

Yam Improvement for Income and Food Security
in West Africa (YIIFSWA)

YIIFSWA Project Description

N.G. Maroya, R.Asiedu, P. Lava Kumar,
A. Lopez-Montes, J. Orchard, and F. Ndiame



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Yam Improvement for Income and Food Security in West Africa
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Cover photo: A yam market in Nigeria.

Acronyms and Abbreviations

AGRA	Alliance for a Green Revolution in Africa
AU	Abuja University
ARI	Advanced Research Institute
BMGF	Bill & Melinda Gates Foundation
CRI	Crops Research Institute, Ghana
CRS	Catholic Relief Services, Ghana
DDS	Diocesan Development Services, Nigeria
ECOWAS	Economic Community of West African States
EPRV	Endogenous para retrovirus
FGs	Farmers' groups
FOs	Farmers' organizations
FOSCA	Farmer Organizations Support Center in Africa
GLDB	Grains and Legumes Development Board, Ghana
GSID	Ghana Seed Inspection Division (Ministry of Food and Agriculture)
IITA	International Institute of Tropical Agriculture, Nigeria
ISFM	Integrated Soil Fertility Management
JIRCAS	Japan International Research Center for Agricultural Sciences
KNUST	Kwame Nkrumah University of Science and Technology, Ghana
MAFF	Ministry of Agriculture, Forestry and Fishery, Japan
MP	Micropropagation
MSHR	Missionary Sisters of the Holy Rosary
NACGRAB	National Centre for Genetic Resources and Biotechnology
NARS	National Agricultural Research Systems
NAQS	Nigerian Agriculture Quarantine Services
NARES	National Agricultural Research and Extension Systems
NASC	National Agricultural Seed Council, Nigeria
NPPO	National Plant Protection Organization, Nigeria
NRCRI	National Root Crops Research Institute, Nigeria
PCR	Polymerase chain reaction
PPRSD	Plant Protection and Regulatory Services Directorate, Ghana
QMP	Quality management protocol
RTEP	Root and Tuber Expansion Program, Nigeria
RTIMP	Root and Tuber Improvement and Marketing Program, Ghana
SARI	Savanna Agricultural Research Institute
SPs	Service providers
SQC	Seed quality certification
TUA	Tokyo University of Agriculture, Japan
NRI	Natural Resources Institute, University of Greenwich, UK
UI	University of Ibadan, Nigeria
VCA	Value chain analysis
VP	Vine propagation
YIIFSWA	Yam Improvement for Income and Food Security in West Africa

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Several other colleagues of the National Agricultural Research Systems (NARS) in Bénin, Côte d'Ivoire, Ghana, Nigeria, and Togo for their support to the proposal development.

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The Bill & Melinda Gates Foundation for their financial contribution for the development of the proposal for the prosperity of the smallholder yam farmers in Ghana and Nigeria.

Preface

The YIIFSWA (Yam Improvement for Income and Food Security in West Africa) project is an R4D project of IITA. The project is funded by the Bill & Melinda Gates Foundation and executed in Nigeria and Ghana by IITA in partnership with a consortium of national and international R4D agencies and in collaboration with service provider organizations, the private sector, farmers, and yam traders.

The YIIFSWA project has the following broad objectives:

1. Strengthen small-scale farmer and trader market linkages, particularly in less accessible producing areas, to realize benefits from improved ware yam productivity and market demand.
 2. Strengthen capacities and empower small-holder farmers in the yam value chain.
 3. Establish sustainable availability of high quality seed yam on a commercially viable and price competitive bases in targeted areas.
 4. Reduce postharvest losses and improve product quality.
 5. Develop technologies for high ratio propagation of high quality breeder and foundation seed yam.
 6. Evaluate and scale out yam production technologies with improved and local popular varieties.
 7. Identify more effective prevention and management tools and strategies for pests and diseases.
- Each objective is addressed by a team of researchers supported by other researchers working on two cross-cutting components, namely impact monitoring, evaluation and learning; and communication and information dissemination.

The YIIFSWA Working Paper Series is published informally by YIIFSWA to disseminate its intermediate outputs. Publications in the series include methodologies for, as well as preliminary results of the various objective teams of the YIIFSWA project. The series is aimed at scientists and researchers working with national agricultural research systems in West Africa, the international research community, policy makers, donors, and members of international development agencies that are interested in yam. As these papers are not in their final form, comments are welcome. Such comments should be addressed to the respective authors or to the YIIFSWA Project Manager.

Individuals and institutions may obtain copies by writing to:

The Project Manager
Yam Improvement for Income and Food Security in West Africa
International Institute of Tropical Agriculture
PMB 5320. Oyo Road
Ibadan, Nigeria

Background

In West Africa yam (*Dioscorea* spp.) is a food and cash crop and therefore plays an important role in the food security and livelihoods of at least 60 million people. Yam is cultivated mostly in the derived and southern Guinea savanna agroecologies of West Africa. About 48 million tons (t) of yam (95% of the global supply) are produced on 4 million hectares (ha) annually in the region, mainly in five countries: Bénin, Côte d'Ivoire, Ghana, Nigeria, and Togo; Nigeria alone accounts for 70% of global supply.

Yam ranks as one of the most important sources of calories in Côte d'Ivoire, Bénin, and Ghana. The crop also makes a substantial contribution to protein in the diet, ranking as the third most important source of supply after maize and rice. Additionally, yam plays a significant role in social rites of passage, thanksgiving, etc., giving it prominence over other food crops in the region.

