feedback on quality and phytosanitary testing results; and
- Presence of functional, two-way dialogue and feedback mechanisms related to farmers' experience of seed quality (including feedback on counterfeit seed) to support ongoing improvement in the quality of seed planted by farmers.

## Methodology

The assessment used best practice standards for seed quality and phytosanitary testing (such as International Seed Testing Association [ISTA], Organization for Economic Cooperation and Development [OECD] where applicable), plus best practice standards for a customer-focused sector for benchmarking. The methodology used for NARS included the following seven Strategic Objectives:

1. QA regulations that are consistent with best practices
2. Implementation of production-related QA activities for *locally produced* seed
3. Implementation of national QA requirements for *imported* seed
4. Implementation of point of sale/distribution QA activities (for both locally produced and imported seed)
5. Efficiency and affordability of QA compliance for seed producers and importers
6. Service focus: QA dialogue, support, training, and feedback
7. Institutional support for QA

Based on these seven objectives, the experts developed 28 indicator questions to guide the assessment. Evidence gathered to conduct the assessment included: desk research conducted by the research team, information requested and submitted by the regulatory entities; recently released and technically qualified third-party reports; site visit observations and data collected by an expert local consultant; phone-based and SMS survey results of seed producers and importers, seed distributors, and representatives of farmer groups; and in-person consultations with additional stakeholders in the Nigeria seed sector. A total of 28 reports from third parties and key government QA documents, such as standard operating procedures, were selected as important contributors to the body of evidence for the assessment. Data and documents requested from NASC were provided but what was requested of NAQS was not availed. Annex VII contains a list of documents requested and the status. The expert team used both a Likert scale (0 to 3) to assess the relative level of satisfaction and health of the QA system.

More detailed information on the methodology can be found in Annex II and in the SeedSAT Guide.

## Findings

Certified seed volumes for the non-root and tuber focus crops for this study (i.e., maize, rice and cowpea) totaled 88,711 MT in 2019. Certification of root and tuber crops is almost non-existent, although there are some projects focused on root and tuber crops with strong internal quality control. Close to 98 percent of certified commercial seed is produced by local seed companies, and import levels are low. Approximately 70 percent of EGS is produced by national research institutes, while close to 30 percent is supplied by private companies.

The NASC is responsible for seed certification and testing, while the National Agriculture Quarantine Service (NAQS) is responsible for phytosanitary testing and decisions. The latter does not appear to be very active with respect to seed QA, however, with most of its activities oriented towards sanitary and phytosanitary regulation of commodity imports and exports. NASC oversees laboratories and field offices throughout the country which are responsible for carrying out QA activities in the region. There is

a national reference lab located in Abuja. The NASC website includes a wide array of information needed by QA stakeholders. NASC became a member of ISTA in 2018 and holds observer status at the OECD, which sets international standards for seed of various crops, with particular relevance to seed trade. There is no ISTA-accredited lab in Nigeria, and at present all certification activities are carried out by government QA employees, although official delegation of QA activities to qualified and licensed third parties has been approved and some training to implement this effort has begun.

High levels of low quality and possibly counterfeit seed in the market are reported, but the recent introduction of a scratch-off label for product authentication may help to improve this situation. This effort is still in its early stages though. Seed distributors are generally not clearly registered or regulated, contributing to seed quality challenges for farmers purchasing certified seed, but NASC is aware of these challenges and is actively seeking recommendations for corrective measures.

A new Seed Act was passed in 2019, which provides a strong legal foundation for improvements and reforms in national QA. A key missing piece of the equation, however, is the formal passage of operational regulations for QA. Seed QA in Nigeria can be characterized as evolving, but also in need of considerable support to meet both national needs and international standards. Several recent studies and strategy documents accurately point the way to improved QA in Nigeria, but operational understanding of how to efficiently, systematically, and effectively improve QA – sustainably – is lacking. Assessment results indicate that QA in Nigeria suffers from significant deficiencies in equipment, adherence to processes and procedures, logistic support which underpins the ability to conduct seed field inspection and sampling, and staff training, in addition to other challenges. Key institutional issues contributing to these deficiencies are lack of regulatory autonomy, insufficient funding and investment plans, insufficient stakeholder dialogue, and lags in developing operational regulations after the passage of the new Seed Act in 2019.

It is important to note that the recommendations below do not include broad improvements such as e-certification and licensing outside inspectors. While these are important and viable steps for systems that are already delivering basic QA at a scientifically valid and reliable level, even if only on a limited basis at a few laboratories or with a small number of crops, they are not valid steps for immature QA systems to take. For a QA system such as Nigeria's, the scientific QA basics must first be put in place at the national level and at several key regional locations. Once this is done, these sites can serve as training, replication, and audit sites for other QA field offices and laboratories, in addition to the work of third-party inspectors. It then also becomes possible to digitize the procedures once they are done properly, with scientific validity. Absent having several key sites operating properly, there is risk of digitizing erroneous processes and/or licensing third-party inspectors without any way to train them adequately, monitor their performance, and determine the continued validity of their licenses. Without a strong base of operations, digitization will simply lead to greater efficiency of inaccurate processes, and without a strong reference lab and technical audit capacity, fast roll-out of third party inspection will simply lead to more people who are authorized to carry out the inaccurate processes. None of these improvements can be carried out in the absence of a clear operating mandate for NASC and NAQS, and the ability to make scientifically valid decisions that will not be overridden by the political economy. NASC already has legal autonomy, but it does not yet have the strong operating autonomy in regulatory enforcement that is required to fulfill its legal mandate.

The recommendations below represent the beginning of a journey, not the complete journey. They have been developed in harmony with the following guiding principles about improving national seed QA.

- The main goal of the recommendations is to ensure high quality and large-scale seed QA implementation, whether directly by a national government, or through delegating activities to qualified third parties and providing the necessary audit and training functions.
- QA improvement must build upon basic QA functionality and technical capacity and accuracy. Without these basics, other improvements such as e-certification do not make sense, although improvements such as digitized certification efforts (also known as e-certification) can help to scale a system once the basics are present.
- Seed QA costs do not need to be prohibitive on a per unit basis once scale is achieved, and participants in a growing and functional seed sector will generally willingly contribute their fair share of the costs if they feel they are receiving good value for money.
- In many cases, efforts to improve QA are already underway through various donor activities and grants. The recommendations attempt to consider these efforts and build upon them, noting potentially constructive repositioning when believed constructive
- Finally, QA is a highly technical undertaking. There are no viable shortcuts, nor is it possible to deliver solid QA without the requisite technical proficiency among staff, functional and calibrated equipment, lab infrastructure, and inspection and sampling activities. All recommendations made are consistent with this reality.

Strong partnerships between government, private sector, technical experts, and donors will be required to undertake these first steps, and also to continue the journey by expanding to additional sites and degrees of efficiency. QA is not overwhelmingly difficult or intellectually challenging. With solid staff training, disciplined management, and good facilities, seed QA can reliably make extremely significant contributions to the Nigerian nation and economy on many fronts.

A list of documents requested and supplied is in Annex VII. A summary of the top bottlenecks, issues, and associated recommendations are below and more detail behind the assessment results can be found in Annex II.

**1. Lack of sufficient autonomy of the national seed regulator under NASC. Need for semi- or fully autonomous status.** At present QA is handled as a functional area under NASC and in theory also by NAQS, but it does not appear to be running autonomously or even semi-autonomously. Certification of seed lots is approved even though the seed sampled and tested is not sampled and tested according to accepted scientific practices, protocols, and/or procedures. Lack of qualified staff and functional equipment in field offices argues against solid decision-making, replacing it with either low-quality decision-making, rubber-stamping, shortcuts, or general endorsements. Some seed companies argue that embedded NASC staff lose objectivity and that potential NASC employee involvement in, or ownership of, seed production entities may compromise independence of NASC (though the assessment did not uncover any specific evidence of this). Nigeria does not have a Conflict of Interest policy that would apply to this situation. While it may not be possible under current legislation to establish seed certification under a separate and independent legal entity from NASC, it is possible to empower the current QA units to run semi-autonomously and maintain scientific integrity. Of course, simply setting up the organizational semi-autonomy, alone, is not sufficient to develop and maintain effective QA practices. It is, however, the essential first step.

**2. Lack of ISTA-accredited labs.** There is no ISTA accredited lab and the labs that do exist have substantial inadequacies such as lack of, or poor equipment, poor infrastructure and storage, and technicians lack capacity. See Annex IV and the Seed Lab Site Visit Report for more detail.

**3. Lack of QA for roots and tubers.** At present the only scientifically rigorous *quality control* work undertaken for root and tuber crops is through projects such as the Building a Sustainable, Integrated Seed

System for Cassava in Nigeria (BASICS) project. Under this project, International Institute of Tropical Agriculture (IITA) has provided extensive support to outfit the National Center for Genetic Resources and Biotechnology (NACGRAB) laboratory in Ibadan for project-related quality control. Based on the laboratory's quality control work, the planting material is certified by NASC, but issues such as how to label the planting material are still being worked out. BASICS has developed a field activity and inspection IT tool (Seed Tracker) and interacted extensively with NASC to discuss how to expand quality control and QA activities conducted under the BASICS project to a broader geography and a wider set of crops. To date, the BASICS quality control and QA activity has not been sustainably expanded beyond the project volume, but valuable lessons have been learned and important initial steps taken.

**4. Additional QA functions need to be in place for ICT solutions (Seed Tracker and SeedCodex) to be more effective.** Accuracy, efficiency, and transparency of QA are all strengthened by appropriate and sustainable use of IT tools. NASC has already selected SeedTracker (developed by IITA) and SeedCodex to provide digitized support for field QA operations and certified seed authentication respectively. However, in conducting the seed system assessment in Nigeria it became clear that additional technical vetting was highly advisable if the rollout and desired implementation of the two tools was to be successful and achieve the desired results. In addition, technical IT capacity building, with respect to hardware, software, project management, data capture and analysis, user interface, and more, appears to be needed. Examples of issues that appear to require additional planning and implementation to ensure effective implementation are:

- Seed Tracker usefulness for full certification decision-making, including interface with lab test results
- Seed Tracker interface with payment and accounting modules
- Effective Seed Tracker expansion beyond cassava, for certification purposes
- SeedCodex labelling design and feasibility, as they relate to company compliance with labelling content
- SeedCodex link with QA seed lot numbering for traceability
- SeedCodex pace of uptake with seed companies, and possible challenges and solutions

While SSAT work did not allow for a full exploration of SeedCodex and SeedTracker issues, initial conversations with stakeholders and comparisons with tools fully in use in other countries in Africa give reason to believe that additional technical support focused on how to roll out both tools effectively and comprehensively will be highly beneficial. In addition, if NASC is to fully employ and recognize the benefits of digital tools in seed systems, it is important that NASC has internal project management and technical capacity in place to fully underpin QA activities.

**5. Lack of effective QA activities at agrodealers and other seed distribution points.** Best practices related to protecting and ensuring seed quality at distribution points, and supporting seed distributors to understand and engage in these practices, are broadly related to: 1) registering and tracking qualified distributors; 2) ensuring valid supply chains, including appropriate labeling; 3) identifying and penalizing distributors that adulterate seed; 4) ensuring that carryover stock is returned to seed companies for retesting versus being sold without retesting and relabeling; and 5) verifying good distributor storage conditions that are free of weevils and have appropriate temperature and humidity conditions. NASC has already identified QA improvements at agrodealer and other distribution points as an important priority, however, effective planning and implementation is still to be done. This effort can be supported by sharing information on best practices in other seed systems, in addition to coaching NASC staff on best practices in implementation, record-keeping, and managing non-adherence to QA standards.

**6. Lack of effective two-way dialogue with private sector.** *This constraint was also highlighted under PLR and NPC.* Stakeholders surveyed indicated that government dialogue with private sector occurs

rarely and/or is generally unproductive. SEEDAN, the seed trade association, exists but there is no publicly documented proof of their engagement with government on quality assurance or in policy formulations. SEEDAN weakness as an association may contribute to rare and frequently non-productive dialogue. Stakeholders also indicated that government quality assurance-related communication about seed certification with seed producers and importers is sporadic and/or highly challenging for users and needs improvement and there is currently no way to proactively communicate with government regarding counterfeit or low quality seed.

**7. Lack of funding for QA activities.** *This constraint was also highlighted under PLR and NPC.* The poor status of labs and equipment indicates severe underfunding, as does lack of training, vehicles, and support for inspector facilitation. NASC and NAQs charge for services offered but fee and/or collection levels are reported to be inadequate. Seed companies reported that NASC staff lack resources to do their job well and most seed producers recommended enhanced capacity for NASC to undertake certification services in terms of increasing the number of personnel as well as training to handle different crops. There is also a need for certification officers to be facilitated (via vehicles and imprests) to avoid being compromised by seed companies. There are issues of balancing funding where needed, for example Zaria does the most testing, but has lower levels of staff on a relative basis while many other labs are overstaffed for the volume of tests conducted. Five primary reports cite the lack of budgetary and financial support as a major challenge. Also, worth noting is that fees paid for government services go to general government Treasury when collected via e-payment system.

**8. Lack of regulations and enforcement for QA, including anti-counterfeiting measures.** *This constraint was also highlighted under PLR and NPC.* Based on stakeholder feedback the assessment found that there is no effective implementation of QA activities for seed storage, carryover and retesting, there is no effective verification of proper disposal of obsolete and/or low-quality seed, and while the certification agency has a de facto plan to combat the sale of fake and low quality seed, the efforts are, however, rarely effective at combatting the overall problem. Both farmers and agrodealers reported dissatisfaction with government efforts to prevent sale of counterfeit and low-quality seed. The roll-out of the SeedCodex feature on seed packets is meant to combat counterfeit seed but is currently not fully utilized or functional. Most farmers and agrodealers are not yet trained in use of SeedCodex. There have been some random searches of agrodealer shops by the Seed Inspectorate Unit to establish if seed sold is certified and in sealed packages, which are a positive sign, however, it is reportedly rare that someone is prosecuted.

### Proposed Interventions

**1. Create and maintain an environment and management structure within the Ministry to ensure sufficient autonomy for the seed regulator, so that independent scientific decision-making by qualified experts drives seed regulatory activities and decisions.** *More detail provided under PLR.* This would essentially involve a institutional change within the Ministry.

**2. Upgrade to basic levels of functionality in two regional labs and to ISTA standards in the federal seed quality and phytosanitary lab(s).** Undertake a scoping study led by a highly competent Quality Assurance technical team to specify in detail what needs to be done to bring Nigeria's essential QA processes and procedures up to ISTA-accreditation standards at the two national laboratories (for seed quality and phytosanitary), and to basic, reliable testing standards at the Zaria and Ibadan field offices. Each location has a different starting point, but all need meaningful improvements. These locations are recommended due to their importance in seed production. However, they can also provide upgrade and training experience for laboratory strengthening in other areas of the country. Module 3 of the FAO Seeds Toolkit[15], which focuses on seed quality assurance, can provide a good guide to best practices which

[15] FAO, "Seeds Toolkit Module 3: Seed Quality Assurance", 2018, Available at: http://www.fao.org/plant-treaty/tools/toolbox-for-sustainable-use/details/en/c/1310563/.

should be covered in a scoping study and the resultant specific technical recommendations. The lab site visit report and recommendations conducted a long with the assessment can be used as a starting point (see Annex IV and V).

**3. Align QA and field office staff with QA needs, and deliver comprehensive training for QA staff.** Once the scoping study and procurement plans are in place to upgrade the labs then: 1) review staffing number and skill needs at all locations, and reassign staff to meet, but not excessively exceed, QA requirements including near term anticipated future requirements; and 2) design and carry out training programs for both federal and regional QA staff to ensure appropriate procedures are followed for all QA activities, and that all staff assigned to perform QA activities have the requisite training. Training should be developed to cover all functional areas of QA, including registering growers and grower fields, sampling, sample intake, sample storage and disposal, testing, analysis, record-keeping, equipment maintenance and calibration, auditing, and communication with service users. In addition, training to contribute to user knowledge and improvement will be important, as will be training on basic computer skills such as Excel usage. Staff assignment planning should also include planning for career paths, continued education, rotational assignments, and preparation for future responsibilities such as auditing third party inspectors and coordinating the development and oversight of e-certification.

**4. Conduct a scoping study to recommend how to develop and deliver a national QA approach for root and tuber crops.** It is recommended that a working team conduct a scoping study related to how to transfer the lessons of BASICS and other relevant projects to a broader playing field in Nigeria, including the field laboratories under NASC. However, the composition of this team will be key, as no one group has all the requisite knowledge to develop a plan. Technical collaboration will be critical, in addition to the introduction of perspectives not included, thus far, in working discussions. The working team should include expertise related to root and tuber production, root and tuber QA and laboratory work, root and tuber labeling practices, QA IT practices especially those related to certification, root and tuber inspection logistics, various types of root/tuber planting material propagation (such as tissue culture), and root and tuber planting material marketing and distribution.

**5. Review NASC current and desired IT tools and capacity, including a viable pathway to implement rollouts of SeedTracker and SeedCodex**. While some initial steps have been taken, more work needs to be done to scope, plan for, and implement the internal NASC IT capacity needed to effectively implement QA activities. The recommendation is to contract technical expertise to work with NASC to address the issues highlighted above, covering both internal NASC IT capacity and effective use of both Seed Tracker and SeedCodex as potentially important support tools for QA in Nigeria.

**6. Develop capacity for effective QA activities at agrodealers and other seed distribution points.** The recommendation is to support NASC planning and implementation efforts by availing qualified technical support to the NASC team to develop an initial plan and to provide implementation coaching as needed. It is assumed that staffing costs and "post-pilot" travel costs will be covered by NASC, that seed testing costs will be provided on a pro bono basis by NASC laboratories, and that IT equipment needed will be covered under recommendation #5.

**7. Establish an SMS-based farmer feedback loop (FFL) to empower farmers to raise issues when fake or low-quality seed is purchased**. The most critical element of any quality assurance system is the end user. This is often forgotten with seed quality assurance, or willfully overlooked. Farmer feedback with respect to seed quality is an essential part of ensuring that all parties are fulfilling their obligations.

- Seed companies need to produce, store and market seed that meet mandated standards

- Regulators need to design and oversee the processes and support that maximize the likelihood that standards are met, and take appropriate action when they are not
- Agrodealers need to store and handle seed to maintain quality, and advise farmers on how to also maintain seed quality until planting time
- Farmers need to handle and plant seed in line with best practices, in order to realize the value of certified seed

As there are many actors in the seed QA chain, feedback to understand when a link is broken is essential. Farmers can provide this if a feedback loop is established. The recommended approach is the design, roll-out and annual implementation of an SMS-based FFL messaging tool that is free to farmers, to empower them to report low quality and fake seed to the regulator when they encounter it. The SMS-based FFL is set up to be used by farmers after planting and emergence, when farmers can ascertain seed purity, germination, vigor, pests and insects in the packaging, and possibly the presence of any seed-borne diseases. This system is different from a scratch-off authentication system, which serves to let the farmer know at the time of purchase that the seed is genuine and certified.

A similar program has been rolled out in Kenya, accompanied by radio advertising after the planting season. Farmers can send a free SMS message to the regulator, delivering information which includes the problem they encountered, the crop, the variety, and the seed brand. A key element of the program in Kenya is that the seed companies and agrodealers are alerted in advance by the regulator that the program will be run in the coming season, which encourages seed producers and distributors to take extra precautions to ensure that low quality seed does not make it to the market and is planted by farmers.

**8. Ensure functional, two-way stakeholder dialogue on QA issues.** *More detail provided under NPC.* This will entail ensuring regular public/private meetings are held, with joint agenda setting including QA issues, with sufficient advance notice, joint agreement on optimal meeting times, and openness to participation by all relevant stakeholder. This may be accompanied by establishing regular feedback channels for follow up on meeting discussions.

**9. Develop and implement sustainable funding plans (both operating and capital expenditure) for QA activities.** *More detail provided under NPC.* This will entail establishing clear payment flows for government-provided seed services back to agency providing services to generate investment revenue; exploring the feasibility of significantly increasing fees charged to QA service users, in parallel with increased delivery of strong QA value through improved services (i.e. accuracy, timeliness, support for improvement); establishing a budget for covering a portion of operating expenses not covered by service fees, or requiring bridge funding while fees are collected; and developing capital expense investment budget to cover acquisition of assets for labs and QA activities such as vehicles, building repairs, equipment, etc.

**10. Develop and ensure legally mandated approval of functional regulations for QA that align with international best practices / Implement legal enforcement measures to uphold QA standards.** *More detail provided under PLR.* Develop functional operational regulations for both seed quality and phytosanitary QA purposes based on recently passed Seed Act. Ensure there is transparent availability of regulations to both public and private stakeholders. This will also entail ensuring legal enforcement for violations of government QA regulations, including the following: seed company knowingly promoting sale of low quality seed, or failing to take the steps necessary to determine seed quality before sale; manufacturing and/or sale of counterfeit/fake seed by any party; seed distributors knowingly promoting sale of low quality seed, or failing to take the steps necessary to preserve seed quality prior to sale; and enforcing accuracy of information on all seed labels. Then the government will need to publicize legal enforcement efforts and results.

## Cost Estimates

Overall, high level cost estimates for implementing the recommended interventions ranges from a low of $498K to a high somewhat above $1 million to scope and initiate activities under the recommendations. More detail of elements included in the cost estimates along with the expert's suggestions in terms of sequencing can be found in Annex III.

| No. | Recommended Intervention | Low (USD) | High (USD) |
|---|---|---|---|
| 1 | Create and maintain an environment and management structure within the Ministry to ensure sufficient autonomy for the seed regulator. | Requires institutional decisions about structure. Estimated cost for legal work included under PLR. | |
| 2 | Upgrade to basic levels of functionality in two regional labs and to ISTA standards in the federal seed quality and phytosanitary lab(s). | $78,000 | $234,000 |
| 3 | Align QA and field office staff with QA needs, and deliver comprehensive training for QA staff. | $159,100 | $291,000 |
| 4 | Conduct a scoping study to recommend how to develop and deliver a national QA approach for root and tuber crops. | 55,000 | $112,630 |
| 5 | Review NASC current and desired IT tools and capacity, including viable pathway to implement rollouts of SeedTracker and SeedCodex. | $50,000 | $120,000 |
| 6 | Develop capacity for effective QA activities at agrodealers and other seed distribution points | $67,500 | $123,000 |
| 7 | Establish an SMS-based farmer feedback loop (FFL) to empower farmers to raise issues when fake or low-quality seed is purchased | $88,000 | $152,000 |
| 8 | Ensure functional, two-way stakeholder dialogue on QA issues. | Included under NPC | |
| 9 | Develop and implement sustainable funding plans (both operating and capital expenditure) for QA activities. | Included under NPC | |
| 10 | Develop and ensure legally mandated approval of functional regulations for QA / Implement legal enforcement measures to uphold QA standards. | Included under PLR | |
| | ***Grand Total*** | ***$497,600*** | ***$1,032,630*** |

## Validation, Prioritization and Feedback

The Nigeria validation break-out session held on March 4, 2021 to cover the QA and seed system production and distribution thematic areas included representatives from NASC, NAIDA, FMARD, IAR, NRCRI, seed companies, and AGRA. The sections below highlight the major suggested changes and how they were integrated into the bottlenecks and recommendations mentioned above.

**Validation Feedback.** Participants did not provide any ratings as to the level of impact or ease of implementation for the proposed QA interventions, but they did provide the following feedback:

- **#1 Create and maintain an environment and management structure within the Ministry to ensure sufficient autonomy for the seed regulator.** The validation group added, "so that independent scientific decision-making by qualified experts drives seed regulatory activities and decisions." This addition is entirely concordant with the expert findings and recommendation.
- **#2 Upgrade to basic levels of functionality in two regional labs and to ISTA standards in the federal seed quality and phytosanitary lab(s).** The validation group added "Upgrade to basic levels of functionality (Tier 2) in **four (4)** regional labs **minimum** and to international standards in the federal seed quality and phytosanitary lab(s)." The experts' findings and recommendation underline the need to sequence this effort starting with ISTA accreditation of the central NASC laboratory and two regional seed labs, in order to establish strong operations, build credibility in sample handling and testing, develop regular performance audits on regional seed labs, and participate in performance benchmarking with international seed labs. The validation meeting indicated that Tier 2 laboratory upgrading would cost about $45,000 and that central laboratory upgrading to international standards

would cost about $150,000, exclusive of training and addition of cold storage. These are design adjustments.

- **#3 Align QA and field office staff with QA needs and deliver comprehensive training for QA staff.** The validation group added "including logistics empowerment". This addition aligns with the assessment finding that inspectors and samplers should have transportation support to reduce their dependence on seed companies for logistics support and improve their ability to carry out independent inspections on a timely basis.
- **#4 Conduct a scoping study to recommend how to develop and deliver a national QA approach for root and tuber crops.** Participants agreed that a national QA approach for root and tuber crops is lacking and needs to be developed.
- **#6 Develop capacity for effective QA activities at agrodealers and other seed distribution points.** Participants added more specifics around, "Practices, are broadly related to: 1) registering and tracking qualified distributors; 2) ensuring valid supply chains, including appropriate labeling; 3) identifying and penalizing distributors that adulterate seed; 4) ensuring that carryover stock is returned to seed companies for retesting versus being sold without retesting and relabeling; and 5) verifying good distributor storage conditions that are free of weevils and have appropriate temperature and humidity conditions."
- **#7 Establish an SMS-based farmer feedback loop (FFL) to empower farmers to raise issues when fake or low-quality seed is purchased.** Participants added, **"**and when farmers spots suspicious planting material (use Kenya system as a model)." The addition of planting material makes the recommendation inclusive of vegetatively propagated crops or nursery plants.
- **#9 Develop and implement sustainable funding plans (both operating and capital expenditure) for QA activities.** Participants added, "including contributions from beneficiaries of the seed systems." The assessment team assumed that sustainable funding plans would include the federal and state budgets for operations and capital investments, revenue from mandated service fees and delivery of services e.g. training, grants, and other sources which could include contributions.
- **#10 Develop and ensure legally mandated approval of functional regulations including QA / Implement legal enforcement measures to uphold QA standards.** The validation group suggested adding "reviewing and updating QA standards and procedures that align with international best practices". The participant addition adds the reference to international standards.
- **New** - The validation group made a new recommendation that they ranked in eighth ($8^{th}$) priority: "the need to support innovations that will improve efficiencies of the services for QA by authorization of third party to offer certification services." This recommendation is part of the NASC strategic plan. The expert assessment agrees with this point, but it suggests that sequencing is important. The recommendation text emphasizes that it is essential to establish a working dynamic among public regulatory staff that ensures that QA is done to the same standard consistently, before the seed service transitions to supervising, auditing, and certifying seed inspected, sampled, and/or tested by third-party services.

