



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



FEED THE FUTURE GLOBAL BIOTECH POTATO PARTNERSHIP Semi-Annual Report October 1, 2021 – March 31, 2022

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1. PROJECT DESCRIPTION

The Feed the Future Global Biotech Potato Partnership (GBPP) is a five-year initiative implemented by Michigan State University (MSU) that focuses on the use of innovative research to promote a robust potato value chain through the commercialization of the 3 R-gene late blight resistant (LBR) potato in Bangladesh, Indonesia, Kenya, and Nigeria. The GBPP consists of the following partners: The International Potato Center (CIP), The University of Minnesota (UMN), The University of Idaho (UI), The Bangladesh Agricultural Research Institute (BARI), The Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development (ICABIOGRAD), The Kenya Agricultural and Livestock Research Organization (KALRO), The National Root Crops Research Institute, Umudike (NRCRI), and The African Agricultural Technology Foundation (AATF). The GBPP project, including its robust team of experts and partners, represents a distinctive contribution to global agricultural biotechnology efforts and addresses the Global Food Security Strategy (GFSS) overarching objectives. The LBR potato achieves inclusive and sustainable agriculture-led growth by improving the lives of smallholder farmers, both women, and men, through increased technology options, improved crop yields, reduced fungicide input costs, and reduced exposure to harmful chemicals. The project will help strengthen resilience among people and systems through improved crop management from seed to post-harvest storage.

This semi-annual report summarizes the achievements and progress towards GBPP's objectives and covers the first half of year one: October 1, 2021 to March 31, 2022.

2. COUNTRY SPECIFIC UPDATES

2.1 Bangladesh

Award activities implemented during this period of performance include the initiation of the subaward by MSU with BARI, which is still pending. Farming Future Bangladesh (FFB) finalized a workplan and service contract with MSU for Year 1 activities. FFB will provide leadership in Bangladesh for communications and advocacy and logistical support for the project as the Country Co-Lead with the BARI Principal Investigator (PI). FFB worked with BARI and project leadership to recruit a Senior Manager for Communications and Advocacy and a BARI Research Associate. Both positions will start in Y1Q3. The National Technical Committee on Crop Biotechnology (NTCCB) in the Ministry of Agriculture forwarded an application received from BARI for a Confined Field Trial (CFT) to the National Committee on Biosafety (NCB) in the Ministry of Environment, Forest, and Climate in October 2021. The NCB was not able to meet in order to review the application in time to plant the single location trial, and the BARI PI requested the NCB consider an application to plant multilocation trials (MLTs) in 2022. The NCB provided meeting minutes reflecting the decision to consider the MLT application. An MLT application has been prepared for trials in 6 locations. GBPP project leadership met with the USAID Mission in Bangladesh to brief them on the project plans and progress. The team in the Biotech Division at BARI has been maintaining the two 3 R-gene Diamant events in tissue culture, and these events are being maintained at MSU as well.

Planned activities in Bangladesh include submission of the MLT application to BARI IBC in April 2021 (Y1Q3). Materials for the Biosafety Review and amendment of the Initial Environmental Examination (IEE) for the MLTs will be submitted to USAID. MSU is producing minitubers to ship for use as seed for the MLTs. After the BARI subaward agreement has been signed, BARI and FFB will hold a project launch meeting at BARI. Furthermore, the GBPP Deputy Director

Asia will travel to Bangladesh for project planning and implementation meetings and regulatory training.

2.2 Indonesia

Award activities implemented during this period of performance include the initiation of the subaward by MSU with ICABIOGRAD, which is pending final in-country approval. A scope of work and service contract with the GBPP Country Co-Lead has been finalized. Completion of a contract with the Indonesian Biotechnology Information Center (IndoBIC) for communications activities is ongoing. ICABIOGRAD submitted a revised MLT application (4 locations) based on a review by the Biosafety Technical Team (BTT) of the initial submission, and the permit for the MLTs was granted in January 2022 (Y1Q2). Materials for the Biosafety Review and amendment of the IEE for the MLTs, and the permit received from the Biosafety Committee, were submitted to USAID. The review was completed, and the amendment has been incorporated into the IEE. Planting of the MLTs has been delayed due to the processing of the subaward.