The amount of land allocated to yam is growing rapidly because demand for the commodity is increasing; as incomes rise, consumers shift from substitutes to yam, especially when the price of yam declines relative to the prices of its substitutes.

Numerous problems which plague the yam food sector impede national policy program efforts aimed at promoting yam as a priority crop in the various countries in West Africa. High cost and unavailability of disease-free seed yam can be considered to be the most critical of the problems; others include the high labor input associated with land preparation and staking, high levels of on-farm losses of tubers during harvesting and storage, and pests and diseases such as viruses, nematodes, fungi, scale insects, and beetles. Increasing intensification of cultivation has raised the incidence and severity of field pests and diseases. These constraints form the basis for the interventions in the YIIFSWA project.

The YIIFSWA Project

This working paper aims to inform yam researchers, policymakers, donors, and NGOs about the YIIFSWA project and has been adapted from the YIIFSWA project proposal which is lengthy and not in the public domain. The YIIFSWA project is a 5-year R4D project of IITA effective from September 2011. The project is funded by the Bill and Melinda Gates Foundation and executed in Nigeria and Ghana by IITA in partnership with a consortium of national and international R and D agencies: the Nigerian National Root Crops Research Institute (NRCRI), the Ghanaian Crops Research Institute (CRI), the Natural Resources Institute (NRI), Alliance for a Green Revolution in Africa (AGRA), Catholic Relief Services (CRS), and Missionary Sisters of the Holy Rosary (MSHR), in collaboration with service provider organizations, the private sector, farmers, and yam traders.

The YIIFSWA project addresses the following major constraints:

- High cost and unavailability of disease-free seed yam.
- On-farm postharvest losses.
- Low soil fertility.
- Unexploited potential of markets by smallholder farmers.
- Unavailability of varieties adapted to stress environments of the savanna agroecologies.
- Diseases and pests.
- Limited opportunities for smallholder farmers, mainly rural women, in production and marketing.

Key Objectives of YIIFSWA

YIIFSWA will address the above challenges through the following key objectives.

1. *Strengthen small-scale farmer and trader market linkages, particularly in less accessible production areas, to realize benefits from increased ware yam productivity and market demand.* This activity will develop a greater understanding of the yam value chain and markets, and deliver a comprehensive market development program to remove the technical and institutional barriers that prevent smallholder farmers from having access to and building more profitable linkages with existing and new/emerging markets.
2. *Strengthen capacities and empower smallholder farmers in the yam value chain.* This activity will develop capacity and empower smallholder farmers in the value chain. Together with other activities, it will develop a strategy for selecting locations and farmers' groups to create the necessary direction, synergy, and coordination among all project activities required to deliver impact and ensure that issues such as gender, drivers of technology adoption, and sustainability are addressed. This activity will strengthen farmers' organizations at different levels in their effectiveness in servicing the needs of their members, thus enabling them to play a more significant role in the value chain and improve their income, livelihoods, and food security.
3. *Establish sustainable availability of high quality seed yam on a commercially viable basis in targeted areas.* This activity will provide the know-how and means for a sustainable improvement in the local capacity to produce the clean seed yam that drives productivity gains and enhance market opportunities for farmers. A commercial system will provide the sustainable means of ensuring smallholders' access to high quality seed yam.
4. *Reduce postharvest losses and improve product quality.* This activity aims to reduce losses of fresh tubers on-farm and in marketing, improve the quality and safety of processed products, and increase income from these products.
5. *Develop technologies for high ratio propagation of high quality breeder and foundation seed yam.* This activity aims at establishing high ratio propagation techniques for the production of high quality seed yam and a quality management protocol to ensure seed quality along the production and distribution chain.
6. *Evaluate and scale out yam production technologies with improved and local popular varieties.* This activity intends to evaluate and disseminate biophysically and economically feasible improved and existing technological packages to increase the productivity and profitability of ware yam production systems.
7. *Identify more effective prevention and management tools and strategies for pests and diseases.* The purpose of this activity is to establish effective technologies for ensuring the quality of seed yam and, by the use of pest risk assessment exercises, determine the risks and rate of the re-infection of healthy seed yam planted in the field.

These are supported by cross-cutting components: impact monitoring, evaluation, and learning, communication, and information dissemination.