**Prioritization feedback.** The table below displays the proposed prioritization and sequencing of interventions given by the expert along with the prioritization feedback from the participants given during the validation workshop.

| No. | Recommended Intervention | Expert Proposed Priority | Validated Priority* |
|---|---|---|---|
| #1 | Create and maintain an environment and management structure within the Ministry to ensure sufficient autonomy for the seed regulator. | 1 | 1 |
| #2 | Upgrade to basic levels of functionality in two regional labs and to ISTA standards in the federal seed quality and phytosanitary lab(s). | 2 | 4 |
| #3 | Align QA and field office staff with QA needs, and deliver comprehensive training for QA staff. | 3 | 2 |
| #4 | Conduct a scoping study to recommend how to develop and deliver a national QA approach for root and tuber crops. | 4 | 7 |
| #5 | Review NASC current and desired IT tools and capacity, including viable pathway to implement rollouts of SeedTracker and SeedCodex. | 5 | 9 |
| #6 | Develop capacity for effective QA activities at agro-dealers and other seed distribution points | 6 | 6 |
| #7 | Establish an SMS-based farmer feedback loop (FFL) to empower farmers to raise issues when fake or low-quality seed is purchased Establish an SMS-based farmer feedback loop (FFL) to empower farmers to raise issues when fake or low-quality seed is purchased and when farmers spots suspicious planting material (use Kenya system as a model) | 7 | 10 |
| #8 | Ensure functional, two-way stakeholder dialogue on QA issues. | 8 | 11 |
| #9 | Develop and implement sustainable funding plans (both operating and capital expenditure) for QA activities. | 9 | 5 |
| #10 | Develop and ensure legally mandated approval of functional regulations for QA / Implement legal enforcement measures to uphold QA standards. | 10 | 3 |
| New | Improve efficiencies of the services for QA by authorization of third party to offer certification services | | 8 |

# SEED PRODUCTION AND DISTRIBUTION

## Vision

Certified seed of improved staple food crop varieties in low-income countries often holds a total market share of ten to twenty-five percent because of reuse by farmers of open-pollinated and self-pollinating varieties, with hybrid maize being the exception. Recycling of seed leads to a decline in the vigor and genetic drift that limits the upper bound of productivity that farmers can achieve. A healthy seed system that can redress these issues can be envisioned as one in which the seed production and distribution system includes the following:

- Farmers are aware of new varieties and the benefits of replacing their old varieties with newer ones that are more productive, climate-smart, and aligned with end-user demand;
- Commercially sustainable production of high quality, improved seed of the demanded varieties that is responsive to the evolving needs of farmers is available; and
- An extensive and robust distribution network that enhances farmer access to and choice of improved varieties that are financially accessible.

## Methodology

The assessment of the seed production and distribution system was broken down into three sub-thematic stages: early generation seed production (breeder and foundation seed), commercial production (certified seed), and distribution (agro-retailers.) The methodology used for each of these stages was designed to respond to the type of stakeholder participating in that stage (such as the seed units of research institutions producing early generation seed, private seed companies, and agro-retailers who sell seed to farmers). The disaggregation of findings by stakeholder type was important because each stakeholder has unique operating models, access to resources, and, therefore, very different experiences and perceptions.

The assessment was guided by three primary strategic objectives with tailored indicators and questions to each stage of the system and by consideration of crosscutting issues among them. The primary strategic objectives were the following:

1. Strategic planning and management (clear business models, organization strategy, performance management, roles, and responsibilities)
2. Capabilities (seed production, post-harvest processing and storage, and distribution, internal quality control and assurance, seed marketing)
3. Resources (budget and finance, personnel experience, infrastructure)
4. Crosscutting (perceptions of suitability of varieties released, equitable access to seed, awareness of programs)

For each stage, the experts gathered three types of information that were both quantitative and qualitative: 1) basic demographic information, 2) data to help determine the vitality of the system, such as volumes produced and sold and access to infrastructure and finance, and 3) attitudinal responses that were stakeholder perceptions of the health of the system and awareness of government programs. The experts used a combination of digitized and phone-based surveys, guided questionnaires, and key informant interviews.

More detailed information on the methodology can be found in Annex II and in the SeedSAT Guide.

# EARLY GENERATION SEED

Nigeria has a three-tier system of seed production and multiplication: breeder seed, foundation seed, and commercial or certified seed under the seed certification scheme. While EGS systems and specific roles and responsibilities vary across the four selected crops for this study, some general themes resonate across crops. Early generation seed, which consists of breeder and foundation seed, is produced by CGIAR

Centers, NARIs, not-for-profit offshoots of CGIAR Centers and research institutes, and by private seed companies. Historically, the National Seeds Service under NASC was responsible for foundation seed production, but under the current National Seed Policy, foundation and certified seed production is led by the private sector. NASC is now responsible for the supervision, monitoring, coordination, assurance of quality, and certification, including licensing private seed companies to produce foundation and certified seeds[16].

The assessment tool consists of a 113-question digital self-assessment questionnaire administered to EGS producers of the focus crops and a supplemental seed volume trend analysis. A total of six EGS producers were targeted. However, only three entities completed the questionnaire. The assessment originally intended to also include a cost of production analysis to produce benchmark comparisons between stakeholders. Unfortunately, as the experts began to conduct the assessment, it was apparent that stakeholder record keeping was not capturing cost information at a level of detail to make this possible. See Annex II for graphic results of the EGS self-assessment. The findings below are primarily based on interviews with key EGS system stakeholders, ongoing project experience, and secondary research.

## Findings

The Nigerian EGS system will benefit from improved cohesion, as it is currently represented by a patchwork of donor-funded, CG-facilitated initiatives that are crop and crop-category-specific. EGS access is driven by a web of personal & professional relationships between breeders, EGS seed units, seed companies, commercial farms, and institutional buyers (NGOs and federal & state governments). As a result, access to high-quality EGS is constrained for all focus crops.

NASC has the mandate for national seed demand forecasting and seed production planning; however, its Seed Coordination and Management Services Department is not performing this function due to a confluence of technical, human capital, and financial resource constraints. Therefore, demand forecasting and production planning activities to coordinate across crops and institutions are nonexistent. NASC's Seed Information, Data Management and Capacity Building Department is also not providing real-time tracking and reporting of seed volumes (including EGS) produced, available, and demanded at a variety level. NASC's ambition, as articulated in its five-year strategic plan, is to "drive seed production planning for the different classes of seeds in Nigeria" by 2024. The current seed system sorely needs this kind of strategic leadership to guide the industry and to facilitate connectivity between stakeholders.

As a result, coordination and search costs for basic seed industry information are high, and there is not a transparent, systematic process that informs how EGS production and distribution decisions get made. EGS producers, when they are not producing to hit specific volume targets defined through donor projects, are making unilateral projections of demand that are not based on historical sales volumes, informed forecasts from government institutions, or down payments from orders from buyers (such as seed companies, research institutions, commercial farms, NGOs, ADPs, or other institutional buyers). Demand for EGS, therefore, comes long after production decisions have already been made. In such a decentralized, disorganized, and uncoordinated model, there is assuredly duplication of efforts that increase the average cost of EGS production in the country and reduce the overall availability of demanded seed in the system.

From seed companies' perspective, the level of satisfaction with parental seed quality and quantity varies by crop and institution. For example, of the eight seed companies that indicated NARIs are the main source of parental rice seed, 62.5 percent indicated that they were Satisfied or Very satisfied with the quality of seed they receive. The other 37.5 percent were *Very unsatisfied*. A second example is that for

[16] Nigeria Early Generation Seed Study, Country Report by Feed the Future: Building Capacity for African Agricultural Transformation Project (Africa Lead II) for the United States Agency for International Development, August 2016.

the four companies sourcing cowpea parental seed from NARIs, 75 percent indicated that they were *Satisfied.* The remaining 25 percent were *Very unsatisfied*.

Recent donor-supported initiatives have meaningfully increased the volume of EGS for maize ( private producers and BMGF-sponsored startup foundation seed company), rice (private producers and AfricaRice), cowpea (AVISA), yam (YIIFSWA II and AfricaYam), cassava (BASICS I & II). This is important because, for EGS, which is a public good, the cost to the agricultural system of underproducing is often higher than overproducing. But because seed production decisions are made at an institution-level, within the context of their unique priorities, capabilities, and resource bases, volumes produced are often less than would be optimal for the whole of the system.

Through these initiatives and others, the EGS systems are making improvements; however, future sustainability remains uncertain.

- **NARIs are establishing private seed company offshoots.** Institute for Agricultural Research (IAR) and National Roots Crop Research Institute (NRCRI) have established seed companies that are subsidized through the provision of personnel and facilities from their mother institutions and through donor-funded initiatives.
- **IITA GoSeed's evolution**. IITA GoSeed is a registered seed company established on the IITA campus with the goal of becoming a financially sustainable EGS production and distribution entity. Its initial focus was on producing EGS of commercial crops like soybean and maize before it expanded to EGS production of vegetatively propagated crops like cassava by leveraging a SAH-based production system (plantlets)[17], on-station nursery, and off-station outgrowers. IITA GoSeed is also the exit plan for the YIIFSWA-II project, which is a yam seed system development project. While both the cassava and yam initiatives have linkages to commercial EGS buyers (industrial processors, private seed companies, and community seed entrepreneurs), the cost of operations exceeds seed sales. The cost-revenue gap is bridged through the allocation of project resources to seed production operations and the ability of IITA GoSeed to leverage resources from IITA, including personnel, field management services, management systems, and physical resources. The tension between filling a critical EGS gap, which is a public good, and profit-making has resulted in a strategically conflicted organization. For example, IITA GoSeed is increasingly focused on crop seed with the highest profit potential, like soybean, and has discontinued the production of EGS of less commercial crops, like cowpea.
- **Private seed companies are producing EGS**. A recent initiative by USAID and AGRA through the *Increasing Production and Dissemination of Quality EGS to Improve Income and Food Security of Farmers* project to boost the production of EGS by private seed companies has been successful in increasing the supply of rice, maize, and soybean EGS. In just two years' time, two seed companies (Value Seeds Ltd. & Premier Seed Nigeria Ltd.), which were judged to have EGS production capabilities, have become the largest producers of EGS in the country. Management at these companies indicate that while sales in the first year were underwhelming, sales in the most recent year exceeded expectations and that they intend to produce EGS beyond the life of the project for sale and for use in their own commercial seed operations. Given the emergence of an independent foundation seed company, these seed companies are positioning their EGS production initiative as a potential stop-gap measure until such time as a trusted, independent foundation seed company is actually established. Essentially, its bet is that (1) the market is large enough to support multiple producers of EGS and that (2) it is unclear when a viable alternative will come into existence and that in the meantime, there is a need for high-quality EGS, which these companies are capable of producing and marketing profitably.
- **Independent foundation seed company for West Africa (EcoBASICS)**. To address the want for an independent, "honest broker" that produces EGS, BMGF recently granted African Agricultural

[17] semi-autotrophic hydroponic

Technology Foundation (AATF) funding to establish an organization like QualiBasic[18] in East Africa, but for Nigeria, which will be named EcoBASICS[19]. This startup foundation seed company will be based in Kaduna, and its vision is to "be recognized as West Africa's most reliable source of high-quality foundation seeds." EcoBASICS would address seed companies' concern of over-relying on their competitors for parental seed supply but is still in its infancy. AATF has been actively recruiting for the Managing Director position who will guide the organization's development process and manage day-to-day operations. The near-term focus of the organization will be on producing parental lines of hybrid maize. It is expected that over time the seed crop portfolio will expand to other crops where there is seed company demand, like rice and soybean.

- **AfricaRice is also implementing** its Consortium of Rice Seed Enterprises and Millers[20] (COSEM-Riz) model, which operates as a kind of regional hub and spoke model for breeder seed production and partnerships for downstream production, capacity building, and new rice product promotion. Interviews with seed companies and the rice seed production unit at AfricaRice indicate that this model is working well. Companies appreciate the high quality of rice EGS that AfricaRice centrally produces in Mbe, Cote d'Ivoire, as reflected by the 1.5X price premium for breeder seed over NRCI. However, seed company executives indicated that demand for AfricaRice EGS of mega varieties, like FARO 44, FARO 66, and FARO 67, exceeds supply. As one executive put it, "There are more seed order booking than AfricaRice can produce. We place orders close to harvest time, and major varieties are often stocked out.
- **Direct from breeders**. For more informal seed systems like yam, seed companies are able to access small quantities of improved varieties in plantlet, tuber, and stem form through projects at IITA (fewer selection of varieties, higher volume) and directly from breeders (more selection of varieties, lower volume). Breeders will continue to be a source of breeder seed for seed producers, especially for new, non-project promoted varieties that are not in production by IITA GoSeed, NRCRI, and IAR Seeds. A testament to this is an initiative underway to establish a satellite production system at IITA Abuja that will be administered by yam breeders and has a two million plantlet production capacity.

With concurrent initiatives operating independently, the sustainment of progress made on Nigeria's EGS seed production is tenuous, with numerous unanswered questions. Will donor-funded projects increasingly shift funding for EGS production from CGIAR Centers and NARIs to private producers? How will EcoBASICS collaborate with existing EGS producers of maize, like GoSeed, IAR, Institute of Agricultural Research and Training (IAR&T), and private seed companies? Can offshoots of CGIAR Centers and NARIs become viable and scalable business units?

The results from the assessment highlight current progress and constraints and provide input for identifying and addressing high-impact opportunities.

**1. Underfunded seed system development policy, strategy, and implementation.**

A framework exists for interventions and corresponding activities to be prioritized through the recently developed National Seed Roadmap (NASC & SEEDAN) and NASC's Five-Year Strategic Plan (2019-2024). Both align to the same development agenda. However, the lack of dedicated public sector funding stymies stakeholders' ability to follow through on the transformation roadmap unless there is meaningful donor investment.

[18] "QualiBasic Seed Company (QBS) was established with the main objective to produce and supply quality foundation Seed (basic seed) to seed companies in East and Southern Africa, with the aim to be their preferred supplier of Foundation Seed, to the ultimate benefit of Africa's farmers." See https://qualibasicseed.com/.

[19] Note that the EcoBASICS name has been reserved for registration but may change if it is not registered within the stipulated time.

[20] See "Consortium of Rice Seed Enterprises and Millers (COSEM-Riz), Partnership Guidelines" at https://43c018b3-2e2d-4407-af86-1d6495506405.filesusr.com/ugd/0839e4_7cc313fa085845a9bb990a7ccccea680.pdf

**Proposed interventions.**

a) Align the focus and priorities of seed sector partners and existing donor programs to avoid duplication of initiatives targeted at developing the seed industry and funding of similar interventions with minimal impacts
b) Establish Nigeria Seed Sector Development Fund (NSSDF) to resource seed production, new varietal promotion, and capacity building for seed producers (NASC & EGS Country Study)
c) Increase seed industry information availability & exchange through the design, implementation, and active management of an online Information Management System that enables access to EGS supply and allocation plans, historical seed volume data, variety catalogs, industry announcements, and public tenders (NSRM)

Start by establishing a seed sector working group, which may be an independent or a subset of the existing agricultural donor working group for donors and strategic partners such as AGRA, BMGF, WUR, IITA, etc. The working group would be responsible for the alignment of seed sector priorities with NASC's short-to-medium term strategy and national priorities for agriculture. It can ensure that funds are channeled towards seed sector development programs in a coordinated and transparent manner to achieve accountability and impact. The working group could also play a role in the development and administration of the seed fund described below.

NASC developed and submitted a concept note for the establishment of a Nigeria Seed Sector Development Fund (NSSDF) for public funding consideration. The NSSDF is broadly framed with a purpose to increase the "*availability and provision of investment funds for the sustainable development of the entire Nigerian Seed Sector (from varietal development, registration, release, protection, certification, extension, production, planning, monitoring, tracing, marketing, regulation, quality control to import, export and commercialization of quality seeds in the country)*." While the probability of securing public funds for seed sector development is low based on historical experience, the thrust of this initiative to increase capital availability and deepen credit markets for the seed industry is much needed.

Under a scenario where public sector funding for the NSSDF is unlikely to materialize, an alternative path could be taken to establish a fund that is more narrowly focused on enabling Nigerian seed producers to produce and distribute a reliable supply of breeder, foundation, and certified seeds of demanded varieties and to actively promote new, elite seed varieties. This independent fund could be called the Nigeria Seed Fund (NSF). The NSF could at some point be institutionalized as a part of the Nigerian government. However, the near-term priorities of the NSF would be to:

- **Ensure a minimum quantity of EGS is available for commercial seed producers** through tenders for EGS volumes on a variety and seed class basis that meet minimum quality thresholds (germination & purity). There is potential to use this mechanism to evaluate the customer service and quality seed production & distribution capabilities of various EGS producers and to identify high-valued capacity building opportunities. Seed samples could be evaluated by multiple labs (public & private) within the country to similarly baseline technical capacity.

- **Cost-share new seed product promotion and marketing** by private seed companies, agrodealers, research, and extension. For example, through partnerships between breeding teams and seed companies to apply the triadic comparison of technology options (tricot) demonstration methodology to solicit farmers' opinions on improved varieties.

- **Establish specialized seed producer financing**, including working capital financial product for the buyback of raw seed from outgrowers (revolving fund) incentives for large capital expenditures and

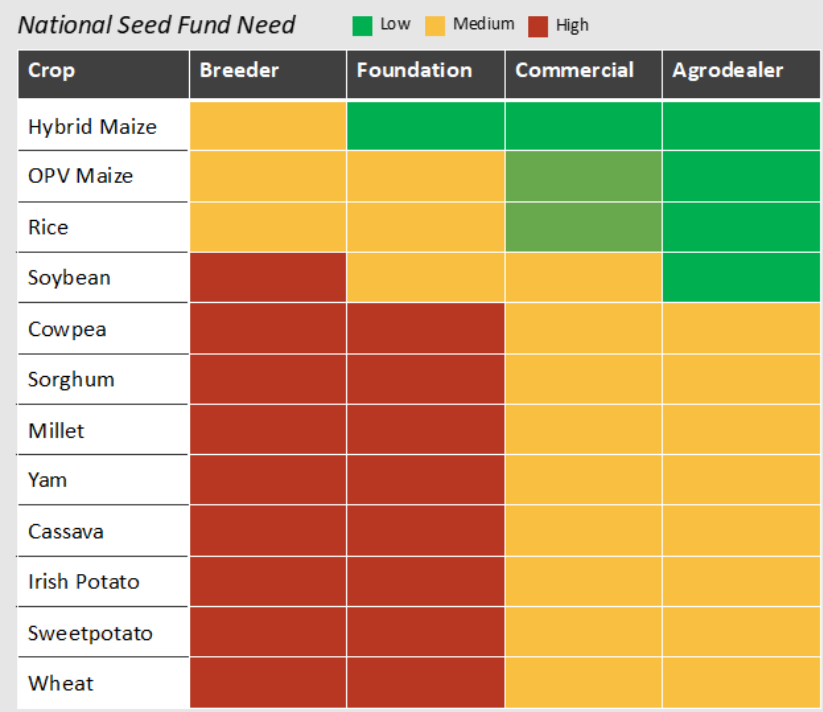
(such as irrigation, field mechanization equipment, seed processing equipment, quality control systems)

- **Increase information availability and reduce search costs** by facilitating the development of market information systems through NASC.

The NSF would recognize that there are tradeoffs between investing in crop "A" vs. crop "B" and would be intentional about investing where returns to farmers are greatest. This means focusing on the crops and seed value chain segments where commercial activity is insufficient to increase Nigerian farmers' awareness of, demand for, and adoption of improved seed varieties.

In practice, this means investing in crops and value-chain segments where the need is highest. For commercial crops (hybrid maize, OPV maize, rice, and soybean), the NSF might play an accelerator role – enabling the scale of formal seed systems through matching grants to seed companies linked to impact targets. This could be analogous to the AGRA Program for Africa Seed Systems (PASS)and Africa Enterprise Challenge Fund (AECF) Models. For secondary crops, such as cowpea, yam, sorghum, millet, cassava, Irish potato, sweet potato, wheat, the NSF could play a more foundational, enabling role – for example –around priming commercial seed producer and farmer "awareness" about improved varieties and issuing tenders for specific volumes of EGS to support. The figure below provides a qualitative assessment of the perceived "need" by crop and value-chain step for additional funding, with red representing a higher need for funding and green representing a lower need for funding.

*Figure 3: Seed funding need by crop and producer and distributor type*




| Crop | Breeder | Foundation | Commercial | Agrodealer |
|---|---|---|---|---|
| Hybrid Maize | | | | |
| OPV Maize | | | | |
| Rice | | | | |
| Soybean | | | | |
| Cowpea | | | | |
| Sorghum | | | | |
| Millet | | | | |
| Yam | | | | |
| Cassava | | | | |
| Irish Potato | | | | |
| Sweetpotato | | | | |
| Wheat | | | | |

Funding decisions could be taken by an Investment Committee, which is envisioned as a strategy forming, decision making, and public advocacy body that provides oversight for the NSF. The Investment Committee would be charged with hiring the Fund Management Firm and Executive Director (ED) responsible for overseeing the operations of the NSF, including leading the development of the NSF's operating plan, recruiting & onboarding team members, and executing day-to-day activities. The ED is likely to be a senior leader from within the investment management firm.

The Investment Committee could be composed of six to eight respected senior leaders from the Central Bank of Nigeria (CBN), the Ministry of Finance, Budget and National Planning, Federal Ministry of Agriculture and Rural Development (FMARD), NASC, and contributing donors. It could be headed by a Chairperson who is elected by the Investment Committee. The selection of Investment Committee members is important and would ideally be underwritten by an independent organization or consultant who can identify and recommend qualified candidates to the funding organization for selection. Due to potential conflicts of interest, representatives from Nigerian seed companies and research institutions are not expected to among the Investment Committee members.

The NSF could be initially funded with capital from international donors and development banks and domestic, public sector sources like CBN, Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL), and FMARD.

**2. EGS supply and quality constrained by technical and resource limitation at research centers**
NARI's have the mandate in Nigeria for breeder seed production but lack the capacity to serve the variable demand from private seed companies.

**Proposed interventions.**

a) Resource the management and facilitation of bi-annual EGS demand forecasting and production planning meetings on a crop-specific basis with breeder, foundation, and commercial seed producers; actively monitor seed yield projections throughout season and re-forecast as needed.
b) Define minimum volumes of EGS to be produced on a varietal-level annually (regardless of capitalized demand) to ensure the availability of public goods.
c) Define minimum internal quality control facilities, capacity, and standard operating procedures for EGS producers.
d) Upgrade irrigation, field mechanization, seed storage, processing, and treatment capabilities at EGS producers to exceed minimum standards.
e) Support the emergence and operations of private sector EGS entities to supply quality seeds sufficiently and timely.
f) Engage with institutional buyers that buy palliative seed to encourage them to purchase commercial seed, not early generation seed.

Identify appropriate private resource organizations to collaborate with NASC (through the Seed Coordination and Management Services department) to facilitate a centrally coordinated demand forecasting and production planning strategy. The demand assessment coordination strategy can be designed and piloted with one crop (or crop group) before incorporating lessons learned and scaling to a larger crop set. Regardless of crop, the stakeholders to be engaged for EGS demand forecasting and production planning include breeders, research institutes, seed companies, farmer associations, donor and development organizations. Some of the key factors that will need to be considered when estimating EGS demand include government policies and seed-related projects, the trend in seed replacement rate by farmers, rate of varietal adoption by farmers, release and publicity of new varieties, trends in the production capacity and volumes of seed companies and research institutes, and trends in demand for crop products by end-consumers.

To determine the quality and capacity requirements for EGS producers, it is imperative to conduct a benchmarking analysis to identify best practices; develop standard operating procedures (SOPs) for production, handling, processing, storage, and seed treatment; and conduct training & capacity building for EGS producers. As noted, this evaluation could become more practical through the use of purchase contracts through NSF.

Further, we propose conducting a study to assess the impact of the existing procurement arrangement of institutional buyers from EGS research institutes and the bottlenecks. Following the assessment, organize a sensitization workshop with key stakeholders to discuss the implication of buying EGS as a palliative for distribution to farmers, emphasize its short-term gain and long-term negative seed sector impact and explore appropriate alternative procurement options for institutional buyers.

*Figure 4. Foundation seed being distributed by FMARD for planting to farmers in Borno State*


## COMMERICAL PRODUCTION

The assessment was in the form of a digital questionnaire that was developed in cooperation with AGRA. The questionnaire consisted of 135 primarily close-ended questions with skip-logic that reduced the

average number of questions that respondents were asked to 75. The questionnaire spanned respondent demographic information, seed products, customer segments, marketing approaches, seed trade association affiliation, and perception on constraints, quality assurance system, and seed subsidies. A list of 50 seed companies was developed in collaboration with NASC to be surveyed. SEEDAN was contacted initially to consult on survey design and targeted respondents, but its leadership did not meaningfully engage. The questionnaire was sent by AGRA to the targeted respondents, and four subsequent follow-up emails were sent to increase the response rate. Despite these efforts, only 12 companies (or 24 percent of the targeted respondents) completed the survey. To supplement the underwhelming response rate, one-to-one key informant interviews were held with seven commercial seed producers.

See Annex II for graphic results of the Commercial Production questionnaire findings.

### Findings

Nigeria's commercial seed industry is still in a nascent stage of development and just scratching the surface of its potential.

In Nigeria, certified seed (or commercial seed) is produced by private seed companies (99 percent) and community-based organizations (or Agricultural Development Projects [ADP]) (1 percent). We estimate that seed market size for lowland rice and maize (hybrid and open pollinated varieties [OPV]) are each between $30M and $50M, with ~20 percent of the area to both crops planted with certified seed annually. By comparison, it is estimated that the market size for certified yam, cassava, and cowpea seed to be less than $5M combined and the area planted with certified seed to be below 1 percent for each crop.

Over the past decade, total certified seed production in Nigeria has expanded at a rapid rate of ~30 percent compound annual growth rate (CAGR) between 2008 and 2019 from 6,800 MT in 2008 to over 93,000 MT in 2019[21]. The largest volume increases occurred in OPV maize (at ~36K MT in 2019) and lowland rice (at ~36K MT in 2009), while the rate of hybrid maize expansion has been much slower at ~10 percent CAGR over the same period to ~8.4K MT.

There are a number of reasons that the seed industry has expanded faster for some crops than others, including:

- Public sector initiatives for rice dramatically increased capitalized demand for certified seed. This is evidenced by the proliferation of hundreds of opportunistic, low-quality seed companies as a result of the Growth Enhancement Scheme in 2013-14. NASC recently took the important step of withdrawing the operational licenses of 103 seed companies based on activities that were "contrary to quality and standard[22]" in 2021, which is important for the integrity of the industry, because as one seed company executive put it, "There are 380 seed companies in Nigeria, but only 50 are buying EGS. What are the other companies doing?"
- The business case for rice and maize – particularly for hybrid – seed is clearer and has commercial precedence in comparison to cowpea, cassava, and yam. The institutional purchasing of rice and maize is a key part of the puzzle, but seed companies also cite farmers' awareness of, and willingness to pay for, improved varieties that offer differentiated value and translate into higher average yields.

The commercial seed market in Nigeria is consolidated for hybrid maize, more fragmented for OPV maize and rice, and currently inconsequential for cowpea, yam, and cassava. There are a handful of multinational seed and crop protection companies (such as Bayer, Corteva, and Syngenta), regional seed companies (such as the SeedCo Group), and national seed companies (such as Premier Seed Nigeria Ltd.,

[21] NASC certified seed production volumes reported between 2010 and 2019.

[22] Vanguard. "Agribusiness: NASC Withdraws, Delists 103 Seed Entrepreneurs in 2020." Vanguard News, 22 Jan. 2021, www.vanguardngr.com/2021/01/agribusiness-nasc withdraws-delists-103-seed-entrepreneurs-in-2020/.

Value Seeds Ltd., Techni Seeds Ltd., Da-Allgreen Seeds Ltd., Nwabudo Agro Seeds & Inputs Co. Ltd., Green Agriculture West Africa Ltd., among others) of scale and hundreds of small seed companies that produce less than 200 MT of annually.

These companies' core business is to produce and sell certified maize and rice seed to institutional buyers (47-48 percent), farmers (23-28 percent), agrodealers (21-27 percent), and other channels (3 percent)[23]. Due to the high cost of production of foundation and certified seeds, private seed companies have generally focused on already established markets with popular varieties to reduce risk and realize quick returns. As a result, more remote agricultural areas have often been overlooked because of the high costs of farmer education and the limited number agrodealers[24].

The main institutional buyers of certified seed are federal and state ministries of agriculture, other institutions, and programs that procure seed include Fadama, the NIRSAL, and the CBN[25].

Given the large proportion of sales to institutional buyers, which are secured through tenders and executive-to-executive relationships, combined with the lack of resources to conduct demonstration trials, extension services, and promotional activities, there is neither the incentive nor means for seed companies to increase farmer awareness and purchase consideration of new, improved varieties at scale.

National seed companies are capital constrained and unable to obtain investment and working capital for seed production operations and managing inventory. Many seed companies lack funds to buy back seed from outgrowers, forcing outgrowers to sell seeds as grain. Also, commercial bank loans are extremely difficult to obtain and carry high-interest rates, which inhibits the growth potential of existing companies and discourages would-be entrepreneurs from entering the seed sector. Further, many private seed companies lack sufficient storage to maintain seed inventory in humid environments, which increases production risk. Furthermore, while some of the larger seed companies have high-quality seed processing facilities, many resort to manually processing seeds, which results in unclean seed[26].

Results from the assessment found that companies' top strategic objective is to increase sales of current products within existing markets. Commercial producers' biggest constraints to producing more seed are access to capital, irrigable land with appropriate isolation distances, and field & seed processing equipment.

The assessment highlighted the following constraints and proposed interventions.

**1. The private seed sector is still in its infancy in terms of size and farmer reach**

**Proposed interventions.**

a) Fast-track outstanding payments from FMARD and State Governments to seed companies for seed delivery under the GES; FMARD to work with CBN to remove "blacklisted" classification for seed companies (TASAI).
b) Provide credit risk guarantees (via NIRSAL) on behalf of seed producers to commercial banks to incentivize investment in seed sector; eliminate underwriting requirement that a purchase contract for finished seed be in place ***OR*** FMARD to provide demand assurance to NIRSAL.

[23] Michael Waithaka, Mainza Mugoya, Adesola Ajayi, Folarin Okelola, Krisztina Tihanyi. 2019. Nigeria Brief 2018 - The African Seed Access Index. Available at: tasai.org/reports.

[24] Nigeria Early Generation Seed Study, Country Report by Feed the Future: Building Capacity for African Agricultural Transformation Project (Africa Lead II) for the United States Agency for International Development, August 2016.

[26] Nigeria Early Generation Seed Study, Country Report by Feed the Future: Building Capacity for African Agricultural Transformation Project (Africa Lead II) for the United States Agency for International Development, August 2016.

c) Offer low-interest seed buyback working capital loans to commercial seed companies to enable them the cash flow needed to purchase raw seed purchase from outgrowers until revenue is received from certified seed sales.
d) Make irrigable land with sufficient isolation distances available to commercial seed companies and outgrowers at preferential lease terms.
e) Professionalize seed companies through a partnership between SEEDAN, FMARD, and development partners to provide best-in-class technical and business advisory support services (as proposed in the National Seed Roadmap [NSRM]).

**2. Maize and rice-centric commercial seed production**

Combined, OPV maize, lowland rice, and hybrid maize represented nearly 87 percent of total certified seed production in Nigeria for 2019.

There are three crop-specific, BMGF-supported initiatives ongoing to increase the demand for and supply of prioritized cowpea, cassava, and yam varieties through the AVISA, BASICS II, and YIIFSWA II projects, respectively. For cassava and yam, commercial partners have demonstrated their ability to rapidly multiply parental breeder seed plantlets, which is critical for profit-making and scale with vegetatively propagated crops. But the long-term commercial viability and scalability of these engagements are still to be determined. Beyond the life of these one-off projects, it is essential that an adequately resourced strategy be established to promote new varieties of these less commercially viable crops in collaboration with certified seed system partners. Commercial funding for the marketing and promotion of varieties for these crops will only go so far. Public funding is, therefore, necessary to bridge the gap and incentivize seed producers to invest in production.

**Proposed interventions.**

a) Fund the coordination and establishment of wide-scale post-release demonstration plots, field days, and promotional packs of elite varieties of staple grain, legume, and root and tuber crops in key production areas; partner with breeders, research institutions, universities, National Agricultural Extension and Research Liaison Services (NAERLS), ADPs, commercial seed producers, and advisory services of input suppliers to design and implement on a state-level.
b) Incentivize commercial seed production & marketing of prioritized staple crops.

## DISTRIBUTION

Agrodealers are an important link in the seed supply chain, as they provide smallholder farmers with access to inputs such as seeds, fertilizers, and plant protection products. Although the official number of registered agrodealers in Nigeria is unavailable, most are concentrated in the north, where production volumes are the highest. Agrodealers are the most important distributors of OPV (mainly maize, rice, and soybean) and hybrid seeds produced by local private seed companies, typically buying products from seed companies at a 10 percent discount and selling them at the company price, earning a 10 percent profit margin[27].

Agrodealers are an important link in the seed supply chain, as they provide smallholder farmers with access to inputs such as seeds, fertilizers, and plant protection products. Although the official number of registered agrodealers in Nigeria is unavailable, most are concentrated in the north, where production volumes are the highest.

The experts evaluated the pros and cons of several surveying approaches and chose to pilot a telephone-based survey because of the potential speed and cost advantages over more intensive, in-person

[27] Nigeria Early Generation Seed Study, Country Report by Feed the Future: Building Capacity for African Agricultural Transformation Project (Africa Lead II) for the United States Agency for International Development, August 2016.

approaches. Therefore, a GeoPoll phone survey was designed with AGRA input and administered to 150 agro-retailers in 12 states, with the majority of participants coming from Kaduna, Niger, and Delta states. The reason for the large proportion of agrodealers from three states is that respondents were selected from AGRA's agro dealer contact list in the North Central Region and a cassava-focused agrodealers project in the South South Region of the country. A limitation of this method was that while the experts were able to gather self-reported information and demographics about the agrodealers, there was no opportunity to follow up with key informant interviews to explain data anomalies, inconsistencies and to gather commentary and gain insight as to the reasons for the answers given (the 'why'). However, there are some clear inferences that can be drawn from responses to access to finance.

### Findings

Only 10 percent of respondents reported seed sales making up over 50 percent of annual revenue. Agrodealer respondents indicate that they sell nearly 75 percent of seed to farmer cooperatives and farmers (as opposed to government, NGOs, independent distributors, and retailers), with farmer cooperatives making up the biggest customer segment (by volume).

Agrodealers' primary source of working capital is family, and they cite high cost of seed and inadequate cash to pay suppliers as top constraints to selling more seed.

Rice, hybrid maize, and yam were cited by agrodealers as their most commonly marketed seed products. This is interesting, particularly for yam, with the implication being that the informal seed system is demonstrating value in comparison to farmer recycled seed.

In terms of agrodealers' perception of national quality assurance, nearly 50 percent of respondents say there is no implementation of government inspection of stored and carryover seed. 41 percent say there is no effort by the government to prevent the sale of counterfeit and low-quality seeds.

In terms of ag-retailers perception of the policy, legal and regulatory environment, 42 percent of respondents said that they are rarely satisfied with the government's effort or there are is no effective public/private dialogue. 28 percent of agretailers say there is no effective support or training by the government, while 53 percent say they are sometimes satisfied or rarely satisfied with government efforts in this area.

See Annex II for graphic results of the Distribution survey findings.

The assessment highlighted the following constraints and proposed interventions.

**1. Large public sector buyers place maize and rice varieties in wrong geographies**

Seed company executives bemoan the incorrect placement of varieties by institutional buyers in agroecologies, which does not benefit the farmer nor the reputation of the seed industry or the intermediating agents.

**Proposed interventions.**

a) Consult with commercial seed producers and breeders to define the areas of adaptation for all varieties purchased to inform product placement strategy. Ensure that the same information is transparently available in the national variety catalogue, on FMARD, NASC, and research institute websites.

NASC in collaboration with SEEDAN, and its seed company membership, are best positioned to investigate the prevalence and impact of institutionally purchased seed being placed in the sub-optimal agroecological environment.

**2. Networks of agrodealers are few and do not provide density of coverage**

a) Strengthen the capacity of agrodealers through partnerships with private agro-input providers, state-level ministries, and development actors to increase farmers' access to extension advisory services

and products (build on learnings from Feed the Future's Nigeria Agro-Inputs Activity and ongoing Extension and Advisory Services Activity and AGRA's Community Based Advisor model)

b) Provide agrodealers with preferential access to credit for inventory management (working capital) and investment.

### Validation, Prioritization and Feedback Responses.

The Nigeria validation break-out session held on March 4, 2021 to cover the QA and seed system production and distribution thematic areas included representatives from NASC, NAIDA, FMARD, IAR, NRCRI, seed companies, and AGRA. The sections below highlight the major suggested changes and how they were integrated into the bottlenecks and recommendations mentioned above.

**Validation feedback.**

- **Early Generation Seed.** The participants noted the impact and damage on the Nigerian seed system when government and other programs make large, pre-emptive and unanticipated draws on EGS volumes to bridge immediate supply gaps in planting seed, which not only gouges foundation seed stocks and only benefits a fraction of potential farmers, but also reduces the availability of future certified and planting seed in the system, ultimately exacerbating the shortfall. Additional damage takes place when the solution to planting seed supply shortages is to distribute seed varieties to inappropriate environments (such as when long-season varieties that are distributed to short-season environments), which leads to lower or unrealized yields due to the unsuitability of the destination environment. The damage to the seed system and to farmer trust in seed companies and public procurement takes to recover. (Note the experts for Seed Production and Distribution recommended setting and maintaining a planned level of breeder seed in good storage and ensuring/banning the conversion of foundation seed into planting seed by national or state-level distribution programs, which was reiterated by experts for NPC and PLR.)
- **Commercial Seed Production.** Seed companies and public research institutions both commented on the need for greater public and private sector investment in new variety promotion and marketing. Added recommendations were for: 1) greater new variety vs most currently used variety demonstration so that farmers can judge if the new varieties are superior or not. "They need to see side-by-side," and, 2) the design and implementation of farmer awareness campaigns on quality seed and its value.
- **Distribution.** The plenary session reinforced the need for an information campaign for agrodealers focused on seed quality and seed handling, capacity building on seed handling, and improvement of agrodealer seed storage facilities.

**Post-Validation feedback.** Following validation workshop, additional feedback was received on the following whole system topics:

- **Seed Working Group.** There is a need to establish a seed working group to align the focus and priorities of seed sector partners and existing donor programs to avoid duplication of initiatives targeted at developing the seed industry and coordination to avoid duplication of funding of similar interventions that increase costs without significant impact.
- **Seed Information Management System.** As outlined in the National Seed Road Map (NSRM), increase seed industry information availability and exchange through the design, implementation, and active management of an online Information Management System that enables access to EGS supply and allocation plans, historical seed volume data, variety catalogs, industry announcements, and public tenders.

**Prioritization feedback.** The table below displays the prioritization feedback from the participants given during the validation workshop based on impact (1= low and 3=high) and ease of implementation (1=

hard and 3=easy) scores. The bulk of the break-out session time was spent on the whole system and early generation seed components of the assessment. Commercial seed production and distribution recommendations were discussed more briefly, but time was not sufficient to do the impact and ease of implementation rankings.

| No. | Recommended Intervention | Impact | Ease of Implement-ation | Validated Priority |
|---|---|---|---|---|
| **Whole Seed Production and Distribution System** | | | | |
| a) | Establish Nigeria Seed Sector Development Fund (NSSDF) to resource seed production, new varietal promotion, and capacity building for seed producers (NASC & EGS Country Study) | 3 | 1 | 2 |
| b) | Increase seed industry information availability & exchange through the design, implementation, and active management of online Information Management System that enables access to EGS supply and allocation plans, historical seed volume data, variety catalogues, industry announcements, and public tenders (NSRM) | 3 | 2 | 2.5 |
| **Early Generation Seed Production** | | | | |
| a) | Resource the management and facilitation of bi-annual EGS demand forecasting & prodguction planning meetings on a crop-specific basis with breeder, foundation, and commercial seed producers; actively monitor seed yield projections throughout season and re-forecast as needed | 3 | 3 | 3 |
| b) | Define minimum volumes of EGS to be produced on a varietal-level annually (regardless of capitalized demand) to ensure availability of public good | 3 | 3 | 3 |
| c) | Define minimum internal quality control facilities, capacity, and standard operating procedures for EGS producers | 3 | 2 | 2.5 |
| d) | Upgrade irrigation, field mechanization, seed storage, processing, and treatment capabilities at EGS producers to exceed minimum standards | 3 | 2 | 2.5 |
| e) | Expand contract production of EGS to capable private sector producers when supply shortfalls and quality issues persist | 2 | 1 | 1.5 |
| f) | Mandate that institutional buyers buy palliative seed from authorized commercial seed companies, not EGS from research institutions | 3 | 2 | 2.5 |
| **Commercial Seed Production - These were discussed during the validation break-out session, but time was not available for prioritization ranking.** | | | | |
| a) | Fund the coordination and establishment of wide-scale post release demonstration plots, field days, and promotional packs of elite varieties of staple grain, legume, and root & tuber crops in key production areas; partner with breeders, research institutions, universities, NAERLS, ADPs, and commercial seed producers to design and implement on a state-level | | | |
| b) | Incentivize commercial seed production & marketing of prioritized staple crops | | | |
| c) | Fast-track outstanding payments from FMARD and State Governments to seed companies for seed delivery under the GES; FMARD to work with CBN to remove “blacklisted” classification for seed companies (TASAI) | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| d) | Provide credit risk guarantees (via NIRSAL) on behalf of seed producers to commercial banks to incentivize investment in seed sector; eliminate underwriting requirement that a purchase contract for finished seed be in place OR FMARD to provide demand assurance to NIRSAL | | | |
| e) | Offer low-interest seed buyback working capital loans to commercial seed companies to enable them to cashflow raw seed purchase from outgrowers until revenue is received from certified seed sales | | | |
| f) | Make irrigable land with sufficient isolation distances available to commercial seed companies and outgrowers at preferential lease terms | | | |
| g) | Professionalize seed companies through partnership between SEEDAN, FMARD, and development partners to provide best-in-class technical and business advisory support services (NSRM) | | | |
| h) | Consult with commercial seed producers and breeders to define the areas of adaptation for all varieties purchased to inform product placement strategy | | | |
| **Distribution – These were presented at the Validation Workshop and discussed in brief at the break-out session, but there was insufficient time for prioritization and ranking.** | | | | |
| h) | Consult with commercial seed producers and breeders to define the areas of adaptation for all varieties purchased to inform product placement strategy. Ensure that the same information is transparently available in the national variety catalogue, on FMARD, NASC, and research institute websites. | | | |
| i) | Strengthen the capacity of agrodealers through partnerships with private agro input providers, state-level ministries, and development actors to increase farmers' access to extension advisory services and products (build on learnings from FtF's Nigeria Agro-Inputs and Agricultural Extension and Advisory Services activities and AGRA's Community Based Advisor model) | | | |
| j) | Provide agrodealers with preferential access to credit for inventory management (working capital) and investment | | | |

# NATIONAL AGRICULTURE RESEARCH AND BREEDING EFFECTIVENESS

## Vision

The key metric for the success of a breeding program is the rate of genetic gain it delivers in farmers' fields. Investments in breeding programs in Ethiopian Institute of Agricultural Research Institute (EIAR)

can only be justified if there is genetic gain over time, thus the need to embark on system changes that would improve the ability of the research system to generate and deliver products efficiently and timely. The vision of a healthy system includes the following:

- Well-articulated and prioritized product profiles that are consistent with producer needs based on market surveys to guide the breeding program;
- A clear varietal pipeline management strategy;
- Research is supported by a team of interdisciplinary scientists focused on the crop product profile;
- Provision of adequate budgetary support from government or other potential sources;
- A program works in tandem with downstream actors (such as EGS producers, extension and commercial producers, regulatory bodies, etc.) to assure proper hand-off and post-release support; and,
- A focus on continual improvement (product replacement) and adaptation to the changing needs of farmers and markets.

## Methodology

The SeedSAT methodology for NARS is a modified version of the BPAT methodology, which addresses key performance metrics that evaluate a breeding program's potential to deliver genetic gain and measure the level of gain achieved by farmers in their production conditions. The BPAT was initially developed over a five-year period to focus on plant breeding by CGIAR centers and is currently being tested and modified for use with NARS. The process is intended to support crop breeding programs that are committed to continually improving the rate of genetic gain. The process is structured to assess program organization, management, and performance using criteria commonly used to evaluate commercial plant breeding programs.

The methodology used for SeedSAT included the following eight strategic objective areas:

1. Customer-centric breeding program with a product development focus,
2. Team capacity and skills to deliver improved varieties,
3. Research infrastructure,
4. Breeding program design,
5. Variety testing program,
6. Variety release,
7. Support for varietal development, and
8. Program impact.

The assessment was conducted in three steps: 1) socialization of the NARS component of SeedSAT with Ministry of Agriculture and research institute leadership to obtain buy-in; 2) information gathering through two extensive pre-visit surveys retained from the BPAT process; and 3) an assessment questionnaire applied during an in-person, on-site evaluation visit by the product development expert working collaboratively with the plant breeding teams and the management of the research institutes. For phase 3, the expert revised the BPAT assessment instrument, selecting nationally relevant questions from the original 155 questions to arrive at 127 questions for the in-person SeedSAT assessment.

In step 2, each national crop breeding program was requested to complete two pre-visit surveys, one for the breeding program leader and another for the research institute's director. The pre-visit survey for the crop breeding programs is intended to provide relevant content and processes, while the pre-visit institutional survey is intended to gather basic information on infrastructure, personnel, budget and other support functions. These surveys were delivered using the Kobo Toolbox web-based application which enabled offline completion on a range of digital devices. The detailed information requested through the pre-visit surveys is necessary for orienting the assessment prior to the in-person, on-site visit.

The experts were unable to complete step 3, the in-person, on-site interviews, due to lack of timely response and engagement from the Nigeria crop-specific breeding programs before the beta time period ended. The information gathered under step 2, however, can still be useful. A regional expert has been trained in how to complete this step and the international expert assigned to the beta assessment stands ready to provide additional support to complete the overall assessment, though this will require funding under AGRA.

Completing step 3 will require engaging the crop specific IAR stakeholders, starting with an institute director briefing, a presentation by the breeding program lead, and the application of a structured questionnaire with follow up focus group discussions and facility visits. Based on review of strategy, assessment of program strategy documents and data, answers, discussions, and available direct observations, each question is scored on a 1-4 Likert scale that measures each aspect assessed against criteria commonly used to evaluate commercial plant breeding programs. A scorecard and report is generated describing program strengths and areas for improvement. While accurate scoring is essential to identify priority gaps for filling, the effort is also intended to demonstrate a process that combines the discipline of the framework and external perspective with internal experience to identify strengths and weaknesses. Research institutions are encouraged also to use the tool for self-improvement regardless of donor direction, and to repeat the assessment to measure change about three years into implementation of improvements. The results of the assessment are intended to assist institutions to develop and implement program improvement plans nationally, with the complementary assistance of interested investors, including donors. The relatively recently created CGIAR Platform for Excellence in Breeding (EiB https://excellenceinbreeding.org ) may be a useful link to support elements of program improvement plans.

More detailed information on the NARS methodology can be found in Annex II and in the SeedSAT Guide.

# NATIONAL POLICY, LEGAL, AND REGULATORY FRAMEWORK

## Vision

Policy, legal and regulatory (PLR) systems provide a lens through which to assess a country's seed system; evaluate implementation challenges; identify relevant regulatory good practices and models that have worked in other markets; integrate legal and political economy considerations to evaluate how policy, law, and regulation can work as an incentive (or disincentive) for change; and identify which interventions could be prioritized. A well-developed policy and regulatory environment is central to a functioning seed system that ensures farmers access to affordable, available, and appropriate quality seed. Each of the key elements of the seed system notably; (i) breeding and variety release; (ii) early generation seed supply; (iii) certified seed production; (iv) awareness by farmers; and (v) seed marketing and distribution is affected by, and requires adequacy of, the policy and regulatory environment at national, regional and international levels. The vision of a healthy seed system includes key components, policies and regulations that:

- Promote rather than restrict private sector access to public varieties,
- Allow the private sector to produce EGS to complement government institutional capacity to meet the needs of farmers,
- Provide for third-party seed inspection with audit and oversight from government regulatory agencies,
- Promote quality and standard seed inspection services,
- Are conducive to the domestication and implementation of regional harmonized regulations,
- Prevent the distribution and sale of fake or counterfeit seed,
- Provide clear and simplified registration processes for seed producers and traders,
- Provide guidelines for strong variety development and variety release,

- Provide guidelines that stipulate, ensure and enforce adherence to packaging and labeling requirements, and
- Ensure that the private sector is aware of policies and rules and has access to updates; Channels and systems exist to allow for private sector engagement, feedback, and right of action where appropriate (e.g., against counterfeit products).

## Methodology

The assessment of Ethiopia's PLR environment was based on the structure of the enabling environment and an existing methodology focused on legal and regulatory design and implementation aspects developed by New Markets Lab.[28] The methodology used for SeedSAT included the following five Strategic Objectives:

1. Policy, legal, and regulatory design (structure of system and process of regulatory development),
2. Efficiency of the policy, legal and regulatory system tracking the time and cost of completion of regulatory processes,
3. Legal and regulatory gateways that establish regulatory pre-conditions,
4. Engagement in the policy, legal, and regulatory system, with assessment of channels for clear stakeholder participation, and
5. Effectiveness of the policy, legal, and regulatory system designed to assess the extent to which policies, laws, and regulations achieve their purpose.[29]

Based on these five objectives, the experts developed a master list of 112 indicator questions to guide the assessment. The expert team then conducted a comprehensive legal assessment of Ethiopia's PLR system guided by the 112-question master list through primary and secondary research to identify gaps in the regulatory framework and possible issues with implementation. Based on the results of the initial legal assessment, the expert team then identified a subset of 40 indicator questions from the master list that represented the most common issues noted. The expert team then developed questionnaires to guide in-person consultations with public and private stakeholders that aligned with the selected 40 indicators. The team consulted stakeholders from the public sector including the Federal Ministry of Agriculture, the National Agricultural Seed Council (NASC) . the Agricultural Research Council of Nigeria (ARCN), the Institute for Agricultural Research (IAR), Ahmadu Bello University (ABU), National Centre for Genetic Resources and Biotechnology (NACGRAB), Institute of Agricultural Research and Training (IAR&T) at Obafemi Awolowo University, and ICRISAT (International Center for Research on the Semi-Arid Tropics). Private sector stakeholders included the Seed Entrepreneurs Association of Nigeria, eight seed companies of different sizes, and the All-Farmers Association of Nigeria (AFAN). The expert team used both a Likert scale (1 to 4) to assess the relative level of satisfaction with the PLR system as well as non-scored qualitative questions.

More detailed information on the methodology can be found in Annex II and in the SeedSAT Guide.

## Findings

Nigeria's PLR environment recently underwent significant changes, with passage of the NASC Act in 2019. Among other things, the NASC Act, which streamlines processes involved in the development, production, distribution and trade of seed; defines institutional mandates; aligns Nigeria's seed regulatory system with regional seed rules under the ECOWAS; and establishes stricter penalties for offences such as the sale of counterfeit seed. Nigeria also has a relatively new National Seed Policy (2015) and a new Agricultural Policy (2020). These measures all lay out an improved policy, legal, regulatory, and institutional framework

[28] New Markets Lab, "Dimensions of Policy, Legal, and Regulatory Implementation," 2019, available at https://www.newmarketslab.org/about and Katrin Kuhlmann and Bhramar Dey, "Using Regulatory Flexibility to Address Market Informality in Seed Systems: A Global Study," *Agronomy* 2021, 11, 377.
[29] Ibid.

for seed in Nigeria, and both public and private stakeholders have heralded these developments as significant steps in creating a vibrant market for high-quality seed. However, while these new measures are commendable, stakeholders have signaled that it is too soon to determine the full impact of these changes, particularly the NASC Act, on the seed market. Moreover, regulations are yet to be developed under the NASC Act, and, in the meantime, the 2016 Guidelines for Registration and Release of New Crop Varieties in Nigeria and 2017 NASC Guidelines for Registration of Seed Producers or Companies and Seed Fields in Nigeria continue to apply to variety release and registration and certification, respectively; in some cases, inconsistency exists between these older measures and the new NASC Act. In addition, the Nigerian National Assembly has just passed in March the legal framework on PBR, with a PVP Act. Once the PVP Act is passed, regulations and an institutional structure will also be needed to make the system operational.

A list of relevant policy, legal, and regulatory measures consulted is in Annex VII. A summary of the top bottlenecks, issues, and associated recommendations are below and more detail behind the assessment results can be found in Annex II.

**1. Legal Gap in Funding for Public Institutions/Research. Insufficient Legal Infrastructure for EGS.** While the NARS play a leading role in breeding public varieties that are used by most smallholder farmers in Nigeria, they do face challenges that affect the institutions' abilities to fully perform their mandates. According to the FAO, Nigeria's NARS system has historically been one of the largest in Africa but has experienced setbacks mainly due to challenges with funding.[30] While nominal funding for research has increased over the years, these have been small, and inadequacies remain. In 2017, studies showed Nigeria's agricultural research spending as a percentage of agricultural GDP at 0.35 percent, which is substantially lower than the intended 3 percent noted in the 2020 Agricultural Policy.[31] Besides being inadequate, research funding is largely irregular and frequently delayed, which makes it difficult for NARS to respond to market needs and challenges the stability of long-term research for the development of new plant varieties and provision of EGS.[32]

**2. Insufficient Legal Infrastructure for EGS.** Consultations with private sector stakeholders revealed dissatisfaction with the legal basis for making EGS available. Seed companies noted that the process for acquiring EGS is not streamlined, and, as a result, public research institutions sometimes do not provide sufficient EGS on time even when contracts are in place, which, in turn, affects the availability of quality seed to farmers. Private seed companies rated the EGS legal infrastructure very low. Public research institutions indicated that their seed production units lack sufficient funding to produce enough breeder seed or conduct EGS estimation ahead of production, which links with other SeedSAT thematic areas.[33]

The NASC Act provides that entities can acquire the necessary EGS amount depending upon the seed class a stakeholder is authorized to produce.[34] The NASC Act, however, does not describe the process through which EGS can be acquired. Regulations under the NASC Act or separate guidelines will need to be

[30] FAO, "Global Partnership Initiative for Plant Breeding Capacity Building; Plant Breeding Programs in Nigeria," available at: http://www.fao.org/in-action/plant-breeding/our-partners/africa/nigeria/en/. See also, New Markets Lab, "Nigeria Guidebook on Regulatory Aspects of Dissemination of Public Varieties," Seeds2B Africa and AVISA, 2019.
[31] Agricultural Science & Technology Indicators (ASTI) (2017): Agricultural Science & Technology Indicators: Open Access Data and Analysis of Agricultural Research Investment in Low- and Middle-Income Countries. Available at http://www.asti.cgiar.org. See also, the Agricultural Policy of Nigeria, available at: http://extwprlegs1.fao.org/docs/pdf/nig149296.pdf. See also, New Markets Lab, "Nigeria Guidebook on Regulatory Aspects of Dissemination of Public Varieties," Seeds2B Africa and AVISA, 2019.
[32] Ambrose Alikidon, "Challenges and Experiences of Agricultural Research Council of Nigeria in Making Agricultural Research Work for End-users in Nigeria," Nigerian Agricultural Policy Research Journal (NAPReJ) Vol. 3. Issue 1. Available at: http://www.aprnetworkng.org/Journal/Paper%201%20V3.pdf. See also, New Markets Lab, "Nigeria Guidebook on Regulatory Aspects of Dissemination of Public Varieties," Seeds2B Africa and AVISA, 2019.
[33] "Nigeria Early Generation Seed Study," Country Report by Feed the Future: Building Capacity for African Agricultural Transformation Project (Africa Lead II) for the United States Agency for International Development, August 2016, page 80.
[34] Section 22 of the NASC Act.

developed to clarify and streamline this process, and these measures will have to be supported by a system that can estimate EGS demand ahead of production to enable research institutions to respond to demand (again, this is linked with other SeedSAT thematic areas). Public institutions will also have to improve contractual enforcement, which could be done through enhanced capacity and resources to meet the EGS market demand on time.

**3. Lack of Legal Framework for Licensing and Royalties.** Licensing agreements can be used as vehicles to get more public varieties to farmers and can involve licensing the right to use a variety registration to commercialize a variety or register a variety in the national or regional catalogue; licenses can be based on these "use rights" or on PBR, discussed below (the latter protects the right beyond just the parties to the license).[35] Licenses can be a source of income to support public research institutions' breeding activities. Notably, however, public research institutions can only retain the financial benefits from licensing if the legal instruments establishing such public institutions allow them financial independence, or if a separate legal instrument is put in place to allow them to do so (this could be done through the PVP Act discussed below). If not, the proceeds from licensing tend to go to the federal government's consolidated fund.