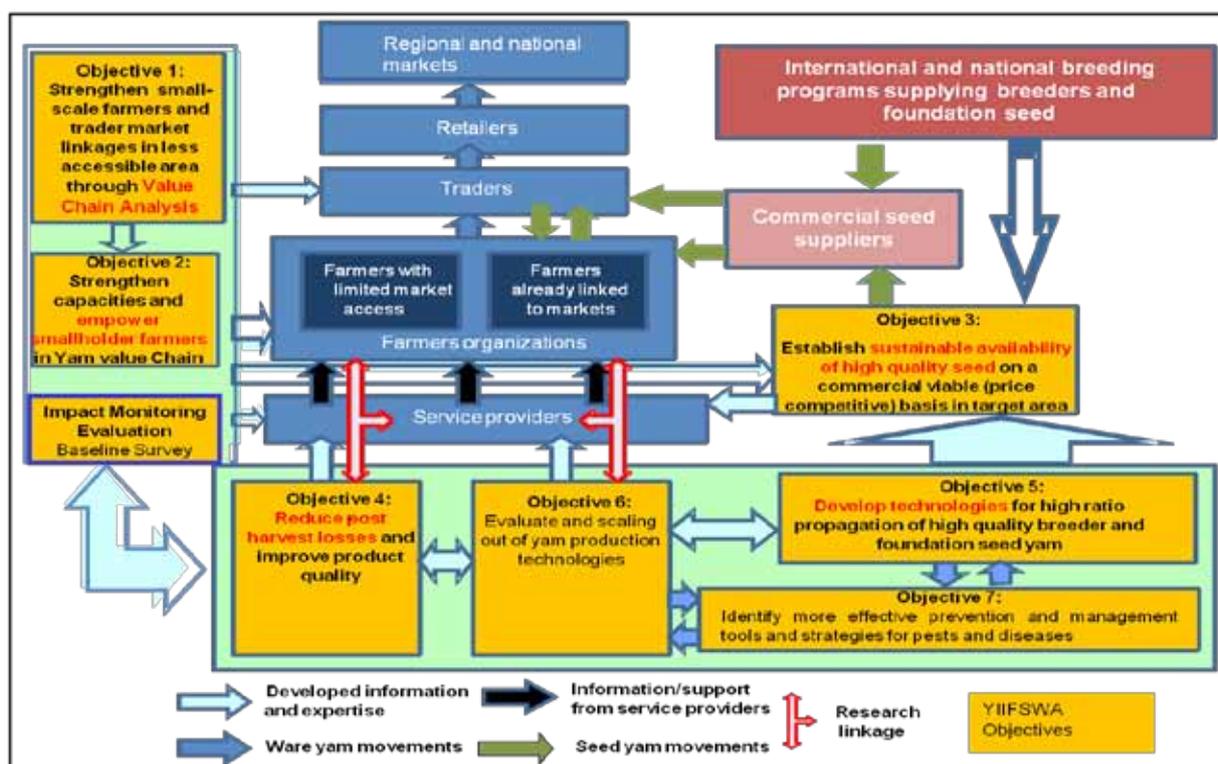


Figure 1. Conceptual diagram of YIIFSWA objectives and linkages for sustainable partnerships.

Implementation strategy

The YIIFSWA project will adopt a holistic and sustainable approach in which technology development is grounded in partnership among researchers, service provider organizations, the private sector, farmers, and traders (Fig. 1). At the center of this partnership are two key approaches to deliver impact.

1. Transforming the current fragmented, undervalued supply chains into more coherent value chains that create greater and more established purposeful linkages among all the actors so that they can benefit from investments in new technologies such as high quality certified seeds.
2. Raising the capacity of farmers, through their organizations, to work more productively with other value chain players and with service providers and researchers to be able to demand, invest in, and manage new technologies, services, and information to increase their productivity and market potential.

The implementation of the YIIFSWA project through these productive partnerships and pathways to impact will engender confidence for further investment by donors and national programs to deliver a 10- year vision of success to sustainably double incomes from yam for 3 million smallholder farming families in West Africa and contribute to ensuring food security for producers and consumers.

Expected outputs

The medium to long-term major outputs/outcomes of the YIIFSWA project are as follows:

- Functional breeder seed yam units and reliable foundation and certified seed yam producers established in Ghana and Nigeria.

- Tuber pest damage in storage barns reduced by at least 25%.
- Farmers using clean planting material increase their yields by at least 40%.
- Standards for high quality clean seed yam production formalized in Ghana and Nigeria.
- Farmers linked to the markets for generating incomes through the increased production and marketing of yam.
- Yam is affordable for the urban and rural consumers.
- Preferred stress tolerant varieties widely grown by farmers.
- Diagnostic tool kits available for the production of clean seed yam and certification.

Hypotheses

A number of hypotheses will be tested during YIIFSWA implementation to provide direction for additional research that will help the full potential of yam to be realized in increasing food security and incomes in West Africa.

- The competition between yam for seeds and for food at the farm level will be reduced as a result of the increased use of more productive seed propagation methods.
- The area planted to yam and productivity will increase as a result of the reduced production costs.
- The reduced costs will allow more smallholder farmers, especially women, to engage in increased production.
- More smallholder farmers, especially women, will be engaged in commercial production as a result of the effective marketing infrastructure.
- The reduced production costs will lead to reduced prices for consumers while ensuring profits for smallholder farmers.

YIIFSWA target countries

The YIIFSWA project targets yam producing areas of the savanna agroecological zones in Nigeria and Ghana that account for 75% of the world's production. Support for research and development is rather limited in most countries but, within their limited resources, the two countries have significant advantages over other West African countries, as follows.

- Importance of yam in the current and planned national research and development agenda.
- Government support for the crop.
- Human resource capacity.
- Basic infrastructure (e.g., tuber storage facilities at the main stations).
- Inclusion of national yam researchers in both in-country and subregional partnerships.
- Demand by farmers for research results on the crop.

Two other countries, Togo and Bénin, will benefit through sharing information and improved varieties. In Côte d'Ivoire, freedom of movement in yam producing zones for effective technology development, testing, and transfer is presently restricted by civil strife.

Beneficiaries

Actors in the crop sector that would benefit from YIIFSWA interventions include farmers producing seed and ware yam, farmers and traders engaged in the storage and wholesale marketing of seed and ware yam, farmers and specialist processors engaged in the transformation of fresh tubers to dry chips and instant foods, traders and food sellers involved in the marketing of tubers and products or food preparation for sale, transporters who link production sites with markets, exporters who buy from local traders or farmers, as well as rural and urban consumers.

Special attention will be paid to the rural poor who dominate the production on small farms and to women who dominate the wholesale and retail trade and food preparation. Impact at the levels of traders and exporters will provide a constant demand for diverse products and enhance stable livelihoods for producers and consumers. Poor rural and urban consumers will benefit from the reduced costs of products for longer periods in the year and from improved wealth and health.