Private sector stakeholders consulted expressed overwhelming interest in entering into licensing agreements with public research institutions that would establish exclusive or nonexclusive rights to commercialize public varieties. Public sector breeders and research institutions also supported licensing of public varieties to seed companies. Stakeholders rated relevance of licensing of public varieties to seed companies very high.

**4. Transitioning to a New Legal Framework for Plant Variety Protection.** A conductive legal and regulatory framework on PVP or PBR could be beneficial to the seed sector by establishing a legal channel to protect breeders of both private and public varieties, with protection extended as varieties enter the market, particularly when protected varieties are traded regionally.[36] For the public sector, PBR could also strengthen the use of licenses, as discussed above. The National Seed Policy of Nigeria recognizes the efforts of inventors in the seed industry and calls for the safeguarding of such inventions and remuneration through royalties for at least ten years, in order to enable inventors to recoup the expenses incurred during research and variety development.[37] While this provides helpful guidance, it is an ambiguous and non-binding provision that would require an act or regulations to be enforceable, including criteria and procedures for claiming what constitutes an "inventor" entitled to PBR and protection of the technology. Under the new NASC Act of 2019, NASC is mandated to approve and implement programs and measures designed to promote the protection of PBRs.[38] The NASC Act further provides for the granting of PBRs for new plant varieties based on internationally recognized criteria but calls for a PVP Act (recently passed in the National Assembly).[39] Like the importance of setting up a legal framework for licensing agreements, stakeholders rated relevance of a PVP legal framework very high.

**5. Possible Institutional Issues in Variety Registration and Release.** The NASC Act establishes the new Seed Registration and Release Subcommittee,[40] which appears to have overlapping functions with the National Crop Varieties Registration and Release Committee (NVRC) and the Technical Sub-committee on Crops based on the still applicable 2016 Guidelines on Registration and Release of New Crop Varieties in Nigeria. The NASC Act also mandates that the Minister of Agriculture and Rural Development will approve procedures for registration of new varieties in the National Crop Varieties Release Catalogue, on

[35] New Markets Lab, "Nigeria Guidebook on Regulatory Aspects of Dissemination of Public Varieties," developed for Seeds2B Africa and AVISA, 2019.
[36] New Markets Lab, "Annotated Guide on Flexible Licensing Models and Agreements," developed for Seeds2B Africa and AVISA, 2019.
[37] Clause 4.5 of the National Seed Policy, 2015, page 18. Available at: https://nesgroup.org/storage/app/public/policies/National-Seed-policy_1562696305.pdf.
[38] Section 38(b) of the NASC Act.
[39] Section 39(1) of the NASC Act.
[40] Section 12 of the NASC Act.

the advice of NASC. This would overlap with the role that the NACGRAB Registrar is currently playing. The existence of duplicative institutions and roles creates uncertainty in the variety release and registration process. Moreover, consultations with (NACGRAB) and NASC revealed that no new institutions will be created, which then means that the NASC Act created a redundant institution, unless regulations to be developed under the NASC Act clarify this point. Consultations revealed that this is an issue for consideration.

**6. Insufficient Funding for National Variety Release Committee Meetings (NACGRAB considering policy approach).** Based on consultations with the NACGRAB registrar, and according to the *Guidelines for Registration and Release of New Crop Varieties in Nigeria 2016* developed by NACGRAB regarding variety release and registration, the NVRC must sit at least twice a year. Stakeholders noted, however, that is not typically the case due to insufficient funding, which creates delay in the release of quality varieties. For instance, stakeholder consultations revealed that in 2019 and 2020, the NVRC only sat once. NVRC funding was rated very low among stakeholders.

**7. Absence of a Binding Regulatory Framework on Certification.** There are currently no regulations under the NASC Act to operationalize provisions on certification. The 2017 NASC Guidelines for Registration of Seed Producers or Companies and Seed Fields in Nigeria continue to apply but are not binding and are based on a repealed law. Consultations with NASC confirmed that the certification process will have to be streamlined, with clear rules set under regulations to the NASC Act, including clearly documented standards.[41]

**8. Unpredictability of Import Permitting Process.** According to the NASC Act, a seed importer who seeks an import permit should be able to apply to NASC and follow prescribed procedures and fees.[42] Notably, regulations are yet to be enacted under the NASC Act to provide the forms and procedures to be followed during seed importation. In the meantime, NASC describes the importation procedures on its website,[43] which is arguably a guiding framework rather than a binding legal structure. Stakeholders also noted that it usually takes significant time to acquire an import permit, even when the application is in order, citing that it can take up between two weeks to a month (or even up to six months without diligent follow up) instead of the five days noted on the NASC website. These delays derail the importation process and make it more costly, which in turn affects stakeholders of all sizes, including smallholder farmers. Stakeholders rated the adequacy of the import process at moderately adequate.

**9. SPS Assessments Often Not Risk-Based.** Stakeholders revealed that compliance with SPS measures is one of the biggest challenges in importation. Moreover, stakeholders expressed concern that SPS assessments are usually not risk-based and that in most cases the diseases that are tested for generally do not pose a threat in Nigeria. Compliance with SPS measures was overall regarded as a time consuming and costly process that affects availability of quality seed.[44] Stakeholders rated quarantine and phytosanitary processing very low, which points to the relevance of the issue.

**10. Absence of ISTA-Accredited Laboratory.** Under the NASC Act,[45] national seed certification standards must be in compliance with ECOWAS seed regulations and internationally recognized standards. According to the NASC guidelines on fee schedules and testing procedures published on the website,

[41] "Nigeria Early Generation Seed Study," Country Report by Feed the Future: Building Capacity for African Agricultural Transformation Project (Africa Lead II) for the United States Agency for International Development, August 2016 at page 80.
[42] Section 37(1)a) of the NASC Act.
[43] See: https://seedcouncil.gov.ng/seed-importation/.
[44] New Markets Lab, "Study of Seed Laws and Regulations Affecting the Development of Private Vegetable Seed Sector in Sub-Saharan Africa," study commissioned by the World Vegetable Center, 2021.
[45] Section 16(2) of the NASC Act.

International Seed Testing Association (ISTA) standards are preferred throughout the testing process. Stakeholders also confirmed that seed that is imported should be accompanied by an Orange ISTA certificate (OIC). Since the ECOWAS Seed Regulations also follow ISTA standards, the requirement to comply with these standards at the national level ensures alignment with regional seed rules and improves the acceptability of locally produced seed at the regional and international levels. Unfortunately, Nigeria does not yet have an ISTA-accredited laboratory, which affects the regional and international recognition of locally produced seed and increases importation costs as all seed is required to be accompanied by an OIC.

**11. Inconsistent Application of ECOWAS Rules.** The NASC Act aligns Nigeria's seed regulation with ECOWAS seed rules, including on variety release and registration procedures, certification, and import and export. However, stakeholders noted that, while this is the case on paper, the practice is quite different. For instance, under the ECOWAS Seed Regulations, any variety entered in the national catalog of a Member State should be included in the West African Catalogue of Plant Species and Varieties and can be traded freely throughout the ECOWAS region.[46] Seed companies noted that, in practice, varieties that are registered in other ECOWAS Member States' national catalogues and listed in the West African Catalogue of Plant Species and Varieties still require retesting to evaluate their compatibility with Nigerian agro-ecological conditions, contrary to the ECOWAS seed rules. Moreover, some DUS and VCU testing protocols are not aligned with the 2008 ECOWAS Procedure Manual for Variety Registration in the National Catalogue for Crop Species and Varieties in West African Countries. In addition, stakeholders reported bureaucratic challenges when importing varieties registered in other ECOWAS Member States even if listed in the West African Seed Catalogue. Stakeholders rated the application of ECOWAS rules very low.

**12. Insufficient Implementation of Anti-counterfeiting Measures.** Under the NASC Act, anyone convicted of a counterfeiting offence is subject to imprisonment for up to one year or a fine of up to one million naira (or both) for a first-time offender, and imprisonment for up to two years or a fine of up to two million naira (or both) for a multiple offender. Private sector stakeholders noted that, while the penalties have been strengthened under the NASC Act, there have not been any reported prosecutions, and counterfeit seed continues to be a major challenge. This, in turn, affects investment in the seed sector and directly affects farmers through supply of inferior quality seed.[47] Private sector stakeholders rated implementation very low.

### Proposed Interventions

**1. Develop Regulations Under the NASC Act.** Regulations are needed under the NASC Act and would address several of the gaps noted above. For example, regulations could streamline the process for variety release and registration, both clarifying institutional frameworks and roles and more fully aligning Nigeria's system with ECOWAS seed rules. A legal infrastructure for EGS distribution could also be incorporated into the NASC regulations, operationalizing the provisions on EGS allocation under the NASC Act. Regulations under the NASC Act could also streamline procedures on certification; in this regard, regulations should incorporate and reference the NASC certification guidelines to make them binding. Import and export procedures could also be streamlined through the NASC regulations to ease the movement of seed across borders. Because regulations under the NASC Act could address all these gaps and bottlenecks, we give them top priority.

[46] Katrin Kuhlmann, et al., Seed Policy Harmonization in ECOWAS: The Case of Nigeria, New Markets Lab and Syngenta Foundation for Sustainable Agriculture Working Paper, December 2018, at pg. 14.
[47] Nigeria Early Generation Seed Study, Country Report by Feed the Future: Building Capacity for African Agricultural Transformation Project (Africa Lead II) for the United States Agency for International Development, August 2016 at pg. 80.

**2. Complete Enactment of PVP law, Develop PVP Regulations, and Establish the Relevant Institutional Framework.** As called for in the NASC Act, a PVP law has been drafted and is at an advanced stage of enactment. Stakeholders reported that the PVP Bill has gone through several readings in the House of Representatives and has now advanced to the Senate. Once the PVP Act is in place, implementation will critical, beginning with development of PVP regulations (and procedural guidelines) and extending to establishment of the relevant executing institutions. Note that it was announced that the PVP law has been approved by the National Assembly during the Nigeria SeedSAT validation meeting held on March 4.

**3. Accelerate the Development and Implementation of Hybrid Funding Options for NASC, Including Funding for the NVRC.** A NASC fund has been created under the NASC Act[48] to facilitate the activities of NASC, which would include funding meetings of the NVRC. Proper funding for NASC will allow it effectively monitor implementation of the NASC Act, including oversight of the variety registration and release and certification processes, proper SPS risk-based assessments, and implementation of anti-counterfeiting measures. Consultations with NACGRAB also revealed that the NACGRAB Registrar, which currently has oversight over the variety registration and release process, is considering development of a policy that would include hybrid funding from both public and private sector sources to fund the regular sitting of the NVRC. Nether this policy nor the NASC fund is currently in place, however. Consultations with NASC revealed that modalities are being developed on how the NASC Fund could be operationalized, based on good practices in other countries where seed sector funds were legally established (e.g., India).

**4. Strengthen Legal Infrastructure for Trade and SPS and Improve Capacity to Conduct Risk-based SPS Assessments.** Currently, the legal infrastructure for trade and SPS is weak, and relevant institutions lack the capacity to conduct risk based SPS assessments. Interventions could include acquiring the right equipment and building skills to conduct risk assessments, as well as updating the national pest list to reflect national and regional quarantine and phytosanitary conditions and make the process of risk assessment more predictable, especially for the private sector.

**5. Obtain ISTA Accreditation for the National Seed Testing Laboratory.** Accreditation of the national seed laboratory by ISTA would increase recognition of locally produced seed in regional and international markets and reduce costs, especially for importers in other countries that require to have an OIC. This is consistent with good practices and is something that a number of other countries, including Kenya and Zambia, have done.

**6. Enhance NASC's Capacity to Implement Anti-counterfeiting Measures.** NASC currently has insufficient capacity to implement anti-counterfeiting measures contained in law, which will have to be addressed in order to make the system operational. Capacity could be built through trainings and other interventions focused on strengthening ability to follow the anti-counterfeiting measures created under the NASC Act (investigatory capacity and ability to impose deterrent fines, penalties, and prosecutions), and public awareness campaigns could be used as well. Good practices in anti-counterfeiting should also be more fully assessed to help identify counterfeit, low quality, and adulterated seed. The regulations to be developed under the NASC Act should also provide for and clarify procedures for NASC to receive individual complaints from seed sector actors. The costing table below notes the legal aspects of implementing anti-counterfeiting measures; other costs will need to be covered including personnel, equipment, and infrastructure.

[48] Section 45 of the NASC Act.

## Cost Estimates

Overall, high level cost estimates for implementing the recommended interventions ranges from a low of $475K to a high somewhat $700K. All cost estimates below are for legal work only and do not include any downstream estimates for implementation of the legal instruments (such as capacity building, procurement of equipment, etc.). More detail of elements included in the cost estimates along with the expert's suggestions in terms of sequencing can be found in Annex III.

| No. | Recommended Intervention | Low (USD) | High (USD) |
|---|---|---|---|
| #1 | Develop Regulations Under the NASC Act (legal aspects only) | $100,000 | $150,000 |
| #2 | Complete Enactment of PVP law, Develop PVP Regulations, and Establish the Relevant Institutional Framework (legal aspects only) | $100,000 | $150,000 |
| #3 | Accelerate the Development and Implementation of Hybrid Funding Options for NASC, Including Funding for the NVRC (legal aspects only) | $150,000 | $150,000 |
| #4 | Strengthen Legal Infrastructure for Trade and SPS and Improve Capacity to Conduct Risk-based SPS Assessments (legal analysis only) | $100,000 | $150,000 |
| #5 | Obtain ISTA Accreditation for the National Seed Testing Laboratory | Cross Ref QA | Cross Ref QA |
| #6 | Enhance NASC's Capacity to Implement Anti-counterfeiting Measures (legal analysis only) | $75,000 | $100,000 |
| | ***Grand Total*** | ***$475,000*** | ***$700,000*** |

## Validation, Prioritization and Feedback

The Ethiopia validation break-out session held on March 4, 2021 to cover the PLR and NPC thematic areas included representatives from FMARD, NASC, NAQS, Techni Seeds, Premier Seeds, AGRA and USAID. The sections below highlight the major suggested changes and how they were integrated into the bottlenecks and recommendations mentioned above.

**Validation feedback.** Participants did not provide any ratings as to the level of impact or ease of implementation for the proposed QA interventions, but they did provide the following feedback on the constraints identified:

- **#1 Legal funding gap for public institutions/research**. Participants observed that there needs to be a deeper dive into the actual spending that goes into crop research activities. Please note that the NARS and plant breeding assessment component, when and if, completed delves into spending patterns in more detail.
- **#2 Insufficient legal structure for EGS**. Participants noted that as a basic principle, EGS supply needs to be based first on a market driven approach that carefully assesses demand and supply capacity, as well as dealing with the issue of allowing private companies to produce more than one class of seed.
- **#3 and #4 Lack of legal framework for PVP or PBR**. Participants observed that bottlenecks #3 and #4 look similar but vary because of the issue of institutional licensing. Research institutions should have a framework to collect royalties. The assessment team notes that royalties are one option in the tool kit for revenue generation.
- **#7 Absence of a Binding Regulatory Framework on Certification**. The participants noted that there is a framework, but that it is incomplete and inadequate for implementation. They further noted that it is true that there is weak implementation of the framework, that is combined with low awareness on the part of end-users and a set of capacity strengthening issue for seed producers and companies, along with ensuring that certification documents are available and used. There is a need to tease out the bundles of information in the Act to develop the binding regulatory framework.
- **#9 SPS Assessments Often Not Risk-Based.** The participants noted that many seed imports do not pass through the regulatory channels given the size of the national borders. There is indeed an

inadequate capacity for risk-based testing of imports. There is also a need for education of the private sector to see the relevance of risk-based testing of seed imports. These technical requirements are not well understood by seed dealers.

**Prioritization Feedback.** The table below displays the proposed prioritization and sequencing of interventions given by the expert along with the prioritization feedback from the participants given during the validation workshop, with the expert prioritization taking precedence.

| No. | Recommended Intervention | Expert Proposed Priority | Validated Priority |
|---|---|---|---|
| #1 | Develop Regulations Under the NASC Act | 1 | 1 |
| #2 | Complete Enactment of PVP law, Develop PVP Regulations, and Establish the Relevant Institutional Framework | 2 | 2 |
| #3 | Accelerate the Development and Implementation of Hybrid Funding Options for NASC, Including Funding for the NVRC | 3 | 3 |
| #4 | Strengthen Legal Infrastructure for Trade and SPS and Improve Capacity to Conduct Risk-based SPS Assessments | 4 | 4 |
| #5 | Obtain ISTA Accreditation for the National Seed Testing Laboratory | Cross Ref QA | Cross Ref QA |
| #6 | Enhance NASC's Capacity to Implement Anti-counterfeiting Measures | 5 | 5 |

# NATIONAL PLANNING AND COORDINATION

## Vision

African nations have made CAADP Malabo commitments to make public investments equal to 10 percent of AgGDP to achieve agricultural transformation with an 8 percent annual sector growth rate. Prioritized translation of these political commitments into policy, policy into strategy, and strategy into seed plans and operations will lead to clear identification of roles and responsibilities and improvement in public, private, and development partner annual planning and coordination. The vision of a healthy system is one in which there is better planning and coordination that support continuous improvement of the supply of quality seed of crop varieties that improve productivity and respond to the demand of both farmers and end users of crops. The more that planning and coordination is based on shared knowledge and understanding of farmer and end-market crop demand, the more likely it is that quality seed supply will be organized to meet the demand.

## Methodology

The assessment of national planning and coordination thematic is based on four themes: the clarity of the national seed strategy; the strength of the public-private joint effort for seed sector planning; the strength of the public-private joint effort for seed sector coordination; and, if applicable, the effectiveness and efficiency of subsidies. These themes are broken down into eight Strategic Objectives:

1. National vision and seed strategy (national agriculture investment or transformation plan linkage to seed strategy, balance between public and private sector roles):
2. Institutional support at the Ministry of Agriculture for seed sector planning (roles, responsibilities, resources);

3. Adequate data on demand trends, supply trends, and formal sales of quality assured seed of crop varieties (advance planning for 3-4-year pipelines of EGS and annually adjusted quality assured seed needs);
4. Planning activities and communication with stakeholders;
5. Private sector coordination including strong seed trade associations with strong leadership and value-added propositions for members;
6. Public sector coordination;
7. Clear and open channels of communication for public-private sector dialogue;
8. Seed subsidies (clear, explicit, and evidence-based reasons why seed subsidies are needed, application of the SMART framework, and a defined exit strategy).

Based on these eight objectives, the experts developed a list of 41 indicator questions. The assessment considered evidence from information and documents requested from public institutions and agencies; review of institutional websites; recent published reports and studies; in-person interviews of stakeholders using questionnaires; and data on institutional and company planning, coordination and communication issues provided by the other thematic areas - NARS, QA, EGS, CP&D. Aggregated information was applied to a 1-4 Likert scoring to determine the overall health of the NPC system. More detailed information on the methodology can be found in Annex II and in the SeedSAT Guide.

## Findings

Nigeria has done extensive internal and partner-assisted analysis of its seed system organization, performance, and planning and coordination issues over the past four years in the run-up to the new National Agricultural Seeds Council Act and the NASC 2020-2025 Strategy. NASC has been vested with the primary responsibility for planning and coordination of the seed system since its establishment in 2007 as an agency of the FMARD emerging from its original role as the National Seed Service following a long transition journey started in 1992 with the National Agricultural Seed Decree. It plays a wide range of roles as planner, coordinator, regulator, promoter, capacity builder, and information hub for the national seed system, which is one of the broadest ranges of roles and responsibilities for a national seed agency or national seed council on the African continent. Its mandate is immense and challenging. Nigeria's agricultural economy is very diverse reflecting the wide span of agroecosystems from the lowland humid tropical forest zone in the south to the semi-arid Sahelian savanna in the north. Farmers in Nigeria use huge amounts of cereal and legume crop seed annually. Nigeria is the world's largest single producer and consumer of cowpea. It is also the world's largest producer of yams and the African continent's largest producer of cassava. Cassava and yams, and other root, tuber, banana (RTB) staple food crops are gradually moving into the formal certified seed system, greatly increasing the complexity and future scale of NASC's regulatory and quality assurance operations. New mechanisms may need to be developed to carry them out.

For example, recent investigation of cassava seed (stem cutting) distribution in Nigeria indicates that famers move improved varieties from trials and demonstrations into the informal seed system even before their official release, and suggests that stem cuttings recycled from the original material can last as long as ten years.[49] And, the high costs to transport bundles of certified cassava stems imply the need for a decentralized system of certified seed production for VPCs, requiring more seed inspectors beyond those currently certifying true-seeded crops. With IITA and BMGF assistance Nigeria has trialed and adopted a

[49] Wossen, T., G. Girma, T. Abdoulaye, I. Rabbi, A. Olanrewaju, J. Bentley, A. Alene, S. Feleke, P. Kulakow, G. Asumugha, A. Abass, M. Tokula and V. Manyong. 2017. The cassava monitoring survey in Nigeria final report. IITA, Ibadan, Nigeria. ISBN 978-978-8444-81-7. 66 pp.

digitized registry for seed certification Seed Tracker, and started a program to train third-party inspectors, but the QA section of this assessment highlights the needs to improve the physical certification process and laboratory analyses as a first priority. Seed companies producing the true-seeded cereal, legume, and oilseed crops are represented by SEEDAN that has intermediated strong efforts on seed policy advocacy and member capacity building with good results, but faces the organizational and resource challenges to increase its regional presence, develop commodity groups, and develop a membership that includes a larger share of seed companies in order to play its representational role in private sector advocacy, planning, and coordination roles. The private seed companies respond to demand that is greatly shaped by the national policy of food import substitution, reinforced by the large institutional market created by seed purchases by national and state governments, development projects, and NGOs. National plans and programs have shifted over the last decade away from direct seed subsidies towards the use of other financial tools, for example, subsidized interest rates, loan guarantees, insurance, and warehouse receipts, to crowd the private sector into supplying inputs and services to farmers with loans repaid from crop sales back to private companies. Strong planning and coordination with frank and open feedback loops are needed to estimate seed demand, plan and finance breeder seed, foundation seed, and certified seed production, and develop seed marketing and distribution that can reach more smallholder farmers. However, planning and coordination activities are still variable in quality and undercut by declines in the public budget that weaken key seed system institutions at a time when they are being asked to increase their impact. This assessment focuses on the practical constraints faced in improving public and private seed system planning and coordination to support Nigeria's ambitions to ramp up agricultural productivity and transformation to a greener economy for food security nationally and for export earnings.

## Constraints

**1. Annual budgets fall far short of high-level planning commitments to fund agricultural development, with flip-flops in funding for domestic production versus food importation disrupting seed producer incentives.** Nigeria's high level commitments to CAADP have reinforced large initiatives to boost agricultural production built out of the experience of Agricultural Development Projects (ADP) at state and river basin levels, with coordinating support from FMARD through the Agricultural Transformation Agenda, Special Presidential Initiatives, and the Agricultural Promotion Policy. The Nigerian government has tested a variety of approaches to accelerating the adoption and use of improved agricultural inputs, with a major focus on fertilizer, but incorporating certified seed and machinery services, using public subsidy approaches, such as the Growth Enhancement Support (GES) scheme, Agricultural Inputs and Machinery Services (AIMS) programs, and their reconfiguration and consolidation through a variety of inter-related finance and insurance programs with the current Anchor Borrowers' Programme (ABP)[50]. Development partners have contributed through a wide range of projects to explore and stimulate the development of private sector and community-based seed production and distribution. There is good evidence that the national plans to increase domestic supply of food crops have resulted in increased seed demand with increasing participation by the private sector[51,52].

[50] Central Bank of Nigeria. Anchor Borrowers' Programme Guidelines. CBN Development Finance Department. December 2016.

[51] Wossen, T., G. Girma, T. Abdoulaye, I. Rabbi, A. Olanrewaju, J. Bentley, A. Alene, S. Feleke, P. Kulakow, G. Asumugha, A. Abass, M. Tokula and V. Manyong. 2017. The cassava monitoring survey in Nigeria final report. IITA, Ibadan, Nigeria. ISBN 978-978-8444-81-7. And, Chris O Ojiewo, Lucky O Omoigui, Janila Pasupuleti, and Jillian M Lenn. Grain legume seed systems for smallholder farmers: Perspectives on successful innovations. Outlook on Agriculture. 2020, Vol. 49(4) 286–292

[52] Iliyasu, I., & Lawal, S. 2020. Nigeria's Self-Sufficiency in Rice and Wheat: An Evaluation of Growth Enhancement Support Scheme (GESS) and Anchor Borrower Program (ABP). *Pakistan Journal of Humanities and Social Sciences*, *8*(1), 1-9. https://doi.org/10.52131/pjhss.2020.0801.009

Production priorities from large agricultural development programs around Nigeria's import substitution and export goals; the multi-year import restrictions on rice, poultry and other foods; the choice of strategic crops to support; and the financial instruments that are put in place to support crop production and input supply all contribute to increased demand for seed. The public sector role is heavy as an institutional market maker for inputs and services, but public resources have declined from the time that the first national CAADP and NAIP commitments were made to devote 10 percent of the public budget to agriculture to generate an 6-7 percent agricultural sector GDP growth annually. Agriculture sector budgetary commitments have declined from 5-6 percent of national budget to just under 2 percent of the national budget. Despite this decline in public budgetary allocation to agriculture, the sector has maintained an annual growth rate over 3 percent and sustained a 20 percent or higher rate of contribution to GDP. Interviewees from public institutions noted that, while FMARD's departments and agencies rank collectively as one of the largest recipients of recurrent budgetary allocation, the allocations to research and development, EGS production, regulatory agencies, and the promotion of new crop varieties have suffered from underfunding. Flat or fluctuating budgets erode institutional assets and human capacities as operating costs inflate, research requirements grow, seed demand expands, and long-standing needs to maintain, upgrade, and intensify seed quality assurance and regulatory enforcement increase. Core public sector capacities still need to be reinforced and strengthened, especially as Nigeria seeks to increase the role of the private sector in early generation seed production and distribution, increase the development of third party inspection services, and seeks to shift more of the financing and financial risk burden to seed companies for certified seed production and distribution.

The pressure to increase national strategic crop production and productivity will grow over the next several years as commodity import license and foreign exchange controls, tariff barriers, currency devaluation, and a rapidly growing and urbanizing population place more demands on the national government and the sector to supply more food at more affordable prices. Public institutional interviewees point to the need for rebalancing public expenditures within the agriculture budget to maintain, operate and upgrade facilities and equipment that have eroded (reference QA thematic area section) and to increase support to the operations essential to closing the seed demand gap (reference EGS thematic area section) and increasing crop productivity and resilience to pest, disease, and weather stress through varietal replacement, while ensuring the quality and integrity of seed supply.

**2. Misaligned government cost accounting and budget allocation practices for seed institutions, especially between personnel, operating, and maintenance costs leading to inability to determine effectiveness of programs and a larger dependence on project and donor support for critical functions.** General budgetary pressures are exacerbated at the institutional level as progressive adjustments have been made in the overall drive to substitute domestic production for imported rice, wheat, and other food and feed crops and to ramp up exports that will generate foreign exchange. Interviewees noted strong year-to-year variability in the nationally approved budgets since 2017. Adding to the lower funding and variability are the practices used to account for and allocate costs between the types of national budgets and between the national institutions. National budgets are split between recurrent (yearly costs) and capital (shorter term investments and projects) in a way that makes evaluating cost efficiency and benefits for programs difficult to ascertain. More specially, recurrent national budgets for FMARD, NASC and the three national agriculture research institutes, IAR, NCRI, NRCRI, are made up of predominantly personnel costs (such as wages salaries, benefits, employment taxes, insurance, etc.), while associated operating and maintenance costs (such as conducting inspections, quality control on certifications, training, maintenance of facilities/equipment, and other regulatory responsibilities) are included in capital budgets as capital expenditures for intangible assets and/or as shorter term "project"

costs.[53] Conversely, the research and development organizations are only allocated operating and capital costs, but not personnel costs for their own staff (which are included in the national recurrent budgets.) While the full NARS and plant breeding effectiveness assessment could not be completed because of COVID-19 issues, the pre-visit data collected showed a wide range in the way that personnel, operating, and capital costs of plant breeding and seed production are addressed, with some considering salary costs as zero, because they are covered in the separate national recurrent budget. This issue recurs in early generation basic/foundation seed production within public institutions making it difficult to determine the costs of production of EGS to identify where efficiency or cost-savings could be found. EGS seed production total costs are not comprehensively developed from line item cost accounts. The EGS assessment was unable to obtain enough data to do a bottom-up costing for EGS production for the five crops in the assessment.

Splitting the costs this way causes several issues that can negatively impact the overall effectiveness of Nigeria public investment. First, it is more difficult to determine how to attribute personnel, operating, and capital costs to either regulatory or research efforts and to determine if those efforts are cost effective or are generating benefits that are better than alternatives. In other words, it is more difficult to identify areas for cost savings and where to prioritize public investment efforts to get the best results. For example, without consolidated budgets, it is difficult to demonstrate the real benefit of government programs that drive the production and utilization of certified seed versus farmer-saved seed. In another example, it also difficult to ascertain the benefits to overall agriculture productivity of centralized NASC extension/demonstration of public crop varieties used for marketing as compared to alternatives, such as competition-based cost- or risk-sharing grants to extend/demonstrate new crop varieties in areas closer to farmers. Second, defining operating costs (such as training or regulatory responsibilities) as "projects" in the capital budget supports the case that capital investments are more defensible as "good" for the economy because they are assumed to generate economic growth, in contrast to expenditure on personnel which is – too narrowly—perceived as civil administration that makes a low or no contribution to growth.[54] Third, under this cost accounting practice managers may defer routine maintenance and repair costs (that should be part of the recurrent budget), which eventually results in more costly renovation or new capital investment. Replacement of retiring or departing mid-level and senior staff may be deferred or hiring requirements downgraded, reducing personnel costs but also reducing institutional capacity. The effects are seen in deteriorating and underutilized facilities, inoperative or uncalibrated equipment, and reduced performance standards, as seems to have happened in most NASC seed testing labs (see the laboratory assessment under QA Annex IV and V.) that are not directly supported by a development partner project (e.g. BASICS for cassava or the molecular genetics lab at NACGRAB). Finally, this practice can lead to sustainability and government commitment issues of institutional programs. Interviewees noted that during the period from 2017 through 2019, the actual funding releases against approved budgets were irregular, averaging about 64 percent of allocated budget with substantial swings from year to year. Lower funding releases deepened the tendency to reduce operating expenditure and defer maintenance and made public programs more dependent on development partner funding than in prior years. If operating costs for programs are covered increasingly by development partner funding, it is difficult for institutions to realize the true cost of programs, making these programs vulnerable to stoppage and failure once partner funding ends. For a regulatory agency like NASC, which has a broad

[53] Costs directly associated with personnel represented an average of 97% of budgeted recurrent expenditure across the FMARD departments, institutes, and agencies in 2017, growing to 98% in 2020. NASCs personnel expenditures accounted for 97% of budgeted recurrent expenditure in 2020, and the average for the three national agricultural research institutes (IAR, NCRI, NRCRI) was about 98%. When recurrent and capital budgets are combined, the percentage of the public budget for personnel costs ranges from 45% to 58% for NASC, NAQS, and the three NARIs.

[54] Osuji, Casmit. Federal Government Recurrent Expenditure and the Nigerian Economy. International Journal of Management Sciences and Business Research, Aug-2018 ISSN (2226-8235) Vol-7, Issue 8 http://www.ijmsbr.com

mandate (policy, regulatory, certification, licensing, standards enforcement for overall QA, and a set of promotional, developmental, and seed security stock maintenance functions) it becomes even more complex to identify the costs and benefits of regulatory outcomes.

**3. Delayed annual cash flow to public institutions erodes performance**. Agriculture is driven by seasons not by bureaucracy. Public institutions reported that besides underfunding and reduced funding releases, the cash releases against their allocated budgets arrived late relative to the agriculture season. Cash can only be released upon National Assembly approval of the budget, which should occur in December of the prior fiscal year or January of the current fiscal year. Over the past four years The National Assembly approval for budgets was given in mid-year of the current fiscal year with interviewees indicating that funding released as cash was too slow. Late cash arrival meant that trials, breeder seed plots, and national performance trials were planted late or had to be deferred. Slowed cash flow on top of budget reductions translated into lower regulatory enforcement capacity. The 2021 budget was approved on time, with substantial internal and external pressure to improve public cash disbursements to deal with the challenges from the COVID-19 pandemic.

**4. Lack of adequate and accurate seed demand and supply information constrains planning, budgeting, and coordination.** One of NASC's core roles in the National Seed Policy is to establish and maintain a system to collect and disseminate data on seed use, planned needs and seed availability to support decision-making by seed suppliers and users. [55] However, both NASC and its predecessor agency the National Seed Service, have had major difficulty in developing a strong information base on seed demand and supply across the major cereal and legume food crops in Nigeria, with vegetatively propagated crops like the immensely important food sources of cassava and yams only beginning to be incorporated. Cassava and yam have embryonic seed certification systems that have been built over the past several years with development partner assistance. The SeedSAT experts found evidence that suggests that demand for seed exceeds supply and that the unmet demand may be driving increases in counterfeit seed. Improvements in data collection, management and forecast modeling is needed to help bridge the gaps and reduce counterfeit seed.

The core seed demand model has been based on filling a seed gap calculated against a total seed requirement from good practice seeding rates on the area planted to a crop; adjusting for new strategies like double or triple-cropping rice in irrigated areas or hybrid maize crop area expansion; projecting an expected rate of uptake of certified seeds; and, more recently, setting aside an emergency reserve percentage to provide a recovery seed supply needed after natural or human- caused disruption. Nigeria's total planting seed requirement estimates for eight cereal and grain legume seed crops has widely ranged from 800,000 MT to over 1,000,000 MT annually. Estimates of potential certified seed demand (assuming that farmers will buy certified seeds of open-pollinated crop varieties and save or get local seed for 3-4 years before repurchasing certified seed) has widely ranged between 350,000 MT to 429,000 MT annually. The potential seed demand sets the gap which NASC and FMARD uses to assess the size and value of the seed marketplace and assess how well current programs are bridging the gap to help fulfill the food and feed import substitution policy. Seed companies reported that there is significant demand for popular varieties that cannot be met because there is insufficient foundation seed available to produce the certified seed. This issue is long-standing and is being addressed along several pathways for cereals, legumes, and root and tuber crops, all of which are supported by NARIs and their seed units or non-profit companies, CG centers with development partners, private companies, and NGOs. Feedback from interviewees noted that the gap forecasting method does not necessarily reflect reality and that there is a large disconnect between certified, foundation, and breeder seed (see Case Study #1.) Inaccurate data, tracking trends and forecasting can mean that counterfeit seed levels are not evident and that effective impacts of government direct and indirect subsidy programs are not known.

[55] NASC. National Seed Policy. FMARD, 2015.

Ideally, NASC would provide a dashboard capturing each phase of seed multiplication (breeder-foundation-certified), using historical data on allocation, distribution and sales for each crop and major variety, combine it with market information about projection of adoption rates for new and old, farmer level performance of new varieties against older varieties, and annually adjust a 4- to 5-year forecast of future needs for each class of seed. This is not a simple task, and NASC currently has an insufficient capacity to fulfill its mandate in national seed demand forecasting and seed production planning. Its Seed Coordination and Management Services Department is not performing this function due to a series of constraints. NASC's Seed Information, Data Management and Capacity Building Department is also not providing real-time tracking and reporting of seed volumes (including EGS) produced, available, and demanded at a variety level.

The data on seed classes is valid only when seed producer quality control meets certification standards. Official quality assurance of breeder, foundation, and certified seed depends upon the work of regional seed inspectors with verification by supervising inspectors of a ten percent sample of registered fields with seed lot inspection and Central Seed Laboratory verification of a comparable sample. NASC is decentralizing its seed inspection to license third-party inspectors and is scaling-out its use of the Seed Tracker™ [56] for online registration to organize field inspection and seed testing for certification of breeder, foundation and certified seed in 2021. Seed Tracker™ was developed by IITA in cooperation with NASC under the BASICS project with BMGF funding. It was designed initially to track and manage certified cassava production, inventory management and sale, was extended to yams under YIISFWA, and is now integrated into the NASC website for registration of all certified seed fields. NASC is also rolling out the Seed Codex that bundles seed labels with scratch off codes to enable farmers to verify that the bag of seed they are purchasing is from a certified seed lot (see QA thematic area).

Interviewees expressed both hope and concern about these digital applications. The hope is that these two systems taken together will provide real-time, accurate information on all three seed class stocks by variety as their inventory builds along with certified seed stock drawdowns, if there is good utilization of the scratch-off verification label. Concern was expressed that digitization improves information flow but cannot address the real-world difficulties of timely field inspections, and timely sampling and testing of samples of seed lots that are often constrained by funding, infrastructure, and transport constraints. NASC IT capacity to integrate the two new tools across all crops was also a concern (see QA thematic area).

Data on effective demand is seen as needing substantial improvement, especially at the variety level for cereals crops. Regional programs like the now concluded West African Agricultural Productivity Program and the West African Seed Program, in cooperation with many partners, have helped to develop and spread the use of potential seed demand forecasting tools. NASC has used some of them in annual planning against national production program objectives. Interviewees pointed to the increasing digitization of forecasting models, such as the Digital Seed RoadMap[57] covering legumes, millets and sorghum, as providing an example of a regionally developed tool that can help make potential demand estimations. The tool uses graphic projections of breeder, foundation, and certified seed production requirements over an assumed varietal lifecycle and adoption rate/market share. The model outputs could be adjusted annually to actual uptake, as real seed production and distribution data is captured. Greatly improved information on adoption rates, the rate of renewal of crop varieties that are recycled, and, ultimately, on the value of certified seed over recycled seed of different generations are needed.

Overall, there is a vital need for a well-integrated seed information management system to pull together the many threads that make up seed supply and demand by crop species and especially by crop variety.

[56] https://seedtracker.org/

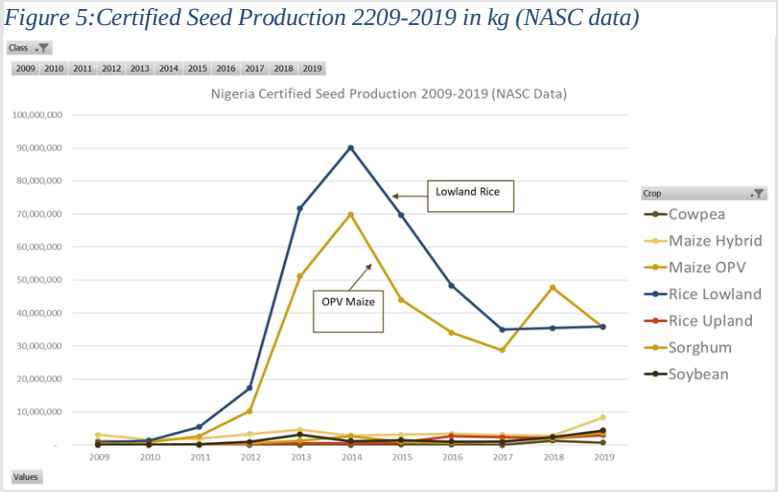
[57] http://seedsystems.icrisat.org/ developed with the ICRISAT, Tropical Legumes III, and HOPE I - II (Harnessing Opportunities for Productivity Enhancement of Sorghum and Millets) funded by BMGF.

This need has been recognized in the Nigeria Seed Road Map and is put forward in the NASC 2020-2025 Strategy. Building it out will require coordination with industry, NGOs, ADPs, and national programs.

***Case Study #1: Nigerian Foundation Seed and Certified Seed Trends 2009-2019***

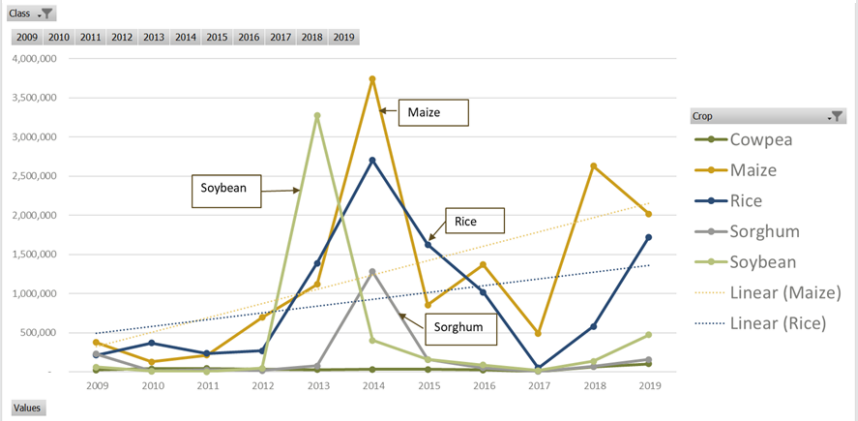
Figure 1 exhibits NASC data on certified seed production for primary crops (not including cassava and yam). The data shows a peak in production in 2014, with a total of 168,000 MT, which is 48 percent of the then estimated demand of 350,000 MT. In this year, there was a confluence of expanded agricultural financial instruments like the GES, Commercial Agriculture Finance, Fund for Agricultural Finance in Nigeria, SME Finance, and mobilization of federal and state effort to increase crop production. This is also the period when many small seed companies were created. If the data are accurate, they can be interpreted speculatively as meaning that while research results and official projections show that potential demand has increased, the effective demand may have declined, but many alternative explanations could be advanced, e.g. that supply, marketing, and/or distribution of seed is inadequately financed and organized.

*Figure 5:Certified Seed Production 2209-2019 in kg (NASC data)*




There are a wide range of economic and social impact studies in Nigeria that demonstrate that there is strong demand for certified seed of improved varieties that is larger than the current supply[58], especially when combined with the prevailing single digit agricultural interest rate of 9 percent of the Anchor Borrower Programme for seed and complementary inputs, and improved input and offtaker access for smallholders. The dynamic of demand for certified seed exceeding supply is reported to have fueled the expansion of sales of fake or counterfeit seed during the peak of certified seed production. Through the SeedSAT agrodealer survey, agrodealers reported volumes of cassava seed traded that was sourced from seed companies that exceeded the amount of cassava seed certified using the new Seed Tracker™ system. Seed companies reported that there is significant demand for popular varieties that cannot be met because there is insufficient foundation seed available to produce the certified seed. This issue is long-standing and is being addressed along several pathways for cereals, legumes, and root and tuber crops, all of which are supported by NARIs and their seed units or non-profit companies, CG centers with development partners, private companies, and NGOs. The available data from NASC shows a similar 2014 peak-year trend in foundation seed production (Figure 2) to that of certified seed production (Figure 1), but with much greater year-to-year variability. The SeedSAT experts did test analysis of multiplication rates across classes from the aggregate data, which appeared low but cannot be fully assessed without better information on the allocation and sales of breeder and foundation seed. The data supplied on breeder seed production is incomplete. SeedSAT pre-visit surveys under the NARS thematic area indicated that breeding programs did not have strong inter-institutional database connectivity. Important quantities of breeder seed are retained for program use. Also, few organizations in Nigeria responded to the SeedSAT EGS survey and triangulation of data was not possible.

*Figure 6:Nigeria Foundation Seed 2009-2019 in kg (NASC data)*



**5. Weak coordination mechanisms reinforce disconnects around incentives and interests across institutions, companies, and donors.** Nigeria's seed strategy is driven by the now decade-long effort spanning the Agricultural Transformation Agenda through the Agricultural Promotion Policy to substitute national production for imports of staple food and feed crops (mainly rice, wheat, maize, soybeans) horticulture, sugar, fish, dairy and poultry, and increase exports to generate foreign exchange from cowpeas, cocoa, cashew, cassava, ginger, sesame, oil palm, yams, cotton, and beef. [59] Agricultural policy has been moving towards restructuring the respective roles of the central government towards governance, regulation, and safety net functions, with greater emphasis on decentralization of implementation measures, and steps towards the development of a commercial ecosystem to drive the growth of the agricultural economy. This has been a nonlinear process, with reversals due to external shocks from the markets, natural disasters, the political economy surrounding national and state elections, and other external events like the COVID-19 pandemic, that lead the public sector to strengthen its implementation role. Weak coordination mechanisms stem from lack of funding for staffing and extension programs, poor implementation of inclusive public/private planning meetings and a general decline in support for seed organizing committees. National coordination mechanisms and platforms exist but still face challenges in effectiveness and inclusiveness.

NASC has clear responsibility for seed sector coordination from research, through all classes of quality assured seed, varietal promotion, licensing of seed businesses, industry and market development, seed trade, and administration of elements of subsidy programs. Executive leadership is present and has relevant skills and expertise. SeedSAT surveys show staff capacity issues exist below leadership level, however, such as the decline in the educational level of QA laboratory staff. The National Seed Road Map (NSRM) and the NASC 2020-2025 strategy recognize that funding falls short of requirements to staff and support NASC operations to the needed standard. Linkage to public extension is perceived as weak by the research institutions and seed producers, given the high household to extension officer ratio[60], the breadth of their responsibilities, and low funding. Some seed companies have started their own combined extension/marketing agent services.

The Agriculture Promotion Policy 2015-2020 (APP) recognizes the long-standing poor linkage between the public and private sector in planning. Private sector companies views the public sector as having allowing CG centers to continue to exceed their mandates beyond to provision of breeder and pre-basic seed, to the provision of foundation and certified seed; unduly limiting seed company licenses to one class of seed; releasing some crop varieties for distribution with product profiles that miss important farmer and processor preferred traits; and unpredictable programs and expenditure on marketing promotion for public varieties. Planning meetings take place at regional level and at national level around major public program seed needs, but improvements are needed on agenda development and follow-up.

States in Nigeria have farming populations that are the same size or larger than the farming populations of many mid-size to smaller African countries. In recent years, NASC promoted the re-activation of State Seed Organizing Committees (SSOC) chaired by the Permanent Secretary of the State Ministry of Agriculture; with representation from the public and private sector. Around seven of the SSOCs have been reactivated with the intent to improve the estimation of the seed requirement and to organize planning and coordination information on seed and other agri-input supply to NASC and FMARD. Since the early 2010s funding has declined for the operation of these committees, which has also reduced the volume and value of information that they can provide on the seed requirement, other input demand, and structure of distribution and marketing channels. Some actors have been displaced toward new roles under ADPs and the Rice Aggregation and Maize Aggregation programs (fadama and millers). The reporting function of these committees may be partly displaced as well, if seed supply and distribution data coming back from the Seed Tracker and Seed CODEX becomes more comprehensive, and if

[59] FMARD. Agricultural Promotion Policy. 2015
[60] TASAI, 2019, shows about one extension agent per 7,500 farmers.

information on producers from the Anchor Borrower, Aggregation, and other programs from their supporting financial institutions can be used to establish accurate seasonal data on effective demand for crop varieties.

Coordination meetings on programs are held nationally and engage the state and federal level public, private, and association/non-profit stakeholders. The National Seed Week and the Seed Connect initiatives are dialogue opportunities, along with the re-establishment of SSOCs are viewed as potentially building blocks for a national platform for stakeholder coordination. The cost of meeting attendance is perceived as a stumbling block and virtualization also poses cost and availability constraints given power blackouts and connectivity issues. The private sector reports that issues arising from these meetings are to dealt with on an ad hoc basis, with projects or programs providing more planning and coordination opportunities at quarterly or semi-annual meetings. The national seed platform established under the West Africa Seed Program (WASP) has ceased to function, along with the West Africa Seed Information and Exchange (WASIX) information system that was intended to supply information on seed availability on a regional basis. A national seed platform can be an important tool for both bottom-up and top-down communication and consultation on planning and coordination if its agenda is prioritized for major seed system actors and if it supports inclusive input. A functioning platform would add significant value for public-private-NGO consultation across all components of the seed system.

**6. National seed trade association SEEDAN, while a strong advocate for private seed company policy initiatives, lacks regional and commodity working group representation.** SEEDAN represents the private seed industry in Nigeria. It was established in 1992 and formally registered with the Corporate Affairs Commission in 2008. It has maintained a strong focus since its inception on promoting and advocating for Nigerian private seed companies active in crop seed breeding, production, marketing, and distribution. Its core membership has come from companies focused on cereals, legumes and vegetables. Interviews conducted by TASAI in 2018 show its membership ranking SEEDAN overall in the fair category relative to the TASAI benchmark[61]. Members ranked SEEDAN higher on policy advocacy and leadership on seed sector activities than on internal management, mobilization of resources, and on governance. SeedSAT interviews with its members and seed system actors expressed a need for the association to improve its communication and transparency in governance, with concerns about slow turnover in leadership (elections are held every 5 years) and the need for a functioning website to increase SEEDAN's information transparency and its influence on seed sector issues.

SEEDAN's 72 members represent the bulk of the larger private seed companies, which represent approximately 80 percent of certified seed volume production, but only 35 percent of the 346 seed companies and seed traders registered by NASC.[62] This membership is largely clustered in Kaduna and focused on cereals and legumes. Given the clustering of seed companies across Nigeria's agroecological zones, the continuing importance of institutional buyers in the seed sector through the Anchor Borrower Program, and the dominance of the larger member companies of SEEDAN in its management, interviewees and researchers see the need to increase the regional presence of the association and to achieve greater representation of different commodity groups to improve the associations role as the umbrella organization for seed companies.

**7. National government programs, projects, and NGOs continue to dominate the seed system, thereby distorting market-oriented development.** National government programs and projects include

[61] Michael Waithaka, Mainza Mugoya, Adesola Ajayi, Folarin Okelola, Krisztina Tihanyi. 2019. Nigeria Brief 2018 - The African Seed Access Index.

[62] NASC registration of seed companies and traders is a bone of contention for SEEDAN, whose own survey of seed companies indicated that many smaller companies had not produced seed for a year or two or had insufficient capacity to be registered as a seed company. TASAI noted the GES program stimulated the creation of seed companies, which may account for some of the registrations. SEEDAN characterized most of the firms on NASCs registration lists as producer-sellers of less than 1,000 mt each. In January 2021, NASC re-registration inspections led to 103 seed companies being de-listed by the seed council.

input subsidy programs and schemes to improve access to credit. National subsidy program rationales are based on seed supply to increase productivity and income in targeted groups and zones. Subsidy implementation approaches are viewed by seed producers as too skewed by top-down initiatives that diverge from more market-oriented approaches that would help define an exit strategy. Successful organization of subsidy information and approaches under the original GES program is seen has having been disrupted by payment issues and a policy shift to special presidential initiatives.

The APP implementation period from 2015 through 2020 has built a system of indirect subsidies by holding interest rates in the single digits at nine percent for qualifying crops and loans. The seed producers generally see the Anchor Borrower Program as supportive of development of the seed market, but have concerns with the timeliness of payment and process for adjudicating payment disputes that, like the GES, leave seed companies heavily indebted to national and state governments and agencies. The Central Bank of Nigeria facilitates the funding of maize farmers and processors through the Anchor Borrowers' Programme Commodity Association, Private/Prime Anchors, State Governments, Maize Aggregation Scheme, and the Commercial Agricultural Credit Scheme. The effect of these programs when combined with NIRSAL credit guarantees and new warehouse receipt programs is to increase the linkage of farmers to markets, boosting their demand for agricultural inputs and services through offtakers. These programs are all planned as revolving capital funds, although the subsidized interest rates at 9 percent reduce the capital of the underlying fund, requiring national budget input to maintain the fund. By 2020, the Nigerian House of Representatives, was becoming concerned about the reported levels of non-repayment of loans made under the Anchor Borrower Programme. The Central Bank of Nigeria had set a capital ceiling of 104 billion Naira with about 86 billion Naira (83.1 percent) disbursed as loans, but only 5 billion Nairia (5.92 percent) was repaid. All of this means the program is not self-sustaining. Ex-post evaluations of impact of the original GES program showed a small positive productivity and overall income impact, but there is not a well-established impact evaluation process across all programs.[63] It is therefore unknown if these programs have been sufficient to significantly shift productivity upward.

Seed relief, NGO project and emergency seed programs provide a major market for certified seeds – about 47 percent according to the TASAI 2019 survey, but their timing and procurement practices are seen by seed companies as providing an incentive for the supply of low quality, counterfeit seed. However, sixty percent of agrodealers surveyed expected that their cash sales to farmers and cooperatives would decrease over one or two years without the support provided by these programs or individual projects.

The NIRSAL and CBN facilitation interventions have taken a significant step away from the public sector's direct seed subsidy and distribution history, moving to market-like approaches that have demonstrated an ability to sustain demand for certified seed if coupled with market linkages. These have propelled the growth of the seed industry, but significant challenges remain in terms of government indebtedness from the past GES scheme that triggered supplier defaults and have kept some seed firms from receiving further loans. The newer programs of indirect subsidy using market-like mechanisms have encountered slow repayment and continued side-selling by farmers. There seems to be a strong likelihood of drawdowns of the guaranty funds on loans and the need for continued budgetary support of the production programs to maintain or increase the demand for seed at farmer level, in addition to the public support needed to sustain the public institutions engaged in the varietal development, early generation seed production, public variety promotion and marketing, and regulation of the seed system.

[63] Ilyasu and Lawal, 2020.

## Proposed Interventions

**1. Improve advocacy to increase Nigeria's public budgetary commitments to agriculture from its recent 2 percent level to its former 5-6 percent level of 6-8 years ago. Work to improve prioritization and coordination of funding for agriculture that is better balanced between production, research and development, early generation seed production, and the regulatory agencies that maintain input quality and agricultural health.** This recommendation needs to be supported by the development of a strong value-added case for the impact of increased public funding of agriculture to both recover from the pandemic and to improve GDP through leveraging greater private sector and smallholder investment and operating response. There should be a corollary case for the impact of increased and sustained funding for core seed system public institutions (ARCN, NARIs, NASC, NAQS) at a minimum over the period of the new National Agricultural Technology and Innovation Plan 2020-2023 needed to structure the licensing, royalties, contracting, and service/user fee revenue streams now authorized under the new PVP and NASC Acts. The CBN, NIRSAL, SEEDAN, farmer and commodity associations, could be natural allies for advocacy, with support from the portfolios of the Agricultural Donor Working Group. A potential focal point for the effort would be the National Economic Summit Group, which has an established working relationship with AGRA (in the Farm Pain to Farm Gain effort) and is a national think tank that can take a position to the National Council on Agriculture.

**2. Improve cost accounting and budget allocation practices such that relevant program costs (personnel, operations, maintenance, and capital) align and program effectiveness can be ascertained.** A stronger, evidence-based case is needed to demonstrate that the public seed system institutions have prioritized program needs and are managing available resources efficiently, and that public resources are concentrated on public good generation and regulatory roles. Operations and maintenance budgets need to move into the recurrent budgets instead of being capitalize as assets (or projectized). This recommendation may include the following activities:

- Provide accounting and financial management assistance to NASC and to NARIs to improve their enterprise and activity cost accounting and budgeting for operations, including transport, facilities and equipment maintenance, and communications.
- Improve and implement sustainable funding plans for operating and capital expenditure for QA. Provide resources to plan and support the transition of NASC and NAQS to meet agreed international (ISTA and OECD) and regionally harmonized standards. This will require the scoping of assistance to develop and implement sustainable funding plans for operating and capital expenditure for the public expenditures on QA for both nationally produced seed for domestic or export use, and on imported seed.
- Improve agricultural research institute capacity to develop grants and project proposals that incorporate balanced capital and operations and maintenance budgeting and funding.
- Provide incentives tied to quantity, quality, and timeliness of delivery for performance-based contracting for breeder, pre-basic, and basic seed production.