The YIIFSWA project will also benefit the international research, academic, and donor communities by generating the scientific information on yam in West Africa which is at present scanty in several respects. The information generated will be a powerful tool for advocacy for yam among West African political leaders and policymakers and among international development agencies and donors.

YIIFSWA Team and Partners

The following partners are chosen for their technical and managerial competence and effectiveness in past projects, their commitment to the development of West Africa, and the mutual trust built up over the years. Most of them participated actively in the activities funded through the planning grant from the Bill & Melinda Gates Foundation for the learning study that formed the basis for this proposal.

International Institute of Tropical Agriculture (IITA)

IITA is a research-for-development institution founded in 1967 and based in sub-Saharan Africa (SSA). In 1971 it became one of the founding centers of the CGIAR. IITA is a not-for-profit institution registered in Nigeria and works directly or with partners in about 30 countries in SSA. To deliver on its mandate to reduce food insecurity and poverty, IITA focuses on the most important food crops (including yam) and related cropping systems of SSA. The Institute's mission is to increase agricultural production, food security, and income in the tropics, especially SSA, through research-for-development (R4D). IITA's goal is to raise over 20 million people out of poverty while simultaneously freeing over 25 million ha of farm lands.

IITA's responsibilities in YIIFSWA include the following:

- Project coordination; administrative management.
- Establishment of partnerships, linkages, and coordination of key stakeholders in the seed yam chains with special emphasis on breeder, foundation, and commercial seed producers and marketers.
- Development and promotion of technologies for enhanced seed yam production.
- Promotion of productive and cost-effective propagation technologies for breeder and foundation seeds.
- Production of clean breeder and foundation seed yam of recommended varieties.

- Identification of “pest-free” field sites for the mass propagation of “clean” seed yam.
- Identification and training of entrepreneurs for the commercial production of certified seed yam.
- Support for the implementation of standards and protocols for the inspection and certification of “clean” and quality seed yam.
- Development and promotion of rapid propagation technologies for the high ratio production of breeder and foundation seeds.
- Development of detailed operational and business plans for increased cost-efficient breeder (and possibly foundation) seed production.
- Development of effective technologies for managing the quality of seed yam.
- Evaluation of popular and near-release varieties for adaptation to environments with low soil fertility, low moisture stress, and labor-saving (no staking) systems.
- Evaluation and scaling out of the best-bet existing and new improved technological packages to overcome constraints and increase productivity.
- Conduct of pest risk assessment (PRA) to identify the risk of pests spreading through planting materials, the rate of re-infection, and deterioration of “clean” yam.
- Development of simple and cost-effective virus diagnostic tools for the indexing and certification of seed yam.
- Evaluation and selection of germplasm resistant to nematodes.
- IM&E and Communication.

Natural Resources Institute (NRI)

NRI is a specialist institute within the University of Greenwich (UoG), in the UK. NRI provides high quality and relevant research, consultancy, learning, and advice in support of sustainable development, food security, economic growth, and poverty reduction. In the context of YIFSWA, NRI supplies the expertise of specialist staff on value chain assessment and development, postharvest technology, market development, gender and diversity, impact assessment/monitoring and evaluation, and yam virology.

NRI will implement the following activities:

- Conduct value chain assessment/mapping.
- Draw up and implement a yam market development program.
- Support communication to reduce market asymmetries.
- Develop and promote technologies to reduce tuber losses on-farm and in storage.
- Develop and promote technologies to reduce tuber losses during marketing.
- Improve postharvest characteristics through germplasm assessment and selection.
- Improve farm/small-scale processing.

Alliance for a Green Revolution in Africa (AGRA)

AGRA aims to increase smallholders' incomes and livelihoods by working with farmers' organizations to provide demand-driven, income-enhancing services to their members. To that effect AGRA established the Farmer Organization Support Centre in Africa (FOSCA) that links organizations with service providers to focus on demand-driven services. The objective of FOSCA is to facilitate the access of farmers' organizations to demand-driven external service providers and to promote market linkages among farmers' groups and private players, development partners, and financial intermediaries. FOSCA works with farmers' organizations to facilitate the local delivery of technical and managerial capacity.

In the YIIFSWA project AGRA through FOSCA will be responsible for the following:

- Strengthen the capacity of farmers' groups and farmers' organizations in management, business and marketing social inclusivity, member representation, and external linkages.
- Build local capacity for market-oriented, participatory, gender-sensitive, and equitable approaches in yam development.
- Develop an effective demand-driven model for building the capacity of farmers' organizations in yam value chains.
- Develop and validate an enterprise resource planning system.

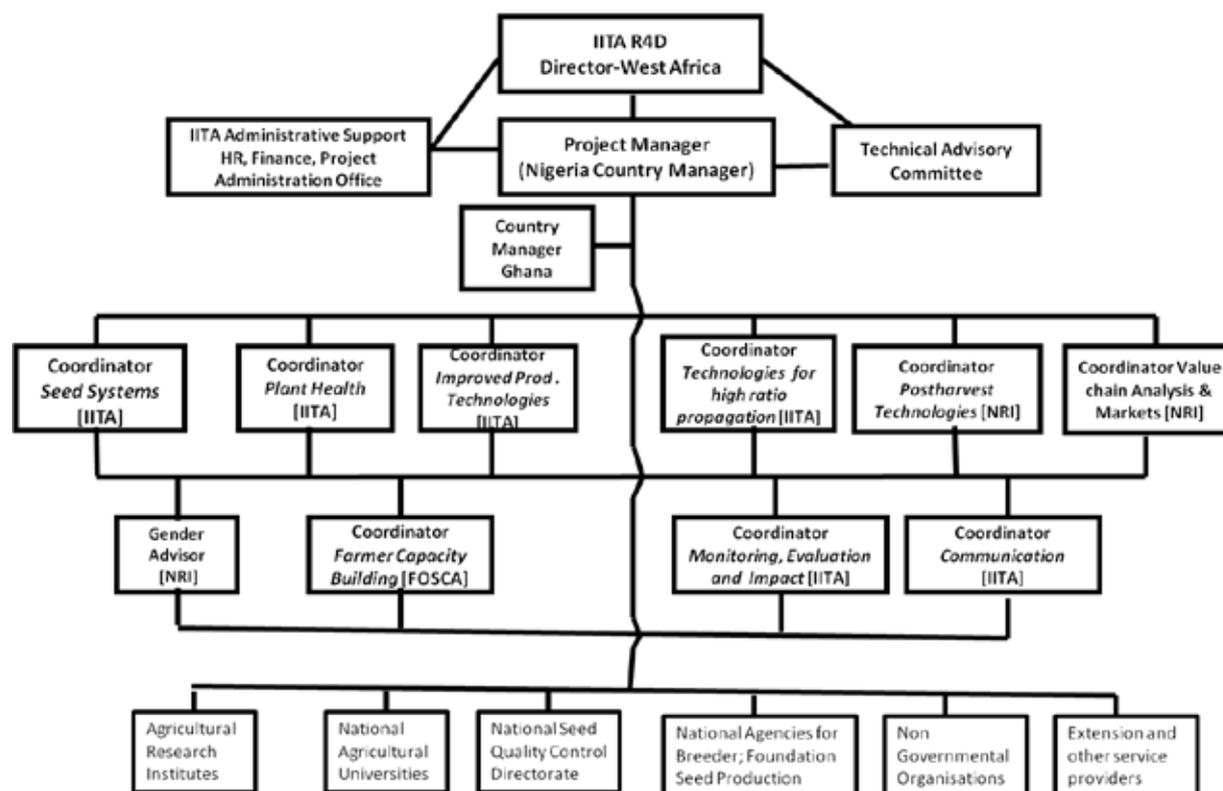
National Agricultural Research and Extension Systems (NARES) of Nigeria and Ghana

The NARES that will be partners in YIIFSWA are (in Ghana) the Crops Research Institute (CRI) and Savanna Agricultural Research Institute (SARI) and (in Nigeria) the National Root Crops Research Institute (NRCRI). The NARES will conduct and coordinate research and development activities in the project's target countries. The NARES will collaborate with other local and international institutions in their core research and development activities on yam and with one another through joint participation in subregional projects. The NARES will maintain regional centers with experimental sites in the yam growing agroecologies of the respective countries, collaborate with a network of yam growers through participatory research activities, and maintain strong links with the national extension services.

Activities of the project to be implemented by NARES include the following:

- Production of breeder seeds.
- Implementation of breeding and seed propagation trials.
- Organization and management of Field Days.
- Pest risk assessment.
- Assessment of agronomic packages.
- Data collection for project monitoring and evaluation.
- PhD student supervision.
- Participatory trials for implementing refined available propagation techniques.
- Seed Quality Control monitoring visits for field and seed yam certification.
- A Revolving Fund to facilitate foundation seed production following the Quality Management Protocol (QMP).
- Training, demonstration trials.
- Support all in-country project interventions, etc.

YIIFSWA Organogram



Organizational Structure of YIIFSWA

Technical Advisory Committee

A technical advisory committee (TAC), consisting of six members, will provide technical oversight of the project. TAC members will be men and women with diverse expertise relevant to the YIIFSWA objectives and will be drawn from national and international organizations. They will review project progress reports and participate in annual project meetings. TAC will meet once a year for critical appraisal of the progress and future directions of the project. TAC members will interact with the Project Manager and the Coordinators of various YIIFSWA activities.

Project Oversight

The West Africa Research-for-Development (R4D) Director of IITA will ensure oversight of the project.

Project Manager

A scientist with strong skills in project management will provide project coordination and management, and budget monitoring, and act as the main contact for communication with the donor and administrative divisions of participating organizations, such as IITA, NRI, AGRA, and the national programs. This position will be based in Ibadan, Nigeria. Together with the main Activity Coordinators and the Country Managers, the Project Manager will oversee the planning and implementation of activities, reporting on outputs, M&E, and the coordination of partnership and stakeholder relations.

Country Managers

There will be Country Managers for the two countries. The Project Manager, who is based at IITA-Ibadan, will double as Country Manager-Nigeria. Country Managers will have a degree in agriculture as well as a strong background in project management, and will be based at the lead national partner institution in the country. The incumbents will coordinate all project activities in the country, ensure coordination between various partners and stakeholders, and review progress with Activity Coordinators and implementation teams on a regular basis in their countries. Country Managers will report to the Project Manager.

Activity Coordinators

Scientists from IITA, NRI, and FOSCA will be responsible for the implementation of the project activities including planning, monitoring, and reporting of outputs, budget monitoring, and the preparation of technical reports to ensure appropriate linkages and communication within YIIFSWA. The Activity Coordinators will report to the Project Manager.