**3. Support establishment of the Nigeria Seed Sector Development Fund (NSSDF).** Financial stability is essential to the functioning of key public institutions in the seed system. Current public flows are variable and insufficient to support key research, EGS, and quality assurance roles. The 2019 NASC Act provides for the establishment of a seed fund to defray the costs of NASC operations. The NASC Strategic Plan provides an outline of funding needs by area of NASC responsibility, and their corresponding potential income and bridge funding sources, but these need to be detailed and concrete steps taken to mobilize them. Support is needed to design the fund, its operations, and a pathway to sustainability that combines public budget allocations, service fees that can be retained, and development partner and industry contributions for joint activities. Design considerations include: benchmarking fund

structures of other industries and countries including capital investment and operating expenditures; fee schedules for regulatory and seed industry development services; development of clear payment flows for NASC-provided seed services; establishment of accounting, financial control, and management and reporting; medium-term planning for expenditures not covered by service fees and estimation of bridge funding requirements while fee collection is scaling; development of memoranda of understanding and standard provisions for contracts and collaborative grants. The PVP Act has been passed and terms of reference developed to design and establish the agency to implement the Act. Consideration should be given to the linking of licensing revenue from public varieties to the Seed Fund, along with allocation of those flows to the support of the varietal development and breeder seed production activities of the NARIs, if there is not already a direct mechanism planned for flows of license revenue to the NARIs directly.

**4. Facilitate strong, multi-stakeholder engagement in the diagnostics and design of the planned NASC seed information one-stop shop, with full incorporation of NAQs seed import and export data.** This is a high systems priority but one that must be built on good understanding of current seed information flows along the seed value chain to enable it to aggregate current information on production and storage location for all classes of certified seed based on production and sales/distribution across research institutions, seed companies, NGOs, and crop development and support programs. This effort will require development partner assistance to help underwrite federal, state, company, research institute, and NGO consultations on the establishment and operations of the planned NASC seed information one-stop shop. There will need a systems analysis of current data collection, aggregation, analysis and reporting for national production (breeder-foundation, certified, and quality declared seed classes along with inspection and seed testing data) and seed import and export, with integration of NAQS phytosanitary certification for exports, and regulatory inspections/testing of imported seed. Co-investment is needed to expand the Seed Tracker effort to bring data on seed availability together in a single, transparent, and online database on certified seed production and marketing. The system will also need to cross-link to the Seed Codex. Reinforcement of the Seed Information, Data Management and Capacity Building Department is needed, and, users will need training as the information system elements are developed and rolled out through the NASC portal.

**5. Strengthen the capacities of existing seed system institutions and organizations to improve coordination mechanism and increase the quality and frequency of their interaction around commodity groups and states.** There is a need to support the design and establishment of a National Seed Working Group to strengthen regular, two-way dialogue between the public and private sectors in Nigeria's seed industry that ensures that at least two regular public/private meetings are held each year on planning and coordination, and that includes joint agenda setting, sufficient advance notice, joint agreement on optimal meeting times, timely reporting, inclusiveness of all relevant stakeholders, and establishment of regular feedback channels for meeting discussions and follow up. Development partners should consider support to the Seed Working Group to design and test a joint planning and coordination agenda to get it up and running. They should consider co-investment in four to five annual cycles that blend digital and in-person semi-annual meetings of working groups on crops and in States (leveraging SSOCs where applicable) to feed into a National Seed Systems Platform. There are already at least semi-annual meetings of partner-funded projects that support different crops and actors in the seed value chains, but issues arising need to come forward to a national platform that can work through national crop strategy adjustments in annual plans, public-private stakeholder roles and responsibilities, and donor coordination issues.

**6. Invest in SEEDAN activities that drive member value around key issues of policy/regulatory change, EGS supply, seed demand and supply information, market development to build working groups for the agricultural regions and commodity types.** SEEDAN is essential to private seed

industry advocacy on policy and regulatory issues, representation in public-private planning and coordination, and the development of member company capacity. It currently is supported by members and development partners across these areas but will need continued support to develop value for its members, while building out greater representation through commodity working groups and regional representation. SEEDAN also needs to develop and maintain a working website to increase its transparency and communication outreach. This intervention needs to support an advocacy effort that addresses key concerns laid out by SEEDAN leadership and member seed producers including:

- Operationalization of the newly approved PVP law,
- Strengthening of national support to NARIs for breeder seed production and engagement of breeders in pre-basic seed production,
- A change in regulations to permit a single company to produce and sell more than one class of seed,
- Clear delimitation of the roles that CG centers will play in seed supply to prevent crowding out of the private sector in EGS production and sales,
- Improvement of the seed demand and seed supply information system to resolve conflicting information on seed demand between public and private sources, and
- Consistency of approach and funding for the promotion and marketing of public varieties.

Grant support will be needed to develop and implement advocacy through annual meetings of the association, national and regional dialogue platforms, and working sessions with decisionmakers on industry feedback on policy and regulatory implementation.

**7. Strengthen prioritization of public sector crop specific interventions and investments using the seed archetype sliding scale of public and private roles.** The public, private, and NGO engagement with seed system planning and coordination is complex because of the size and diversity of Nigeria's agriculture sector, but public investment resources are limited and have declined over the past several years. It is therefore important that public investment is prioritized for interventions that are particularly risky and/or private sector is unwilling or unable to invest. It is also necessary to expand the role of the private sector in seed production and distribution when commercially feasible, and when the private sector can deliver and distribute certified seed more efficiently than the public sector. The optic of seed systems archetypes based on relative profit and demand for different crops can be used to prioritize roles between the public and private sector and develop supporting intervention and investment programs (see Case Study #2). This can be used when there is good data on the strength of demand for seed, when there is good information on the profitability of seed production and distribution, and when there is solid information on the relative costs of building public sector assets or incentivizing private sector investments.

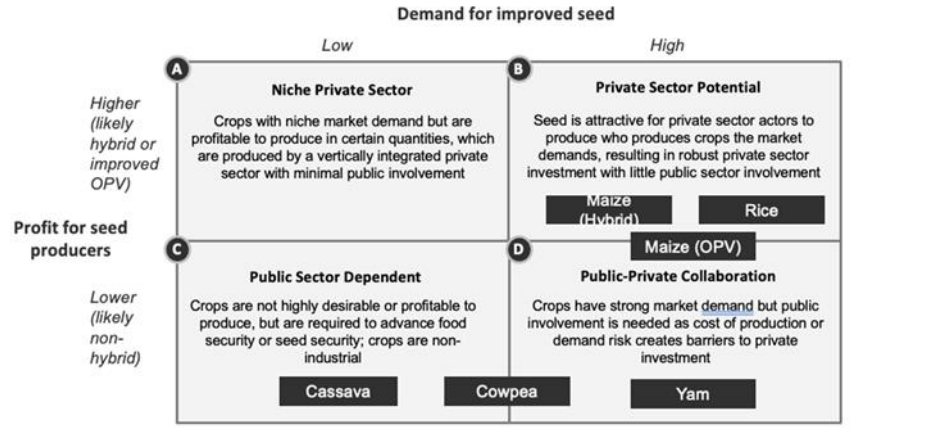
At the systems level two sub-recommendations are to:

- Support broad stakeholder input for the design of the Nigerian seed safety net (humanitarian and natural disaster) components using the pressure test experience of the COVID-19 pandemic, e.g., the Seed Bank incorporated in the NASC 2020-2024 Strategy to compare the centrally based model with one that is more logistically distributed across public seed institutions, private seed companies, and NGOs.
- Revisit the utility of tools like the E-wallet and BVN (biometric Bank Verification Number) that provide greater flexibility and lower costs to structure input and service delivery systems for commercial input and crop sales transactions; seed safety net, and public procurement efforts.

***Case Study #2: Nigerian Seed Systems Archetypes***

At the crop level a mature state for the seed systems to consider for planning and coordination purposes could look like the following:

*Figure 7: Seed System Archetypes for the 5 Nigerian Crops Assessed*




- Hybrid Maize Seed already has demonstrated private investment, but growth of hybrid maize seed production (and presumably planting) has been underwhelming around 10 percent CAGR with more use around producing companies in the North, than in the south. Core programming concerns revolved around company dependence on parental lines that have a limited number of producers; challenges with securing land with sufficient isolation distances to multiply the seed crop; and fake seed scams that limit sales to a small network of trusted sales outlets.
- Rice Seed has demonstrated private sector potential, and the seed system will continue to expand so long as producers have market protections against imported supply and as long the number and scale of millers increases. Increases in miller offtake to maintain seed demand will require improvement of finance for working capital procure raw materials probably using a guaranty fund, and stronger quality assurance on the seed side.
- OPV Maize Seed has demonstrated profitability. While OPV maize should reduce as a share of total maize seed production over time, this hasn't been the trend in Nigeria. Seed producers expect that over time, the maize seed market will expand, both OPV and Hybrid will grow, and Hybrid will grow at faster rate.

**Public-Private Collaboration:**

- Yam has an emerging seed yam business model through the YIIFSWA-II project, wherein commercial seed companies multiply parental plantets/tubers from breeder seed public providers in a screenhouse before transplanting rooted vines & tubers to the field for tuber production. Yam is bulky, expensive to cultivate in the field, and doesn't store long. However, in companies' short foray into marketing formal seed, they have been met with strong demand signals. With financial and technical support to companies, this is a model that shows promise, but is still in its infancy.

**Public Sector Dependent:**

- Cowpea seed is dominated by conventional varieties with the public sector dominant, with genetically modified varieties having a stronger case for a private-public archetype. The relatively low operating margins on certified cowpea seed have discouraged companies from promoting and carrying improved varieties. In response, companies that do commercialize cowpea in Nigeria typically sell to large institutional buyers – such as the government and NGOs – that ensure stable demand, may pay a price premium, and often are lower cost to serve.
- Cassava improved varieties have not demonstrated superior performance to farmer saved seed in Nigeria. As a result, demand for improved varieties is from processors seeking high starch content, starch stability, and upright plant architecture (TME419 is mega variety), not from farmers. The processor-led model for seed system development, wherein a starch processor vertically integrates into clean seed production using an SAH-lab (or other screenhouse setup), has shown promise in that processors have demonstrated their willingness to invest and multiply plantlets. However, the value proposition to the processor is not from profit made from seed sales to outgrowers/farmers. It's from the differential starch revenue at the factory. As a result, the support for private sector supply is less about the benefit of clean seed, and more about the speed to convert varieties.

## Cost Estimates

Overall, high level cost estimates for implementing the recommended interventions ranges from a low of $1.9 million to a high of $4.1 million. More detail of elements included in the cost estimates along with the expert's suggestions in terms of sequencing can be found in Annex III.

| No. | Recommended Intervention | Low (USD) | High (USD) |
|---|---|---|---|
| #1 | Improve advocacy to increase Nigeria's public budgetary commitments to agriculture | 250,000 | 300,000 |
| #2 | Improve cost accounting and budget allocation practices such that relevant program costs (personnel, operations, maintenance, and capital) align and program effectiveness can be ascertained | 500,000 | 1,500,000 |
| #3 | Establish the Nigeria Seed Sector Development Fund (NSSDF) | 400,000 | 600,000 |
| #4 | Facilitate strong, multi-stakeholder engagement in the diagnostics and design of the planned NASC seed information one-stop shop, with full incorporation of NAQs seed import and export data | 250,000 | 750,000 |
| #5 | Strengthen the capacities of existing seed system institutions and organizations to improve coordination mechanism and increase the quality and frequency of their interaction around commodity groups and states | 300,000 | 600,000 |
| #6 | Invest in association activities that drive member value around key issues of policy/regulatory change, EGS supply, seed demand and supply information, market development to build working groups in regions and commodities. | 85,000 | 125,000 |
| #7 | Strengthen prioritization of public sector crop specific interventions and investments using the seed archetype sliding scale of public and private roles. | 250,000 | 400,000 |
| | ***Grand Total*** | ***$1,885,000*** | ***$4,125,000*** |

## Validation, Prioritization and Feedback

The Nigeria validation break-out session held on March 4, 2021 to cover the PLR and NPC thematic areas included representatives from FMARD, NASC, NAQS, Techni Seeds, Premier Seeds, AGRA and USAID. The sections below highlight the major suggested changes and how they were integrated into the bottlenecks and recommendations mentioned above.

**Validation Feedback.** Participant retained the rankings of impact and ease of implementation developed by the experts. They also suggested the following additions and points to emphasize to translate the recommendations in action:

1. A recommendation must be added to address seed system insufficiencies in infrastructure (facilities, communication, power supply,) and in logistics (e.g. transport and support of movement of personnel; transport, storage, and inventory management of regulatory samples, test materials, etc.) because these greatly constrain operations and coordination.
2. Recommendation #1 on public budgetary commitments is understood to mean that the advocacy case must show that increasing the budget closer to 6 percent from under 2 percent would result in production and productivity gains that would reduce food import bills and stimulate the demand for seed. It should show how private investment would respond to increased demand, and it should indicate how disciplined and prioritized public support to research, EGS supply, and quality assurance would improve returns to the increased public expenditures.
3. Carrying over the recommendation from QA to develop and implement sustainable funding plans (both operating and capital expenditure) for QA activities, this recommendation must include contributions from beneficiaries of the seed systems to support these costs.

4. The PLR presentation mentions the need for Nigeria to align more fully with the ECOWAS harmonized seed regulations for seed trade. NASC indicated that Nigeria has aligned with ECOWAS and varieties that have been registered in at least one other ECOWAS state are also authorized for "production and marketing" in Nigeria. Those varieties will be included in the national catalogue. However, certification of nationally produced seed of these varieties requires the development of varietal specific certification standards [implying a variety by variety national testing requirement], because these are not "known" by NASC. This point is also an issue of planning and coordination with ECOWAS, with NASC stating that the ECOWAS regional seed regulations now need to be reviewed and modified on the basis of the experience of member states since enactment of the regional rules.
5. In plenary there was agreement that large projects and NGOs do have substantial effects on the seed value chains. There is a need to examine these impacts to integrate this demand in seed planning and coordination more effectively and efficiently.
6. In plenary, participants noted the need for increased levels of investment – and therefore planning and coordination of – the promotion and the marketing of new crop varieties. Three main points were raised:
    a. The need for farmer awareness campaigns on the value of quality seed;
    b. The need for more demonstrations that compare the most used varieties with the new varietal releases ("farmers need to see them side-by-side);
    c. The need for agrodealer awareness campaigns and capacity building to properly handle and store seed.
7. The word "lack" in Nigeria is understood to mean the total absence of something. Change the wording from "lack" to "ineffective" or "insufficient" so that it aligns with Nigerian usage, for example:
    a. Ineffective – rather than 'lack of' - two-way dialogue with private sector
    b. Insufficient – rather than 'lack of' funding for QA activities

**Prioritization feedback.** The table below displays the proposed prioritization and sequencing of interventions given by the expert along with the impact, ease of implementation and prioritization feedback from the participants given during the validation workshop. The session discussion aligned with the expert priority.

| No. | Recommended Intervention | Expert Proposed Priority | Validated Priority |
|---|---|---|---|
| #1 | Improve advocacy to increase Nigeria's public budgetary commitments to agriculture from less than 2 percent back to 6 percent | 1 | 1 |
| #2 | Improve cost accounting and budget allocation practices such that relevant program costs (personnel, operations, maintenance, and capital) align and program effectiveness can be ascertained. | 2 | 2 |
| #3 | Establish Nigeria Seed Sector Development Fund (NSSDF) Seed Fund | 3 | 3 |
| #4 | Facilitate strong, multi-stakeholder engagement in the diagnostics and design of the planned NASC seed information one-stop shop, with full incorporation of NAQs seed import and export data | 4 | 4 |
| #5 | Strengthen the capacities of existing seed system institutions and organizations to improve coordination mechanism and increase the quality and frequency of their interaction around commodity groups and states | 5 | 5 |

| | | | |
|---|---|---|---|
| #6 | Invest in association activities that drive member value around key issues of policy/regulatory change, EGS supply, seed demand and supply information, market development to build working groups regions and commodities. | 6 | 6 |
| #7 | Strengthen prioritization of public sector crop specific interventions and investments using the seed archetype sliding scale of public and private roles. | 7 | 7 |

# Annex

## ANNEX I: BIBLIOGRAPHY

Access to Seeds Index, Seed Sector in Nigeria, April 2019. https://www.accesstoseeds.org/index/western-central-africa/country-profile/nigeria/

Africa Lead. "Nigeria Early Generation Seed Study." USAID. August 2016.

Agricultural Science & Technology Indicators (ASTI) (2017): Agricultural Science & Technology Indicators: Open Access Data and Analysis of Agricultural Research Investment in Low- and Middle-Income Countries. http://www.asti.cgiar.org

Ajayi, Sola. "Reports of the Assessment of Seed Testing Laboratories of the National Agricultural Seed Council (NASC). *(In addition, list of Analysts that participated in induction course held Dec. 1-4, 2010, and the training program)."* 2009.

Alliance for a Green Revolution in Africa (AGRA). "AGRA Nigeria Operation Plan." 2020.

Ambrose Alikidon, "Challenges and Experiences of Agricultural Research Council of Nigeria in Making Agricultural Research Work for End-users in Nigeria," Nigerian Agricultural Policy Research Journal (NAPReJ) Vol. 3. Issue 1. http://www.aprnetworkng.org/Journal/Paper percent201 percent20V3.pdf.

Central Bank of Nigeria. Anchor Borrowers' Programme Guidelines. CBN Development Finance Department. December 2016. https://doi.org/10.1002/isd2.12066.
Chris O Ojiewo, Lucky O Omoigui, Janila Pasupuleti, and Jillian M Lenn. Grain legume seed systems for smallholder farmers: Perspectives on successful innovations. Outlook on Agriculture. 2020, Vol. 49(4) 286–292

Council of Ministers. "Regulations C/REG.4/05/2008 on Harmonization of the Rules Governing Quality Control, Certification and Marketing Plant Seeds and Seedlings in ECOWAS Region." 17th & 18th May 2008.

Emmanuel Olatunbosun Benjamin, Oreoluwa Ola, Hannes Lang, and Gertrud Buchenrieder. Public-private cooperation and agricultural development in Sub-Saharan Africa: a review of Nigerian growth enhancement scheme and e-voucher program. Food Security (2021) 12:129-140. https;//doi.org/10.1007/s12571-0203-01130y

FAO, "Global Partnership Initiative for Plant Breeding Capacity Building; Plant Breeding Programs in Nigeria" http://www.fao.org/in-action/plant-breeding/our-partners/africa/nigeria/en/.

FAO. Seed Security Assessment in North Eastern States of Nigeria. Participating Partners: FAO (Nigeria), Catholic Relief Services (Nigeria), (Nigeria), Cooperazione Internazionale (Nigeria), National Agricultural Seed Council (Nigeria). 2016.

Federal Ministry of Agriculture and Rural Development. "National Agricultural Seed Degree." 23rd November 1992.

Federal Ministry of Agriculture and Rural Development. The Agriculture Promotion Policy-APP (2016 – 2020) Building on the Successes of the ATA, Closing Key Gaps. Policy and Strategy Document. 2015
Food Agriculture Organization (FAO). "Seed Security Assessment in North Eastern States of Nigeria." 2016.

Iliyasu, I., & Lawal, S. (2020). Nigeria's Self-Sufficiency in Rice and Wheat: An Evaluation of Growth Enhancement Support Scheme (GESS) and Anchor Borrower Program (ABP). *Pakistan Journal of Humanities and Social Sciences*, *8*(1), 1-9. https://doi.org/10.52131/pjhss.2020.0801.009

International Fertilizer Development Centre (IFDC). "Nigeria Agro Inputs Project." USAID. 2017.

International Food Policy Research Institute (IFPRI). "Determinant of Agrodealers' Participation in Loan Market in Nigeria." 2014.

International Institute of Tropical Agriculture PMB 5320, Ibadan, Nigeria. 2002.

Jeffery W. Bentley, Olupomi Ajayi, Kehinde Adelugba. "Nigeria Clustered Seed Companies." 2011.

Joseph Ikechukwui Uduji, Elda Nduka Okolo-Obasi, Simplice Anutechia Asongu. The impact of e-wallet on information farm entrepreneurship development in rural Nigeria. The Electronic Journal of Information Systems in Developing Countries. Volume85, Issue3 . May 2019.

Katrin Kuhlmann and Bhramar Dey, "Using Regulatory Flexibility to Address Market Informality in Seed Systems: A Global Study," *Agronomy* 2021, 11, 377.

Katrin Kuhlmann, et al, Seed Policy Harmonization in ECOWAS: The Case of Nigeria, New Markets Lab and Syngenta Foundation for Sustainable Agriculture Working Paper, December 2018.

Kehinde Oyekale, et al, Bridging The Seed Management Gaps In The Nigerian Seed Industry Journal Of Biology And Nature, Vol.3(4): 132-138, 2015.
https://www.researchgate.net/publication/279978559_BRIDGING_THE_SEED_MANAGEMENT_GAPS_IN_THE_NIGERIAN_SEED_INDUSTRY.

Kehinde Oyekale, Growing an Effective Seed Management System: A Case Study of Nigeria, Journal of Agriculture and Environmental Sciences, Vol. 3, No. 2, pp. 345-354, June 2014.
http://jaesnet.com/journals/jaes/Vol_3_No_2_June_2014/22.pdf

Kuhlmann katrin, Yuan Zhou, Adron Nalinya Naggayi and Heather Lui. "Seed Policy Harmonization in ECOWAS: The Case of Nigeria." December 2018.

Michael Waithaka, Mainza Mugoya, Adesola Ajayi, Folarin Okelola, Krisztina Tihanyi. 2019. Nigeria Brief 2018 - The African Seed Access Index. tasai.org/publications

NACGRAB, Crops Variety Release Catalogue. https://www.nacgrab.gov.ng/index.php/varietal-release/88-crop-varieties-release-catalogue

National Agricultural Quarantine Service. "Service Level Agreement." 2017.

National Agricultural Quarantine Service. "Standard Operating Procedures." 2020.

National Agricultural Seed Council, Premier Seeds, Value Seeds. "A Proposal for Special Intervention Submitted to the Alliance for a Green Revolution in Africa." 2018.

National Agricultural Seed Council. "Draft National Harmonized Seed Rules and Regulations." 2009.

National Agricultural Seed Council. "National Agricultural Seed Council Annual Report." 2018.

National Agricultural Seed Council. "National Agricultural Seed Council Annual Report." 2017.

National Agricultural Seed Council. "Nigeria Minimum Certification Standards." No year.

National Agricultural Seed Council. "Seed Certification Manual." No year.

National Agricultural Seed Council. "Seed Testing Manual." No year.

National Agricultural Seeds Council. "A Strategic Plan for the National Agricultural Seed Council (NASC) 2020 to 2014." Sahel Consulting and Partners. September 2019.

National Agricultural Seeds Council. "National Agricultural Seeds Council Act 2019." 2019.

National Agricultural Seeds Council. "National Seed Roadmap for Nigeria." Sahel Consulting and Partners. September 2019.

National Centre for Genetic Resources and Biotechnology. "Crop Varieties Releases and Registration in Nigeria." 2019.

New Markets Lab, "Annotated Guide on Flexible Licensing Models and Agreements," developed for Seeds2B Africa and AVISA, 2019.

New Markets Lab, "Nigeria Guidebook on Regulatory Aspects of Dissemination of Public Varieties," developed for Seeds2B Africa and AVISA, 2019.

New Markets Lab, "Study of Seed Laws and Regulations Affecting the Development of Private Vegetable Seed Sector in Sub-Saharan Africa," study commissioned by the World Vegetable Center, 2021.

Nigeria Early Generation Seed Study, Country Report by Feed the Future: Building Capacity for African Agricultural Transformation Project (Africa Lead II) for the United States Agency for International Development, August 2016.

O.E. Ayinde; O. Fatigun; K. Ogunbiyi; K. Ayinde; Y.O. Ambali. Assessment of Central Bank Intervention on Rice Production in Kwara State, Nigeria: A Case-study of Anchor Borrower's Program. 2018. Paper presented at the International Conference of Agricultural Economists, July 28-Aug 4, 2018. Vancouver, Canada.

Office of the Director General National Agricultural Seeds Council, Fact Sheet: Understanding The National Agricultural Seeds Council Act, 2019.
https://nesgroup.org/farmgain/documents/factsheet_understanding_seeds_act percent20(1)-compressed.pdf.

P. Kormawa, E. Okorji, R. Okechukwu, Assessment of Seed-Sub Sector Policy in Nigeria, International Institute of Tropical Agriculture, PMB 5320, Ibadan, Nigeria. https://www.inter-reseaux.org/wp-content/uploads/pdf_nigeria_seed_sector_policy_analysis.pdf.

P. Kormawa, E. Okorji, R. Okechukwu. Assessment of Seed-Sub Sector Policy in Nigeria
Program for Africa's Seed Systems. "Seeding an African Green Revolution: The PASS Journey." 2017.

The African Seed Access Index. The African Seed Access Index; Nigeria Brief. https://tasai.org/. October 2019.

Uduji, Joseph I.; Okolo-Obasi, Elda N.; Asongu, Simplice (2019) : Growth enhancement support scheme (GESS) and farmers' fertilizer use in rural Nigeria, AGDI Working Paper, No. WP/19/055, African Governance and Development Institute (AGDI), Yaoundé

Vanguard. "Agribusiness: NASC Withdraws, Delists 103 Seed Entrepreneurs in 2020." Vanguard News, 22 Jan. 2021, www.vanguardngr.com/2021/01/agribusiness-nasc withdraws-delists-103-seed-entrepreneurs-in-2020/.

Wageningen University and Research, Seed Sector Review in Nigeria, Assessment Report, October 2019.
https://issdafrica.files.wordpress.com/2020/02/seed-sector-review-nigeria-assessment-report_final.pdf.

Wageningen University. "Nigeria Seed Sector Assessment Report." October 2019.

Wageningen University. "Nigeria Seed Sector Review Briefs and Roadmap." October 2019.

World Bank Group, Agribusiness Indicators: Nigeria, http://documents1.worldbank.org/curated/en/909651468193779954/pdf/949650WP0P12860Country0Study0R20ST.pdf

World Bank, Enabling the Business Environment for Agriculture: Nigeria Country Profile, 2019. https://eba.worldbank.org/content/dam/documents/eba/NGA.pdf.

World Bank. "Enabling the Business of Agriculture." 2019.

Wossen T., Spielman D. J., Abdoulaye T.and Kumar P.L. (2020). The cassava seed system in Nigeria: Opportunities and challenges for policy and regulatory reform. Lima, Peru: CGIAR Research Program on Roots, Tubers and Bananas (RTB). RTB Working Paper. No. 2020-2.www.rtb.cgiar.org

Wossen, T., G. Girma, T. Abdoulaye, I. Rabbi, A. Olanrewaju, J. Bentley, A. Alene, S. Feleke, P. Kulakow, G. Asumugha, A. Abass, M. Tokula and V. Manyong. 2017. The cassava monitoring survey in Nigeria final report. IITA, Ibadan, Nigeria. ISBN 978-978-8444-81-7. 66 pp.