The following four specialists will work with the Activity Coordinators for Seed Systems; Communication; Impact Monitoring, Evaluation, and Learning.

1. Seed System Specialist

The Seed System Specialist will have a higher degree in agriculture and a minimum of 5 years of professional experience in seed production and multiplication schemes. The incumbent will also have a good background in seed certification and quality control procedures as well as knowledge of input marketing and agribusiness.

The Seed System Specialist will assist in the conduct of field experiments and demonstrations on seed technologies with partners; develop seed yam production training modules, and conduct training courses and workshops related to seed systems; identify entrepreneurs (groups or individuals) wishing to establish seed production enterprises; develop an information exchange strategy among plant breeders, seed producers, seed distributors, and farmers on variety performance and

market information; assist in the promotion of seed businesses through media campaigns, field demonstrations, and advocacy efforts at all levels; and assist in matching seed businesses with trained, certified, and networked agrodealers.

2. Communication Specialist

In addition to excellent writing and oral communication skills, the Communication Specialist will have a comprehensive knowledge of the production and design of agriculture-based Information Education/Extension and Communication (IEC) materials. The Communication Specialist will also have a good knowledge of online social media tools and extensive media network/contacts in West Africa. The Communication Specialist will be technically supervised by IITA's Head of Communication and will assist with the implementation of the project's communication plan in consultation with the Project Manager.

3. Impact Monitoring Evaluation and Learning (IMEL) Specialist

The incumbent will have at least an MSc degree in social sciences with a strong background in economics or agricultural economics. The IMEL specialist will also have 5 years of experience in the field of M&E and be knowledgeable in performance analysis indicators, logical framework approach, theory-based evaluation, formal survey techniques, rapid appraisal and other participatory methods, cost-benefit analysis, and impact assessment approaches. The IMEL specialist will provide comprehensive assessment of the socioeconomic and institutional determinants and the impacts of yam technology development and seed delivery efforts in consultation with the project management team. The IMEL Specialist will be supervised by an IITA senior economist specialized in Impact Assessment.

4. Gender Specialist

Gender expertise will be commissioned by the Coordinator of Activity 2 to provide analysis and advice on gender issues and lead partners' training activities on the subject.

Management Plan

Project management will involve, among others, monitoring project inputs, activities, outputs, and milestones through a process monitoring and evaluation system which will also provide a database for internal and external evaluations as well as for regular progress reports to stakeholders. All partners' involvement in the project will be defined by subcontracts linking deliverables to financial support. Assessment will cover whether milestones and outputs are being achieved and whether project funds are being used to achieve most effectively the project's purpose and vision of success.

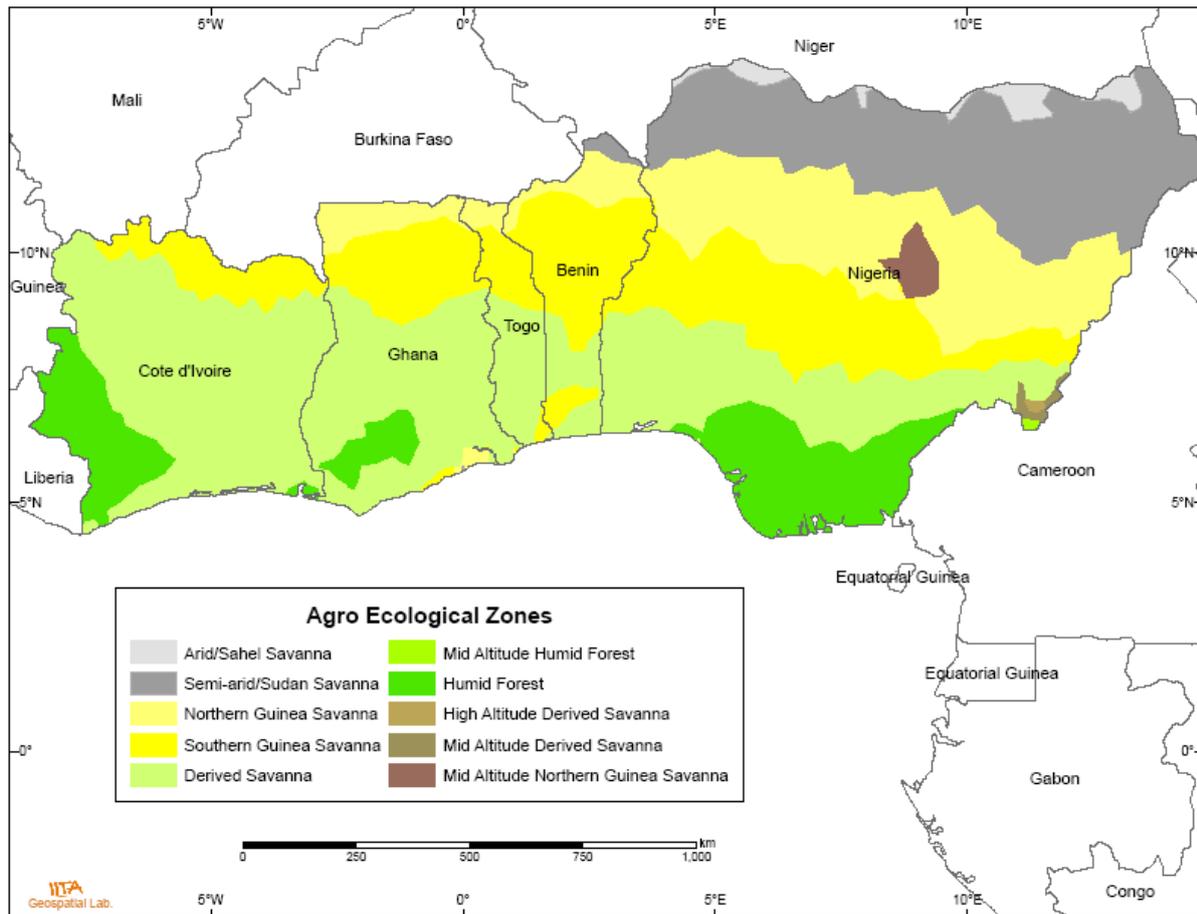
Annual project meetings and TAC meetings will review project progress, establish annual work plans and the roles of scientists and partners, discuss and apply new insights for the most effective use of funds within the objectives and activities of YIIFSWA. The project will produce scientific and administrative reports regularly to inform the donor and to exchange results among partners and key stakeholders, and with the global scientific community.

A management information system will be designed and put in place for the monitoring and evaluation

of inputs, activities, and outputs. This will be undertaken at different levels using established tools and software at IITA (e.g., PROMIS, ORACLE) for project monitoring and evaluation. Project management will involve the description and measurement of observed outputs and outcomes along defined metrics agreed on a *a priori* basis, such as in the log frame, and will include regular reviews of milestones as a measure for project progress, monitoring visits and (virtual, annual face-to-face) meetings of research partners, and corrective measures where these are necessary. Process evaluation will determine to what extent the project has been implemented as planned and identify operational and strategic lessons for flexible and adaptive management. Specifically, performance assessment will review the quality and quantity of outputs and outcomes based on the evolution of key performance indicators. Adoption of outputs by clients will be a key indicator for the usefulness and quality of the outputs. Research results and databases from internal impact monitoring and evaluation activities will be fed back to project management and used to enhance project effectiveness.

Annexes

Annex 1. Key agroecologies of the major yam producing countries in West Africa.



Annex 2. Project partners, beneficiaries, capacity building, and sustainability in YIIFSWA.

Organization	Role
CGIAR Center	
International Institute of Tropical Agriculture (IITA)	<ul style="list-style-type: none"> • Project coordination and implementation. • Coordination of Objectives 3, 5, 6, and 7. • Participation in baseline and value chain analysis. • Promotion of good production and storage practices. • Development of true-to-type, clean seed yam stocks of varieties chosen for seed systems by stakeholders. • Facilitation of efficient formal seed yam system. • Development of Quality Management Protocol (QMP) and seed yam certification system. • Evaluation of elite yam varieties in multilocations, PVS, and release. • Development of integrated crop management practices. • Development and scaling up of integrated soil fertility management options. • Development of virus indexing tools. • Research on high-ratio, cost-effective seed yam propagation techniques (vine propagation, micropropagation, aeroponics, and other novel multiplication techniques). • Development of SSR markers for genotype identification. Screening of germplasm for pathogens and nematodes. • Development of efficient pest and disease management techniques, including pest risk assessment. • Capacity building of partner organizations, entrepreneurs, and farmers in seed production, storage, marketing, and crop management. • Monitoring and evaluation, impact assessment. • Communication of information and knowledge.
Advanced Research Institutes	
Japan International Research Center for Agricultural Sciences (JIRCAS), Japan	<ul style="list-style-type: none"> • Development and scaling up of integrated soil fertility management options to be integrated as new improved technologies (complementary grant).
Universities	
University of Ibadan (UI), Nigeria Abuja University (AU), Nigeria	<ul style="list-style-type: none"> • Degree training and capacity development of NARS staff through co-supervision of postgraduate thesis research.
Kwame Nkrumah University of Science and Technology (KNUST), Ghana	<ul style="list-style-type: none"> • Degree training and capacity development of NARS staff through co-supervision of postgraduate thesis research on collaborative research, labor-saving techniques, and the mechanization of production and postharvest systems.
University of Greenwich-Natural Resources Institute (NRI), UK	<ul style="list-style-type: none"> • Value chain analysis, studies in postharvest systems and market development, gender issues, capacity building of partner organizations.

Organization	Role
National Agricultural Research and Extension Systems (NARES)	
Crops Research Institute (CRI) Ghana	<ul style="list-style-type: none"> • Production of breeder seeds. • Participation in development of novel seed propagation techniques. • Facilitation of formal yam seed systems. • Crop management, ISFM, and PVS. • Collaborative research in genetics and host plant resistance breeding. • Baseline studies, VCA, and pest risk assessment. • Postharvest systems and marketing. • Collaborative research on labor-saving techniques and the mechanization of yam production and postharvest systems. • Development and scaling up of existing and new improved technologies, monitoring and evaluation.
National Root Crops Research Institute (NRCRI), Nigeria	
Nigerian Agricultural Quarantine Services (NAQS) in Nigeria	<ul style="list-style-type: none"> • Facilitation of safe movement of germplasm in the subregion. • Implementation of seed certification in Nigeria.
Plant Protection Regulatory Service Division (PPRSD), Ghana	<ul style="list-style-type: none"> • Facilitation of safe movement of germplasm in the subregion. • Implementation of seed certification in Ghana.
National Agricultural Seed Council (NASC), Nigeria	<ul style="list-style-type: none"> • Foundation (basic) seed production; and seed quality inspection and certification in Nigeria.
Grains and Legumes Development Board (GLDB), Ghana	<ul style="list-style-type: none"> • Foundation (basic) seed production in Ghana.
Ghana Seed Inspection Division (GISD)	<ul style="list-style-type: none"> • Seed quality inspection and certification in Ghana.
Plant Genetic Resource Institute, Ghana	<ul style="list-style-type: none"> • Germplasm conservation in Ghana.
National Centre for Genetic Resources and Biotechnology (NACGRAB)	<ul style="list-style-type: none"> • Germplasm conservation in Nigeria.
Root and Tuber Expansion Program (RTEP), Nigeria	<ul style="list-style-type: none"> • Collaborative gender studies, value chain development and studies, scaling up of seed systems, scaling up of Integrated Crop Management systems, Participatory Variety trials, and participatory impact assessment.
Root and Tuber Improvement and Marketing Program (RTIMP), Ghana	<ul style="list-style-type: none"> • Collaborative gender studies, value chain development and studies, scaling up of seed systems, scaling up of Integrated Crop Management systems, Participatory Variety trials, and participatory impact assessment.
ADPs (State Agricultural Development Projects), Nigeria	<ul style="list-style-type: none"> • Collaborative gender studies, value chain development and studies, scaling up of seed systems, scaling up of Integrated Crop Management systems, Participatory Variety trials, and participatory impact assessment.