Wossen, Tesfamicheal, Tahirou Abdoulayeb, Arega Alenec, Shiferaw Feleked, Jacob Ricker-Gilberte, Victor Manyongd and Bola Amoke Awotide. Productivity and Welfare Effects of Nigeria's e-Voucher-Based Input Subsidy Program World Development Vol. 97, pp. 251–265, 2017 0305-750X. 2017 http://dx.doi.org/10.1016/j.worlddev.2017.04.021

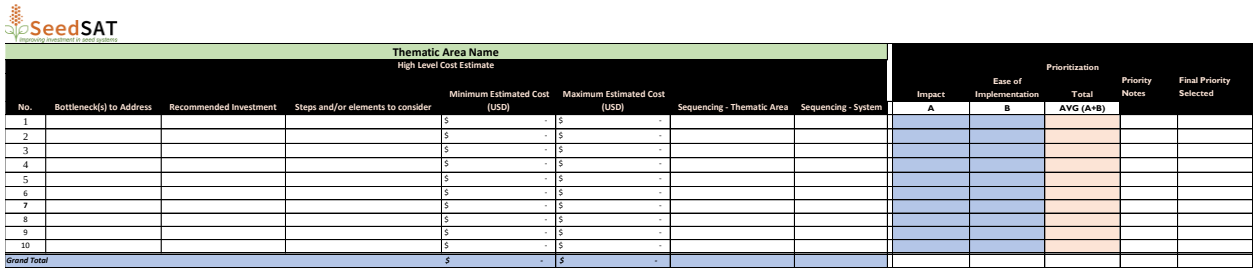
## ANNEX II: ASSESSMENT DETAIL

This annex is found in a separate PowerPoint document, entitled SeedSAT Annex II_Nigeria.ppt. This document includes further detail on the following:

1. Assessment Notes – Beta, implementation, confidentiality, costing, and scoring
2. National Policy, Legal, and Regulatory Framework
3. National Planning and Coordination
4. National Agriculture Research and Breeding Effectiveness
5. National Quality Assurance
6. Early Generation Seed Production / Commercial Seed Production and Distribution

## ANNEX III: COSTING AND VALIDATION DETAIL

This annex is found in a separate Excel document, entitled SeedSAT Annex III_Costing and validation detail_Nigeria.docx. The spreadsheet includes a tab for each of the six thematic areas in the format below. There are additional tabs for the QA cost estimates.



| Thematic Area Name | | | | High Level Cost Estimate | | | | Prioritization | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | Bottleneck(s) to Address | Recommended Investment | Steps and/or elements to consider | Minimum Estimated Cost (USD) | Maximum Estimated Cost (USD) | Sequencing - Thematic Area | Sequencing - System | Impact | Ease of Implementation | Total | Priority Notes | Final Priority Selected |
| | | | | | | | | A | B | AVG (A+B) | | |
| 1 | | | | $ - | $ - | | | | | | | |
| 2 | | | | $ - | $ - | | | | | | | |
| 3 | | | | $ - | $ - | | | | | | | |
| 4 | | | | $ - | $ - | | | | | | | |
| 5 | | | | $ - | $ - | | | | | | | |
| 6 | | | | $ - | $ - | | | | | | | |
| 7 | | | | $ - | $ - | | | | | | | |
| 8 | | | | $ - | $ - | | | | | | | |
| 9 | | | | $ - | $ - | | | | | | | |
| 10 | | | | $ - | $ - | | | | | | | |
| *Grand Total* | | | | $ - | $ - | | | | | | | |

# ANNEX IV: LAB SITE VISIT SUMMARY TABLE, EXAMPLE LAB EQUIPMENT LIST, ILLUSTRATIVE TRAINING OUTLINE

## A. Lab site visit summary table

Nigeria: Status of quality assurance labs and field offices assessed

| | Assessment Area | NAQs-Ibadan | NASC-Ibadan | NASC-Zaria | NASC-Abuja | NASC-Jos | NACGRAB [1] |
|---|---|---|---|---|---|---|---|
| 1. | Lab space is of adequate size and is functional (# of square meters) | Yes [2] (>2,500) | No [3] (160) | Yes (202) | No (485) | No [4] (659) | Yes (55) |
| 2. | Required technical and managerial staff is employed at site (# of staff) | Yes (5) | Yes (16) | No (28, but only 5 for testing) | Yes (19) | See footnote 4 (5) | Yes (8) |
| 3. | Staff is adequately trained | No | No | No | Yes | See footnote 4 | Yes |
| 4. | All basic equipment is on site | Yes | No | No | Yes | No | Yes |
| 5. | Basic required equipment on site is functional and calibrated | Yes | No | No | Yes | No | No [5] |
| 6. | Equipment maintenance plan in place and implemented | No | No | No | No | No | Yes |
| 7. | Sample storage is adequate and functional | No | No | No | No | No | Yes |
| 8. | Required volume of tests are carried out (Avg. of 2018 + 2019 sample volume) | (152/yr) | (67/yr) | (1,883/yr) | (336/yr) | (91/yr [6]) | (4,139/year) |
| 9. | Lab tests are done accurately and on time | No | No | No | No | No | Likely |
| 10. | Operational vehicles are available to adequately support basic QA field work | No | No | No | No | No | N/A |
| 11. | Power is adequate, and backed-up | No | No | No | Yes | No | Yes |
| 12. | Internet connectivity is sufficiently present [7] | None | None | None | Weak and insufficient in office areas | None | Weak and insufficient in office areas |

[1] Note that NACGRAB, which focuses on germplasm testing, is not part of the NASC QA function, but is included here for comparative purposes as it conducts the majority of germplasm testing done in Nigeria and has benefitted from donor support
[2] The cold storage was not in use, but was claimed to be functional
[3] Lab is of adequate size, but only the germination room is being used to some extent per the consultant's report
[4] The Jos lab was ransacked during a period of insecurity immediately prior to the planned visit by the consultant and was not operative at the time of writing
[5] Germination equipment was non-functional at the time of the consultant visit
[6] Prior years' volumes were much lower, at 63 and 146 for 2019 and 2018 respectively
[7] The consultant report states that Internet connectivity is not feasible in the near term

## B. Example lab equipment list

**List 1: Illustrative basic equipment required for seed testing laboratory – approx. 10,000 samples/year**

Source: Government of India, Ministry of Agriculture, Director of Seeds, 2010

| Line # | Equipment | # |
|---|---|---|
| 1 | Seed Divider (Soil type) and Boerner type | 1+1 |
| 2 | General seed blowers-model ER type with kit & transformers | 1 |
| 3 | Binocular magnifier | 1 |
| 4 | Simple microscope | 1 |
| 5 | Electrically heated oven with thermostatic control | 2 |
| 6 | Universal moisture tester and improved moisture tester with transformer | 2 |
| 7 | Electronic timer | 1 |
| 8 | Grinding mill (At ISTA specification) | 1 |
| 9 | Balance with readability up to three decimal places | 1 |
| 10 | Cabinet type germinator | 1 |
| 11 | Refrigerator (165 Ltr.) | 1 |
| 12 | Air conditioner for walk in germinator (germination room) | 2 |
| 13 | Timer, temperature control for walk in germinator(germination room) | 2 |
| 14 | Humidifier for walk in germinator (germination room) | 5 |
| 15 | Steel trolley | 2 |
| 16 | Hot Air oven (seed sterilizer) | 1 |

| Line # | Equipment | # |
|---|---|---|
| 17 | Auto clave | 1 |
| 18 | Moveable open trolley | 4 |
| 19 | Wild stereo bio-noculars microscope wild M-5A as per required caliber | 2 |
| 20 | Compound Research microscope DIAPLAN Microscope(wid levy company) | 1 |
| 21 | In Calculator maintaining 20 degree centigrade fitted with NUV tubes, timer, racks etc. | 1 |
| 22 | Incubator | 1 |
| 23 | Laminar flow of Horizontal/vertical | 1 |
| 24 | Dehumidifier for sample storage room | 1 |
| 25 | Air conditioner for sample storage room | 2 |
| 26 | Generator | 1 |
| 27 | Digital Moisture Meter | 1 |
| 28 | Automatic Seed Analyzer | 1 |
| 29 | Vacuum seed counter | 1 |
| 30 | Purity work board | 1 |
| 31 | Digital Thermo hygrograph | 1 |
| 32 | Seed Blower | 1 |
| 33 | U.V. Chamber | 1 |
| 34 | Mini centrifuge | 1 |

**List 2: Illustrative layouts, equipment and staff calculations for a seed health lab:**

*Source: Worede Woldemariam*

The following assumptions are made to calculate the required equipment and supplies:

| | |
|---|---|
| Visual inspection: | 40 samples/analyst/day |
| Washing test | 15 samples/analyst/day |
| Blotter test, 4 x 100 seeds | 20 samples/analyst/day |
| Agar plate test, 40 x 10 seeds | 5 samples/analyst/day |
| Embryo test, 2000 seeds | 10 samples/analyst/day |

Number of samples to be tested per year:

| | |
|---|---|
| Visual inspection: | 3000 samples = 75 mandays |
| Washing test | 750 samples = 50 mandays |
| Blotter test | 1400 samples = 70 mandays |
| Agar plate test | 300 samples = 60 mandays |
| Embryo Test | 700 samples = 70 mandays |
| Total | 325 mandays |
| One analyst works 200 days/year, including time for lab maintenance, reporting, etc: | 2 analysts |

The laboratory should be furnished with benches along the wall (height for comfortable sitting while working), with cupboards with glass sliding doors, and if space permits with a center bench with bench-top shelves (height for comfortable standing while working). At least one rectangular sink, approx. 35 cm deep. Sufficient stools and chairs, whiteboard, coat hangers, filing cabinet.

1. Basic equipment for testing fungal pathogens

| | |
|---|---|
| 1 | Incubation room, well insulated and air conditioned, with movable shelves, equipped with daylight fluorescent tubes or black light tubes, e.g. Phillips 'TL'D 18W/08, 600 mm long, dia. 26 mm, Ord. No. 9280 480 008 and timer |
| 1 | Thermograph with weekly record sheets |
| 2 | Compound microscopes, one of them with phasecontrast, with 4x, 10x, 25x, 40x and 100x lenses, with measuring eyepiece and calibration slide |
| 1 | Stereo microscope with sub-stage and incident illumination, with 10x, 25x, and 50x magnification |
| 1 | Balance, top-loading, capacity 1 kg, readability 0.1 g, digital display |
| 1 | Analytical balance, capacity 160 g, readability 0.001 g, digital display |
| 1 | Centrifuge, up to 5,000 rpm, with graduated centrifuge tubes |
| 1 | Freezer, upright type, volume approx. 250 liters |
| 1 | Refrigerator, household type, volume approx. 250 liters |
| 1 | Autoclave, pressure cooker type, pressure 1.5 bar, capacity 20 liter, if possible with integrated heater |
| 1 | Incubator, volume approx. 120 liter |
| 1 | Water still, capacity approx. 2 liter/hour |

2. Basic supplies (glassware, chemicals, etc.) for testing fungal pathogens

| | |
|---|---|
| 4 | Erlenmeyer flasks, 2 liter |
| 6 | Erlenmeyer flasks, 1 liter |
| 10 | Erlenmeyer flasks, 500 ml |
| 10 | Erlenmeyer Flasks, 100 ml |
| 6 | Beakers, plastic, 1 liter |
| 10 | Beakers, glass, 500 ml |
| 10 | Beakers, glass, 100 ml |
| 2 | Measuring cylinders, plastic, 1 liter |
| 4 | Measuring cylinders, glass, 250 ml |
| 2 | Measuring cylinders, glass, 100 ml |
| 2 | Measuring cylinders, glass, 10 ml |
| 2 | Aspirator bottles, 10 liter, white plastic |
| 6 | Washing bottles, 500 ml, clear plastic |
| 6 | Funnels, 100 mm dia. |
| 6 | Funnels, 150 mm dia. |
| 1 m | Rubber hose, to fit above funnel stems |
| 10 | Pinchcock clamps |
| 4 | Thermometers, range -20 to 100 °C |
| 4 | Reagent bottles, amber, 250 ml |
| 4 | Reagent bottles, amber, 500 ml |
| 4 | Reagent bottles, amber, 1000 ml |
| 10 | Pipettes, 1 ml |
| 10 | Pipettes, 2 ml |
| 10 | Pipette, 10 ml |
| 20 | Pipette teats |
| 10 | Alcohol burners, with spare wicks |
| 10 | Dropping bottles, amber, 10 ml |
| 500 | Glass petri dishes 9 cm |
| 100 | Test tubes |
| 6 | Test tube racks, each for 12 tubes |
| 4 | Support stands |
| 4 | Support rings, 10 cm dia. |
| 2 | Funnel supports, each holding 2 funnels |
| 10 | Wire gauze squares, 10x10 cm |
| 1 | Set of sieves, 1 mm and 2.5 mm mesh |
| 6 | Scoops, various sizes |
| 4 | Kolle needle holder |
| 20 | Inoculation loops |
| 10 | Lancet needles |
| 10 | Spatulas, various sizes |
| 10 | Tweezers, various sizes |
| 1000 | Microscope slides |
| 5000 | Cover glasses |
| 2 | Haemocytometers, e.g. Fuchs-Rosenthal, with cover glasses |
| 500 | Germination boxes, e.g. 13 x 8 cm, with tight fitting lid |
| 5000 | Sheets thick flat blotter paper, to fit boxes |
| 5000 | Pc. pleated filter paper to fit boxes, 50 pleats |
| 2 | Draining boards |
| 4 | Tally Counters |
| 4 | Brushes, various sizes |

| | |
|---|---|
| | Labels, Aluminum Foil, Cotton, Parafilm, Pencils, Felttip Pens, Clorox, Detergent, Vim, Sponges, Towels (paper and cloth), Tool kit |
| 10 l | Alcohol, (methylated spirit) |
| 3 kg | Phenol |
| 2 kg | NaCl |
| 5 l | Glycerol |
| 5 l | Lactic Acid |
| 2 kg | NaOH |
| 100g | Trypan Blue or Cotton Blue |
| 2 kg | Potato Dextrose Agar |

3. Safety equipment

| | |
|---|---|
| 6 | Pot holders |
| 4 | Labcoats |
| 2 | Packs disposable gloves |
| 2 | Safety pipette fillers (rubber) |
| 1 | First-aid kit |
| 1 | Eye wash station |
| 1 | Fire extinguisher |

4. Equipment for a more advanced laboratory

| | |
|---|---|
| 1 | Laminar air flow bench |
| 1 | Fume hood on cupboard base, with light, gas and water supplies, size approx. 120 x 80 x 240 cm |
| 1 | Oven, volume approx. 100 liter, temperature range 50 to 250°C |
| 1 | pH meter with combination electrode, electrode holder, buffers, and electrolyte |
| 1 | Magnetic stirrer with hot plate, with magnetic bars of various sizes and retriever |
| 1 | Shaking waterbath, approx. 40 x 25 x 15 cm, with stainless steel tube racks |
| 3 | Microliter pipettes (Eppendorf), 20 to 100 µl, 100 to 500 µl, 200 to 1000 µl, with appropriate tips |
| 1 | Household microwave oven, standard |
| 1 | Household blender |
| 1 | UV analysis lamp with 366 nm radiation |
| 2 | Lab carts, one with shelves, one with plastic container and lower shelf, size approx. 80 x 40 cm, 1 m high |

## List 3: Illustrative equipment list for labs of 5,000 and 2,000 samples per annum

Source: Worede Woldemariam

| ITEM # | # required for 5,000 samples | # required for 3,000 samples | Description |
|---|---|---|---|
| **SAMPLING, RECEIVING** | | | |
| 1 | 2 | 1 | Large spear trier (beans, peas) brass tube with pointed end; whole length 65.3 cm; pointed end of 8.2 cm long; slot 4.0 cm x 1.5 cm; outside ø at open end 1.9 cm. |
| 2 | 2 | 1 | Standard spear trier (cereals, small legumes, etc) brass tube with pointed end; total length 60 cm; pointed end of 8.5 cm long; slot 3.3 cm x 1.1 cm; outside ø at open end 1.5 cm. |
| 3 | 2 | 1 | Small spear trier (clovers, brassicas) brass tube with pointed end; total length 43.2 cm ; pointed end of 4.3 cm long; slot 2.0 cm x 0.75 cm; outside ø at open end 1.2 cm. |
| 4 | 2 | 1 | Stick trier (large size seed-beans, peas), double tube, 160 cm long, 9 openings; open end, without partitions; 3.8 cm outside ø; heavy bronze point. |
| 5 | 2 | 1 | Stick trier (medium size seed-cereals, chaffy seed), double tube, heavy bronze point, 76.2 cm long, 6 openings; open end, without partitions; 2.54 cm outside ø. |
| 6 | 2 | 1 | Stick trier (small size seeds-clovers, etc), double tube, heavy bronze point, 76.2 cm long, 9 openings; open end, without partitions; 1.3 cm outside ø . |
| 7 | 2 | 1 | Stick trier, double-tube, heavy bronze point, 183 cm long; 12 openings; open-end, without partitions; 3.4 cm outside ø. |
| 8 | 2 | 1 | Stick trier, brass, 3.05 m long; 20 openings, with partition; extra heavy bronze point. |
| 9 | - | 1 | Trier, deep bin cup, with T-handle and four 90 cm extensions; brass cups, 3.8 cm outside ø, 37.5 cm deep, 265 g capacity. |
| 10 | 1 | 1 | Divider, Riffle type; with hopper and attached 18 channels and frame to hold hopper; 3 receiving and 1 pouring pan. |
| 11 | 1 | 1 | Label printer, stencil printing type similar to machine for printing library cards; with all required components. |
| 12 | 1 | 1 | Numbering stamper, hand used, dating stamp type with consecutive numbering. |
| 13 | 2 | 1 | Thermometer, dial; with 30 cm stem; range -10 to 100oC; stainless steel; 5" dial; bimetallic system, accuracy 1 percent; |
| 14 | - | 1 | Thermometer (bulk seed); with standard T-handle and four 90 cm handle extensions; 21.1 cm brass cover over 13.8 cm glass thermometer protected by cover; range 0-60oC with 1oC divisions. |
| 15 | 1 | 1 | Sling psychrometer; with wicks and thermometers; two 12.5 cm etched mercurial lens magnifying thermometers attached to aluminum back with metal handle for field use; scale range -5 to 45oC. |

| ITEM # | # required for 5,000 samples | # required for 3,000 samples | Description |
|---|---|---|---|
| 16 | 1 | 1 | Hygrothermograph, weekly recording; oC; recording mechanism with 8 day spring wound clock; gear for 7 day chart rotation; rh range 0-100 percent in 1 percent increments, accuracy ± 3 percent. |
| **MOISTURE DETERMINATION** | | | |
| 17 | 2 | 1 | Moisture tester, portable electronic; with charts for all crop; temperature or moisture correction indicator; direct dial reading for common seed; balance meter for adjustment; built-in sample scale. |
| 18 | 1 | 1 | Oven, heated-air, electric; temperature, 130oC ± 3oC; double wall with aluminum interior, enameled steel exterior; bimetallic oven thermostat with indicator; mercury thermometer mount in top. |
| 19 | 2 | 2 | Desiccator with cover and silicagel; heavy annealed glass; sealing with greased internal edge of flanges; 200 mm ø; with 190 mm not breakable polypropylene plate with no feet, with flanged outside rim. |
| 20 | 1 | 1 | Grinder; non-moisture absorbent; adjustable, suitable for all size seeds; easy to clean; set of three sieves with 0.5, 1 and 4 mm ø. |
| 21 | 1 | 1 | Balance, precision; electric; 160 g capacity, 1 g x 10 mg graduations; 1 mg readability; direct reading and tare mechanism. |
| 22 | 50 | 30 | Dishes for moisture test; aluminum, with straight edge and flat bottom; approx. 0.5 mm thickness, ø base 6 cm, depth 3 cm; with tight fitting lids. |
| 23 | 2 | 2 | Tongs, for removing sample containers from oven; general purpose, nickel plated steel; 20 cm, 2.5 cm stirrup jaws with teeth. |
| 24 | 50 | 30 | Can, for moisture samples; polyethylene plastic, tight fitting enameled plastic cap and gasket insert for air seal; capacity, 1 liter. |

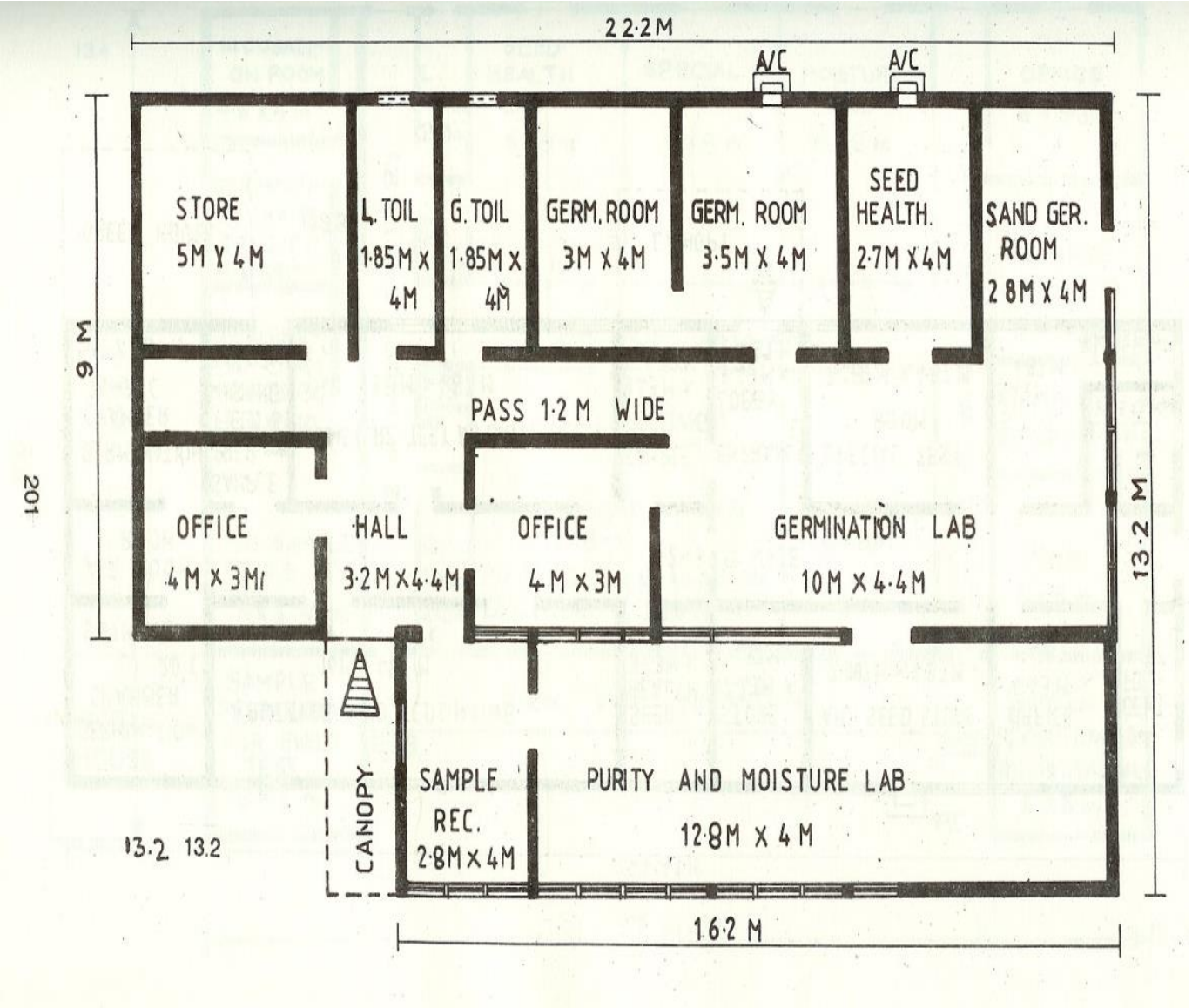
| ITEM # | # required for 5,000 samples | # required for 3,000 samples | Description |
|---|---|---|---|
| **SAMPLE DIVIDING** | | | |
| 25 | 1 | 1 | Divider, Riffle; with 3 receiving and 1 pouring pans; with hopper & attached channels alternating in opposite direction; 18 channels & 18 spaces (each 1.3 cm) with a frame. |
| 26 | 1 | - | Divider, Boerner; with pans (4) and extension; hopper over center separating cone, 19 sections for separating seed in alternating direction; steel legs and supports. |
| 27 | 1 | - | Divider, Gamet, with pans (4); sample divided by centrifugal motor driven revolving neoprene disc under hopper; smooth inside finish; hopper and cylinder top lift off. |
| **PURITY TESTING** | | | |
| 28 | 1 | - | Seed blower; with separating column; air control by a calibrated valve on column cap; trap in upper column for lightweight materials, screen in bottom column to collect heavy good seed; mounted in operating cabinet; 5-minute timer; adjustable stop/on/off; with complete set of separating columns. |
| 29 | 1 | - | Seed counter, electronic; electro-magnetic vibratory action to move seed upward along counting track in single file and layer; sensor threshold sensitivity adjustable to avoid counting chaff; with 25 mm feeder bowl to handle seed up to 9 mm ø x 25 mm long; batch count 1 - 9,999; dual switchable bag chutes. |
| 30 | 1 | - | Test weight apparatus; in kg-hl, with hopper, 1-liter dent proof bucket, triangular pans for overflow, kg-hl calibrated weigh beam; hopper with sliding gate valve and standard 3 cm opening; hopper height adjustable to give standard 5 cm above bucket; cast iron base. |
| 31 | 10 | 6 | Purity workboard (30 x 50 cm) or diaphanoscope fitted with 20 W light; work area of smooth opal glass surface; light off/on switch under the glass to shine through when required for seed examination. |
| 32 | 10 | 6 | Desk lamp; with magnifier and correct fluorescent lighting; 12.5 cm lens; 45 cm adjustable arm, 25 cm long light fixture with three 6-W tubes. |
| 33 | 10 | 6 | Magnifier, hand-held; compound lens; corrected for aberrations; lens swings into cover for protection in carrying; 14x power; 11 mm lens ø, 1.9 cm focus. |
| 34 | 1 | 1 | Binocular microscope, with light; stereo-zoom, magnification, 16x; illuminating system. |
| 35 | 15 | 10 | Forceps, analyst, 13.1 cm, medium-sharp point for manipulating medium and small seed. |
| 36 | 15 | 10 | Forceps, analyst, 15 cm, blunt point; for manipulating large seed. |

| ITEM # | # required for 5,000 samples | # required for 3,000 samples | Description |
|---|---|---|---|
| 37 | 300 | 100 | Containers for purity fractions; pure seed; aluminum or metallic with well fitting lids; large (20 mm x 40 mm ø, depth 20 mm). |
| 38 | 600 | 200 | Containers for purity fractions; other fractions; aluminium or metallic with well fitting lids; small (10 mm x 40 mm ø, depth 10 mm) |
| 39 | 1 | 1 | Cupboard; metalic with plastic drawers; storage for weed seed collection. |
| 40 | 1 | 1 | Glass test tubes; fitted with tight stopper; to store weed seed for reference. |
| **WEIGHING** | | | |
| 41 | 1 | 1 | Balance, precision; 1000 g capacity; 1 g x 10 mg graduations; 10 mg readability; scoop of polished stainless steel; with weight loader; 9 g total x 1 g increments. |
| 42 | 1 | 1 | Balance, analytical; 160 g capacity; readability, 0.1 mg; touch control bar to turn balance on or sets to zero; digital weight read-out; enclosed weighing cabinet to eliminate drafts. |
| 43 | 1 | 1 | Balance, electronic; top loading; digital read- out; dual capacity of (1) 3,000 g at 0.1 g readability, and (2) 300 g at 0.01 g readability. |
| **GERMINATION TESTING** | | | |
| 44 | 2 | - | Germination room, with thermal insulation and moisture/vapor barrier and rubber gasket seals on all surfaces and door; inside push door opener; Temperature and humidity controls, fan(s); fluorescent lights with timers; corrosion proof wall, ceiling, floor, and door surfaces; adjustable metal shelves; capable to establish and hold 10, 15, 20, 30, and alternating 10-20, 20-30oC, etc.; capacity 500 samples. |
| 45 | 2 | 2 | Germinator, with lights; capacity $^3$ 600 liter, with supports for 30 trays; all trays provided; double chamber with fluorescent; exterior and interior finish of stainless steel; reach and maintain 2oC to 40oC ± 2oC; maintain 95 percent rh. |
| 46 | 1 | - | Germinator, copenhagen tank; capacity for 120 samples; all coils and belljars provided; stainless steel tank; circulator; connecting tubing and draining tap; range 5 to 35oC constant and alternate. |
| 47 | 1 | 1 | Refrigerator; front opening door, closed with gaskets; capacity 250 liter; maintain temperature between 5 and 10oC. |
| 48 | 1 | 1 | Oven, heated-air, electric; temperature, 160oC; for sterilizing sand; double wall with aluminum interior, fiberglass insulation, enameled steel exterior; bimetallic thermostat with indicator; mercury thermometer, mount in oven top. |
| 49 | 1 | - | Mixer; small concrete mixer; to mix water and sand for germination test; set of sieves 0.8, 0.05 mm ø. |