Organization	Role
NGOs and Farmers' Associations	
Farmer Organizations Support Center in Africa (FOSCA)	<ul style="list-style-type: none"> To strengthen capacities and empower smallholder farmers in the yam value chain. Establish and train farmers' organizations. Facilitate the access of farmers' organizations to demand-driven external service providers. Promote market linkages between farmers' groups and private players, development partners, and financial intermediaries.
Catholic Relief Services (CRS), Ghana	<ul style="list-style-type: none"> Scaling up of seed systems. Scaling up of Integrated Crop Management systems. Participatory Variety trials. Participatory impact assessment.
Diocesan Development Services (DDS), Nigeria	
Farmers' Organizations (FOs), e.g., ALFAN (All Farmers Association of Nigeria)	
Advocacy and Financing	
Economic Community of West African States (ECOWAS)	Umbrella advocacy for policy impact.

Annex 3. Distribution of YIIFSWA's major responsibilities among partners.

Organization	Category	Major responsibilities*
IITA	Grantee (Regional)	<ul style="list-style-type: none"> - Project coordination; administrative management. - Establish partnerships, linkages, and coordination of key stakeholders in the seed yam chains with special emphasis on breeder, foundation, and commercial seed producers and marketers. - Develop and promote technologies for enhanced seed yam production and development of seed growers. - Promote efficient and cost-effective propagation technologies for the production of breeder and foundation seeds. - Produce clean breeder and foundation seed yam of recommended varieties. - Identify "pest-free" field sites for mass propagation of "clean" seed yam. - Identify and train entrepreneurs for commercial production of certified seed yam. - Support implementation of standards and protocols for inspection and certification of "clean" and quality seed yam. - Develop and promote rapid propagation technologies for high ratio propagation of breeder and foundation seeds. - Develop detailed operational and business plans for increased cost efficient breeder (and possibly foundation) seed production. - Develop effective technologies for managing the quality of seed yam. - Evaluate popular and near-release varieties for adaptation to environments with low soil fertility, low moisture stress, and labor-saving (no staking) systems. - Evaluation and scaling out of the best-bet existing and new improved technological packages to overcome constraints and increase productivity. - Conduct pest risk assessment (PRA) to identify the risk of pest spread through planting materials, rate of re-infection, and deterioration of "clean" yam. - Develop simple and cost-effective virus diagnostic tools for indexing and certification of seed yam. - Evaluate and select germplasm resistant to nematodes. - IM&E and Communication

Organization	Category	Major responsibilities*
NRI	Subgrantee (Regional)	<ul style="list-style-type: none"> - Value chain assessment/mapping. - Draw up and implement a yam market development program. - To support communication to reduce market asymmetries. - Develop and promote technologies to reduce tuber losses on-farm and in storage. - Develop and promote technologies to reduce tuber losses during marketing. - Improve postharvest characteristics through germplasm assessment and selection. - Improve farm/small-scale processing.
FOSCA	Subgrantee (Regional)	<ul style="list-style-type: none"> - Strengthen the capacity of farmers' groups and farmers' organizations in management, business, and marketing social inclusivity, member representation, and external linkages. - Build local capacity for market oriented, participatory, gender sensitive, and equitable approaches in yam development. - Develop a productive demand-driven model for building the capacity of farmers' organizations in yam value chains. - Develop and validate an enterprise resource planning system.
CRI, Ghana	Subgrantee (National)	<ul style="list-style-type: none"> - Production of breeder seeds. - Implementation of breeding and seed propagation trials. - Field Days organization and management. - Assessment of pest risk. - Assessment of agronomic packages. - Data collection for project monitoring and evaluation.
NRCRI, Nigeria	Subgrantee (Regional)	<ul style="list-style-type: none"> - Production of breeder seeds. - Implementation of breeding and seed propagation trials. - Field Days organization and management. - Pest risk assessment. - Assessment of agronomic packages. - Data collection for project monitoring and evaluation.
Other local collaborators in Nigeria and Ghana	Service providers as needed (National)	<ul style="list-style-type: none"> - Data collection for project monitoring and evaluation. - PhD student supervision. - Participatory trials for implementing refined available propagation techniques. - SQC monitoring visits for field and seed yam certification in Ghana. - Revolving fund to facilitate foundation seeds following the QMP protocol. - Training, demonstration trials, etc. [Activities 3.2 and 3.6.]