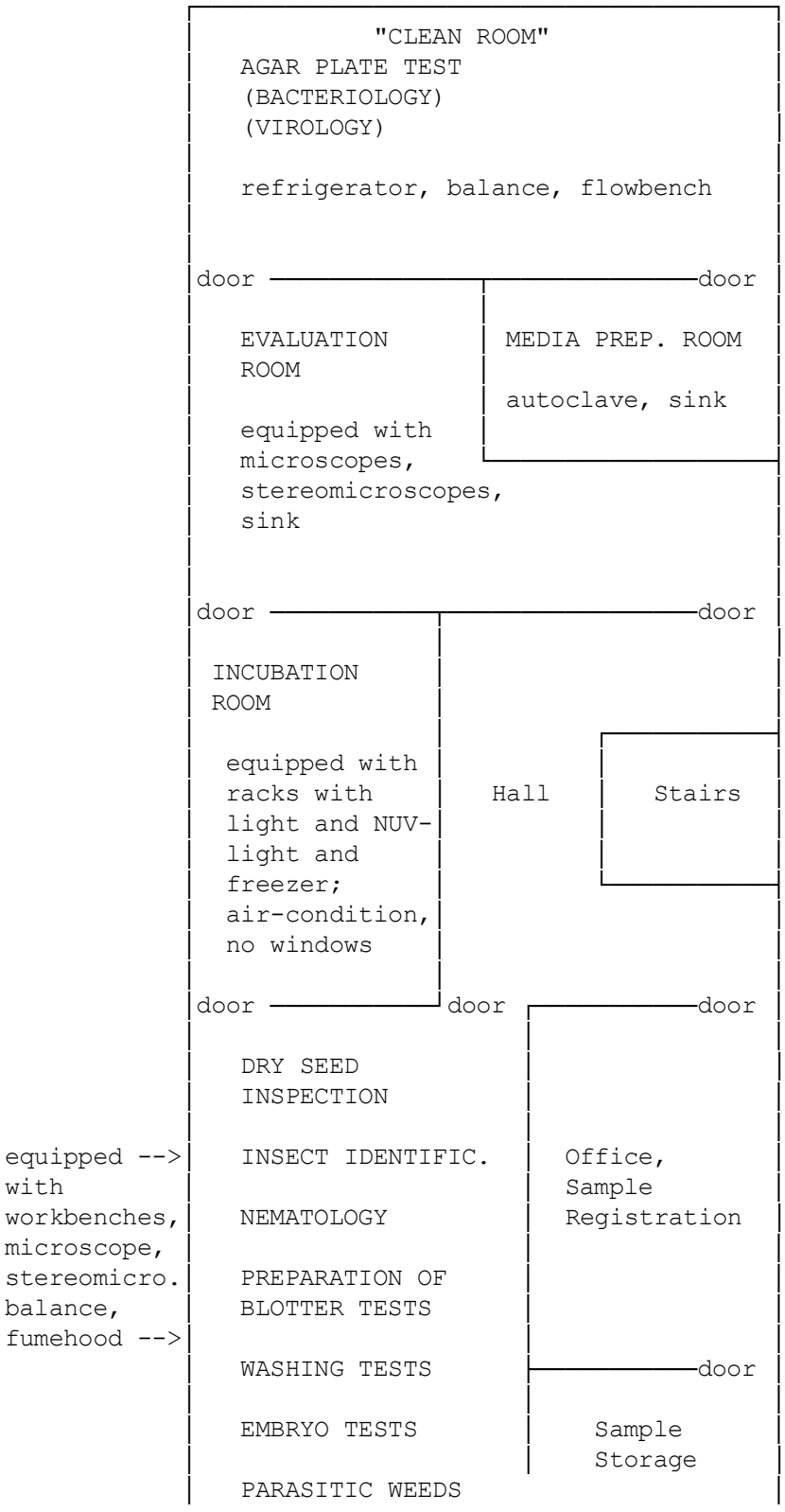
| ITEM # | # required for 5,000 samples | # required for 3,000 samples | Description |
|---|---|---|---|
| 50 | 4 | 2 | Rakes and scrapers; rust-proof metal; for loosening and smoothing the seed beds ; compatible with box size. |
| 51 | 6 | 4 | Counting boards, for large seed (beans, peas, maize); tray for 25, 50 or 100 seed; acrylic and brass to allow washing or sterilization; tray size < 0.75 cm for rectangular or ø of seed bed. |
| 52 | 1 | 1 | Vacuum seed counter, for medium or small seeds; with all interchangeable heads for all crop seed (cereal sized -1.1 mm, brassica sized- 0.3 mm); self-contained unit installed in cabinet. |
| 53 | 1000 | 500 | Boxes; germination in sand (cereals, pulses); size 17 cm x 14 cm x 4.5 cm; tight fitted with 9 cm deep transparent cover. |
| 54 | 200 | 100 | Boxes; germination in pleated paper; shallow and transparent; size 21 cm x 5 cm x 3 cm; fitted with 9 cm deep transparent cover. |
| 55 | 300 | 100 | Pan, aluminum, rectangular, approx. 25 cm x 50 cm x 7.5 cm deep, for rolled and folded paper towel tests. |
| 56 | 500 | 200 | Petri dish, standard size; plastic, with loosely fitting cover; ø 10 cm, depth 1.6 cm. |
| 57 | 10 | 5 | Thermometer, lab; Centigrade, red alcohol, white back; temperature range -20oC to +110oC, 305 mm long, immersion 76 mm. |
| 58 | 15 | 10 | Tweezers; short-arm, not thin or sharp tips; to manipulate small and tender seedlings |
| 59 | 15 | 10 | Spatula; metallic or plastic; for counting seeds. |
| **CONDITIONING TESTING** | | | |
| 60 | 1 | 1 | Hand testing screens, complete set of different perforation sizes & shapes for various crops; with storage racks, 12 blank screens; 30 cm screen frame size, wood frame with design to permit secure stacking of screens for hand shaking. |
| 61 | 1 | 1 | Lab-model air-screen cleaner; to process samples or small lots; with screens of different size to clean all seed; air aspiration before and after screen separation; dust collector; $^3$ (not less than?) 3 screens in sequence flow, 2 scalping and 1 grading; rubber ball screen cleaning system; mounted on work table; adjustable feed hopper; variable speed screen shake with tachometer to indicate shake speed to facilitate reproducible testing; seed pans to collect all discharged fractions; with all required motors, drives, switches. |
| 62 | 1 | 1 | Lab model indented cylinder separator; variable speed drive; adjustable liftings discharge; seed pans for discharged fractions; mounted on worktable; adjustable feed hopper; with 10 common grain indented cylinder sizes; all motors, switches, and drive. With complete conversion kit for sizing (width and thickness, perforated cylinders) separations, including commonly used perforation sizes and shapes for major field crop seed. |

| ITEM # | # required for 5,000 samples | # required for 3,000 samples | Description |
|---|---|---|---|
| 63 | 1 | 1 | Lab model seed scarifier; with brush type adjustable feed hopper; adjustable scarifying mechanism to provide different degrees of polishing hulling or scarifying action; seed pans for all discharged fractions; dust aspiration and collection system; mounted on worktable of standard height; with 20 interchangeable mantles; all required motors, switches, and drive. |
| 64 | 1 | 1 | Lab model gravity separator; with precise air control system; 5 interchangeable deck surfaces for small to large seed; deck slope adjustable from end-to-end and from side-to-side; adjustable deck speed with tachometer to indicate exact speed to allow reproducible testing; seed pans for all discharged fractions; adjustable feed hopper; mounted on worktable of standard height; all required motors, switches, and drive. |
| 65 | 1 | 40 | Sample pan; aluminum, rectangular with pouring spout; size approx. 21.3 cm x 30 cm x 3.75 cm. |
| 66 | 1 | 40 | Sample pan, triangular; heavy tin; approx. size 25 cm x 25 cm x 6.3 cm. |
| **CALCULATION** | | | |
| 67 | 1 | 1 | Desk top calculator; for calculating test results |
| 68 | 1 | 1 | Computer software and printer, for typing test results and certificates |
| **OPERATIONS** | | | |
| 69 | 1 | 1 | Air compressor, heavy duty; with ³ 7.5 gallon tank; portable, on semi-pneumatic tires, with pull handle; oil-less twin-cylinder air pump; one 15-m hose with quick-snap connectors, trigger operated air gun; pressure regulator; automatic pressure actuated on/off compressor switch; 2 extra complete (male and female units) quick-snap connectors. |
| 70 | 1 | 1 | Vacuum cleaner, heavy duty industrial type; to handle solid, liquid, and semi-liquid materials ; portable, on casters; with hose ³ 5 m long, floor sweeping tools and handle, crevice tool, and other cleaning attachments; tank to hold heavier materials; filter bag to filter light dust; liftings tank of stainless steel, ³ 16 gallons; detachable carrier, running gear; fixed handle and utility basket; ³ 50 ft. attached electric cable. |
| 71 | 1 | 1 | Hand tools, complete set, for small repairs to mechanical and electrical equipment; with socket, ratchet, key, open-end and ignition wrench set; torque wrench; set of pin punch, hammer, plier and phillips screwdrivers; pinch bar, tin snips, hacksaw, screwdrivers etc.; with steel toolbox and lock. |

**Site example 1: Seed Laboratory – Illustrative floorplan example**
**Source: Worede Woldemariam**



**Site example 2: Seed Laboratory – Illustrative floorplan example**
**Source: Worede Woldemariam**



door

**C. Sample of QA training agenda tied to indicative cost estimate**

***Source: Training organized by Monsanto/Bayer (Godwin Lemgo, Regulatory Policy and Scientific Affairs Lead- Africa), with sponsors***

## Workshop on International OECD Seed Certification
## Arusha, Tanzania
## 24 September – 4 October 2019

## DRAFT PROGRAMME

| | | | |
|---|---|---|---|
| **Sunday September 22 – Gerry, Kobus and Eddie arrive** | | | |
| **Monday November 23 – familiarisation and final preparation day, participants arrive** | | | |
| **Day 1 – Tuesday, 24 September 2019<br>General, OECD Seed Certification Schemes** | | | |
| 08:00 | 08:30 | *Registration of participants* | |
| 08:30 | 9:00 | Welcome address, opening ceremony | |
| 9:00 | 9:10 | Introductions | |
| 9:10 | 9:30 | Zero Assessment | |
| 9:30 | 10:00 | ***Coffee / Tea break*** | |
| 10:00 | 10:20 | International (OECD) Seed Certification – overview, different seed schemes, benefits and scope | Eddie |
| 10:20 | 10:40 | Status of implementation of OECD Seed Scheme in Zambia | Tanzania |
| 10:40 | 11:30 | The Role of International Organisations in the Global Seed Trade (ISF, IPPC, UPOV, ISTA, OECD) | Eddie |
| 11:30 | 12:00 | OECD Seed Schemes Rules and Regulations: Part I.<br>Legal and General Terms Common to All Seed Schemes - Council Decisions, Basic Principles, Methods of Operation, Application Procedures, Participation in Meetings, etc. | Gerry |
| 12:00 | 13:00 | OECD Seed Schemes Rules and Regulations: Part II.<br>General Rules and Regulations of all Seed Schemes- Eligibility criteria for varieties; Categories of seed, Definitions & Common appendices | Eddie |
| 13:00 | 14:00 | ***Lunch*** | |
| 14:00 | 14:20 | The SADC Seed Harmonisation – progress | Eddie |
| 14:20 | 15:00 | General Discussions – TASTA Topic | TASTA |
| 15:30 | 15:50 | ***Coffee / Tea break*** | |
| 15:50 | 16:20 | The OECD Scheme for Maize Seed | Eddie |
| 16:20 | 16:50 | The OECD Scheme for Cereal Seed (Rice) | Gerry |
| *16:50* | *17:00* | *General Discussions* | |

| Day 2 – Wednesday, 25 September 2019<br>Seed Certification Lectures | | | |
|---|---|---|---|
| 09:00 | 09:30 | The OECD Scheme for Sorghum Seed | Eddie |
| 09:30 | 10:00 | The OECD Scheme for Grass and Legume Seed (Common Beans & Soybeans) | Kobus |
| 10:00 | 10:30 | The OECD Scheme for Crucifer Seed and Other Oil or Fibre Species (Sunflower) | Eddie |
| 10:30 | 11:00 | ***Coffee / Tea break*** | |
| 11:00 | 11:30 | Eligibility criteria and acceptance of varieties – DUS & VCU testing procedures in the context of OECD Seed Certification | Gerry |
| 11:30 | 12:00 | Rules and Directions for listing of varieties/hybrids under OECD Seed Scheme in Tanzania | Tanzania |
| 12:00 | 13:30 | Registration of seed production fields, general crop and field requirements, Field Inspections | Eddie |
| 13:30 | 14:30 | ***Lunch*** | |
| 14:30 | 15:00 | Authorization of Inspectors, samplers, seed testing laboratories | Gerry |
| 15:00 | 15:20 | Labelling 1. – Colour coding, examples of OECD Labels, required information on labels and OECD Varietal Certificates | Kobus |
| 15:20 | 15:35 | Labelling 2. - Supply of OECD labels in Tanzania | Tanzania |
| 15:35 | 15:50 | ***Coffee / Tea break*** | |
| 15:50 | 16:10 | Rules and Guidelines for Multiplication Abroad | Eddie |
| 16:10 | 17:00 | Database & Record maintenance – RSA Example | Kobus |
| *17:00* | *17:20* | *General Discussions* | |

| Day 3 – Thursday, 26 September 2019<br>Sampling Lectures (ISTA) | | | |
|---|---|---|---|
| 09:00 | 10:00 | Overview on ISTA Rules Development and Seed Testing | Eddie |
| 10:00 | 10:30 | Heterogeneity (Smiley Exercise) | |
| 10:30 | 10:50 | ***Coffee / Tea break*** | |
| 10:50 | 12:00 | General principles of seed sampling | Gerry |
| 12:00 | 13:00 | General introduction to sampling methods | Eddie |
| 13:00 | 14:00 | ***Lunch*** | |
| 14:00 | 14:30 | General introduction to sampling methods (Continued) | Eddie |
| 14:30 | 15:00 | Dividing composite samples into submitted sample | Gerry |
| 15:00 | 15:30 | ***Coffee / Tea break*** | |
| 15:30 | 16:15 | Control, calibration and maintenance of sampling equipment | Eddie |
| 16:15 | 16:40 | Sealing Methods | Gerry |
| *16:40* | *17:00* | *General Discussions* | |
| 19:00 | 22:00 | Workshop Dinner (Optional, can be any other night) | Organisers |

| Day 4 – Friday, 27 September 2019<br>Sampling Practical (ISTA) | | | |
|---|---|---|---|
| *08:00* | *09:00* | *Transfer to venue for practical exercises* | Organisers |
| 09:00 | 10:15 | Practical Session: Sampling of containers, bags and boxes. | All |
| 10.15 | 10:45 | ***Coffee / Tea break*** | |
| 10:45 | 11:30 | Practical Session: Sampling of containers, bags and boxes (continued) | All |
| 11:30 | 13:00 | Practical Session: Dividing composite samples into submitted sample | All |
| 13:00 | 14:00 | ***Lunch*** | |
| 14:00 | 15:00 | Practical Session: Calibration of dividing equipment | All |
| 15:00 | 15:30 | ***Coffee / Tea break*** | |
| 15:30 | 17:00 | Practical Session: Calibration of dividing equipment | All |
| *17:00* | | *Transfer back to Hotel* | Organisers |

| Day 5 – Saturday, 28 September 2019<br>Post Controls | | | |
|---|---|---|---|
| 09:00 | 10:15 | Presentation 'Post-Control general' | Gerry |
| 10:15 | 10:30 | Harmonisation of seed testing for OECD seed certification | Tanzania |
| 10:30 | 11:00 | ***Coffee / Tea break*** | |
| 11:00 | 12:00 | Presentation 'Planning and management of control plots" | Gerry |
| 12:00 | 13:00 | Group assignment 'Planning a post control field' | |
| 13:00 | 14:00 | ***Lunch*** | |
| 14:00 | 15:00 | Group assignment 'Planning a post control field' (ctd) | |
| 15:00 | 15:30 | ***Coffee / Tea break*** | |
| 15:30 | 16:00 | General Discussions on Post Controls | |

| Day 6 – Sunday, 29 September 2019<br>Rest Day | | | |
|---|---|---|---|
| *08:00* | *18:00* | *Free Time* | *All* |

| Day 7 - Monday, 30 September 2019<br>Field Inspection Lectures | | | |
|---|---|---|---|
| 09:00 | 10:30 | General principles of OECD field inspection | Gerry |
| 10:30 | 11:00 | ***Coffee / Tea break*** | |
| 11:00 | 11:45 | OECD Requirements: Field Inspections on Maize (Including the taxonomic characteristics) | Eddie |
| 11:45 | 12:15 | OECD Requirements: Field Inspections on Soya (Including the taxonomic characteristics) | Kobus |
| 12:15 | 13:00 | OECD Requirements: Field Inspections on Rice (Including the taxonomic characteristics) | Gerry |
| 13:00 | 14:00 | ***Lunch*** | |
| 14:00 | 14:45 | OECD Requirements: Field Inspections on Sorghum (Including the taxonomic characteristics) | Eddie |

| | | | |
|---|---|---|---|
| 14:45 | 15:30 | OECD Requirements: Field Inspections on Common Beans (Including the taxonomic characteristics) | Kobus |
| 15:30 | 16:00 | ***Coffee / Tea break*** | |
| *16:00* | *17:00* | *General Discussions* | |

| **Day 8 – Tuesday, 1 October 2019<br>Control Plot Practical** | | | |
|---|---|---|---|
| *08:00* | *09:00* | *Transfer to venue for practical exercises, Divide in Groups* | Organisers |
| 09:00 | 10:00 | Practical exercises in control plots (soya) | |
| 10:00 | 10:30 | ***Coffee / Tea break*** | |
| 10:30 | 13:00 | Practical exercises in control plots (maize, sorghum) | |
| 13:00 | 14:00 | ***Lunch*** | |
| 14:00 | 15:00 | Practical exercises in control plots (rice) | |
| 15:00 | 15:30 | ***Coffee / Tea break*** | |
| 15:30 | 16:45 | Practical exercises in control plots (beans) | |
| *17:00* | | *Transfer back to Hotel* | Organisers |

| **Day 9 – Wednesday, 2 October 2019<br>Crop Inspection Practical Day 1** | | | |
|---|---|---|---|
| *08:00* | *10:00* | *Depart from hotel and travel to Inspection fields* | Organisers |
| 10:00 | 10:30 | ***Coffee / Tea break*** | |
| 10:30 | | Group 1 – Crop inspection training (Maize & Sorghum)<br>Group 2 – Seed Industry Visit | |
| 13:00 | 14:00 | ***Lunch*** | |
| 14:00 | 15:30 | Group 1 – Crop inspection training (Beans & Soybeans)<br>Group 2 – Seed Industry Visit | |
| 15:30 | 16:00 | ***Coffee / Tea break*** | |
| 16:00 | 17:00 | Group 1 – Crop inspection training (Rice, Sunflower)<br>Group 2 – Seed Industry Visit | |
| *17:00* | | *Transfer back to Hotel* | Organisers |

| **Day 10 – Thursday, 3 October 2019<br>Crop Inspection Practical Day 2** | | | |
|---|---|---|---|
| *08:00* | *10:00* | *Depart from hotel and travel to Inspection fields* | |
| 10:00 | 10:30 | ***Coffee / Tea break*** | |
| 10:30 | | Group 2 – Crop inspection training (Maize & Sorghum)<br>Group 1 – Seed Industry Visit | |
| 13:00 | 14:00 | ***Lunch*** | |
| 14:00 | 15:30 | Group 2 – Crop inspection training (Beans & Soybeans)<br>Group 1 – Seed Industry Visit | |
| 15:30 | 16:00 | ***Coffee / Tea break*** | |
| 16:00 | 17:00 | Group 2 – Crop inspection training (Rice, Sunflower)<br>Group 1 – Seed Industry Visit | |
| *17:00* | | *Transfer back to Hotel* | Organisers |

| Day 11 – Friday, 4 October 2019<br>Assessment & Closure | | | |
|---|---|---|---|
| 09:00 | 09:30 | Final Assessment | Participants |
| 09:30 | 10:30 | Position of BMT in the OECD Seed Schemes | Gerry |
| 10.30 | 11:00 | ***Coffee / Tea break*** | |
| 11:00 | 12:00 | Open session with Zambian NDA | |
| 12:00 | 12:45 | OECD seed Schemes in the UK | Gerry |
| 12:45 | 14:00 | ***Lunch*** | |
| 14:00 | 14:45 | OECD Seed Schemes in South Africa | Eddie |
| 14:45 | 15:15 | Assessment answers | Gerry / Eddie |
| 15:15 | 15:45 | ***Coffee / Tea break*** | |
| 15:45 | 16:15 | Final discussions and round-up | Gerry / Eddie |
| 16:15 | 17:30 | Presentation of Certificates and Closing Ceremony | |

| Day 12 – Saturday, 5 October 2019<br>Departure | | | |
|---|---|---|---|
| *08:00* | *18:00* | *Depart for Home* | *All* |

## ANNEX V: LAB SITE VISIT REPORT

This annex is found in a separate Word document, entitled SeedSAT Annex V_Lab site visit report_Nigeria.docx.

## ANNEX VI: INSTITUTION INTERVIEW LISTS

| PLR Interview List |
|---|
| **Institutes and Government Partners** |
| National Agricultural Seed Council |
| Seed Entrepreneurs Association of Nigeria |
| Agricultural Research Council of Nigeria |
| All Farmers Association of Nigeria |
| Institute for Agricultural Research |
| Ahmadu Bello University, Zaria, Kaduna |
| National Centre for Genetic Resources and Biotechnology (NACGRAB) |
| Institute of Agricultural Research and Training (IAR&T), Obafemi Awolowo University |
| IAR/ABU Zaria |
| ICRISAT |
| **Private sector seed companies – 8 companies** |

| Quality Assurance Interview List | |
|---|---|
| **Seed Producers** | |
| Abuja | 2 Representing Imported Seed, Local Seed, Commercial Seed, EGS, Maize, Rice, Cowpea, Yam, Cassava |
| Lagos | 2 Representing Imported Seed, Local Seed, Commercial Seed, EGS, Maize, Cowpea, Yam, Cassava |
| Kaduna | 3 Representing Local Seed, EGS, Commercial Seed, Maize, Rice, Cowpea, Yam |
| Oyo | 1 Representing Local Seed, EGS, Cassava |
| Gombe | 1 Representing Local Seed, EGS, Commercial Seed, Maize, Rice, Cowpea |
| Katsina | 2 Representing Local Seed, EGS, Commercial Seed, Maize, Rice, Cowpea |
| Kano | 3 Representing Local Seed, EGS, Commercial Seed, Maize, Rice, Cowpea |
| Zamfara | 1 Representing Local Seed, Commercial Seed, Maize, Rice |
| Niger | 1 Representing Local Seed, EGS, Commercial Seed, Rice |
| Abia | 2 Representing Local Seed, EGS, Commercial Seed, Maize, Rice, Cowpea, Yam, Cassava |
| Plateau | 2 Representing Local Seed, EGS, Commercial Seed, Maize, Rice, Cowpea, Cassava |
| Ebonyi | 1 Representing Local Seed, Commercial Seed, Rice, Yam |
| | |
| **Farmer Groups** | |
| Abuja | 6 Representing Maize, Rice, Cowpea, Yam, Cassava |
| Oyo | 1 Representing Maize |
| Makurdi | 2 Representing Cassava |
| Benue | 3 Representing Cassava |
| Enugu | 1 Representing Rice |

# ANNEX VII: DOCUMENT REQUEST LISTS

## A. List of Legal and Regulatory Instruments:

1. National Agricultural Seed Council Act, 2019.
2. National Center for Genetic Resources and Biotechnology (NAGRAB) Guidelines for Registration and Release of New Crop Varieties in Nigeria, 2016.
3. NASC Guidelines For Registration Of Seed Producers / Companies And Seed Fields In Nigeria, 2017.
4. The Agriculture Promotion Policy, (2016 – 2020).
5. Federal Ministry for Agriculture and Rural Development, National Seed Policy, 2015.
6. Economic Community for West African States (ECOWAS) Regulation C/REG.4/05/2008 on Harmonization of the Rules governing quality control, certification and marketing of plant seeds and seedlings in the ECOWAS Region.

## B. List of documents requested for Quality Assurance:

| Item # | *DOCUMENT REQUEST - NIGERIA* | |
|---|---|---|
| | **Information requested** | **Completion Status** |
| 1 | Organogram of institutional QA entities within the MoA, and within each entity | Partial |
| 2 | Ministerial level seed policy and legislation (e.g., Seed Act plus amendments) | Completed |
| 3 | The last three years of available annual reports from the certification agency and/or the phytosanitary agency, if agencies are separate | Partial, missing NAQS |
| 4 | List of varieties currently planted by farmers, with date of registration and indication of current level of commercialization or distribution | Partial |
| 5 | Seed classes covered by government mandated QA activities, e.g. breeder, pre-basic, basic, full certified, standard certified, QDS | Completed |
| 6 | Current and historical certified seed volume by crop, seed class -- for both locally produced and imported seed, by both ha inspected and mt certified | Completed |
| 7 | List of registered seed companies and other seed production entities, with date of initial registration, location, and contact information if available | Completed |
| 8 | List of officially registered seed distribution entities, location, designation by type (hub agrodealers, retailer, cooperative, seed company store, government site, etc.), and contact information if available | Pending |
| 9 | Relevant QA standards followed by the country, e.g. ISTA, IPPC, ISPM, OECD, regional body, etc., by crop and by class of seed | Completed |
| 10 | Officially gazetted regulations and amendments for locally produced seed, plus draft of any new regulations if they are being updated | Completed |
| 11 | Officially gazetted regulations and amendments for imported seed, plus draft of any new regulations if they are being updated | Completed |
| 12 | Documentation of inspection, analysis and/or testing protocols (or standard operating procedures, or other relevant documents) for government QA employees for SSAT focus crops, if separate from the | Completed |
| 13 | Documentation of inspection, analysis and/or testing protocols (or standard operating procedures, or other relevant documents) for QA employees of independently authorized entities, if separate from the regulations | Don't Have |
| 14 | Samples of all QA labels (by crop, by seed class) including anti-counterfeiting labels, if any | Completed |
| 15 | Any other public materials related to QA given to seed producers by the government | Completed |
| 16 | Any other public materials related to QA given to seed importers by the government | Completed |
| 17 | Any other public materials related to QA given to seed distributors by the government | Pending |
| 18 | Regulatory authority schedule of fees for certification activities, plus phytosanitary activities if separate | Completed |
| 19 | Service charter from regulator, and from phytosanitary authority if separate | Pending |
| 20 | Service charter from phytosanitary authority | Completed |
| 21 | Documentation of official process for seed producer or importer challenge of QA results | Pending |
| 22 | List of all government QA facilities and location (listed by purpose, e.g. branch/field office, lab, quarantine facility, growout field), with capacity of premises, and total number of seed QA staff | Partial |
| 23 | For the facilities listed above, list of equipment, storage capacity (including cold), land available for post control growouts, vehicles, ICT infrastructure and status of IT connectivity | Pending (but partially collected in site visit exercise) |
| 24 | List, including location, services delivered, and owner, of all licensed labs other than government labs | Completed |
| 25 | Names, locations, qualifications and years of QA experience of all public seed inspectors, samplers, analysts | Pending (but partially collected in site visit exercise) |
| 26 | Names, locations, qualifications and years of QA experience of all fully licensed independent seed inspectors, samplers and analysts | Do not have independent inspectors yet |
| 27 | List of registered members of seed trade association | Pending |
| 28 | Last three years of budget information for seed quality and phytosanitary agencies | Pending |