Planned activities in Indonesia include the planting of the CFTs at 2 locations in April 2022 (Y1Q3) if the subaward is finalized. If not, MLTs at these 2 locations will be planted in October 2022 (Y2Q1), and the seed tubers intended for the April CFTs will be planted for seed multiplication at IVEGRI, if possible. MSU is also producing minitubers that will be shipped for planting in the CFTs, if needed. A communications workshop required by the regulatory authorities for CFTs and biosafety training will be conducted by project partners prior to planting of the CFTs. Finally, the GBPP Deputy Director Asia will travel to Indonesia for project planning and implementation and regulatory training. MSU is maintaining the three lead 3 R-gene Granola events in tissue culture and will ship tissue culture plantlets to be maintained by ICABIOGRAD as well.

2.3 Kenya

The inclusion of Kenya as a partner country of the GBPP occurred during the first quarter of the project. The GBPP team identified KALRO as a key partner to lead activities towards the commercialization of 3 R-gene LBR potato in Kenya. Award activities implemented during this period of performance include the initiation of the subaward by MSU with KALRO, which is still pending. The GBPP team worked with KALRO on development of the Y1 Workplan. An application to conduct a CFT and for the biosafety review for the IEE were submitted to the National Biosafety Authority (NBA) and USAID respectively. The CIP team continued to maintain in vitro the stocks of 3 R-gene LBR potato transgenic events, and the selection of candidate lead transgenic events (TEs) for future regulatory trials and prepare the CFT trial site with the KALRO team.

Planned activities in Kenya for the remainder of the year include obtaining subaward agreements and biosafety permits from NBA. This will trigger a project inception meeting with Kenyan stakeholders, a biosafety training course for all field staff, and transplanting the transgenic and non-transgenic potatoes from the KALRO biosafety greenhouse to the Muguga KALRO CFT site. In addition, we will survey the pathogen population by collecting samples for genotyping. Several members of the GBPP leadership team including the Director, Deputy Directors for Africa and Asia, and Global Resource Lead for Disease Resistance Management are planning travel to Kenya in Y1Q3.

2.4 Nigeria

Award activities implemented during this period of performance include the initiation of the subaward by MSU with NRCRI. Additionally, NRCRI obtained the certification from the National Biosafety Management Agency (NBMA) to work with genetically engineered potato. An

application to conduct a CFT was developed and submitted by NRCRI with input from CIP and reviewed by the Global Resource Lead for Regulatory Affairs. CIP and MSU prepared seed tubers for the CFT in Nigeria which is planned to start towards the end of YIQ3.

Planned activities in Nigeria for the remainder of the year include the CFT in YIQ3-Q4. This entails land preparation, site fencing, and establishing a small store and guard shelter on the CFT site as described in the CFT application submitted to NBMA. Plant materials consisting of transgenic and non-transgenic potatoes from Kenya and Michigan will be shipped with the appropriate permits. Shipped seed tubers will be planted in the field for testing resistance to LB. Furthermore, plans for field design as well as *Phytophthora infestans* sample collection have been discussed and will be further refined with the GBPP Global Resource Leads. Several members of the GBPP leadership team including the Director, Deputy Directors for Africa and Asia, and Global Resource Lead for Disease Resistance Management are planning travel to Nigeria in YIQ3.

3. TECHNICAL REPORT

3.1 Workstream 1: 3 R-gene LBR Potato Field Trials

3.1.1 Major Activities and Achievements

Bangladesh:

- CFT application submitted, but approval delayed due to Bangladesh regulatory authorities. The NCB agreed, as reflected in the meeting minutes, to consider an application for planting multilocation trails (MLTs) in November 2022 because the November 2021 single location trial was not approved in time to plant.
- Two Diamant events are being maintained in vitro by BARI Biotech Division and by MSU.

Indonesia:

- Biosafety permit obtained for MLTs; Biosafety Review and IEE amendment completed for CFTs at four locations.

Bangladesh/Indonesia:

- MSU conducted a study to test the resistance levels of the tubers of the 3 R-gene LBR Diamant and Granola events to late blight infection during storage.

Kenya:

- An application permit to conduct CFT was submitted to NBA by KALRO and CIP, and an IEE for CFT in Kenya was submitted to USAID.
- The biosafety greenhouse at KALRO has been accommodated with minor repairs to receive the 3 R-gene LBR potato for transplanting into the field.
- The 3 R-gene LBR potato transgenic events and their controls are maintained in vitro at ILRI/BecA facilities by CIP.
- Transgenic and non-transgenic seed tubers from four local varieties (Desiree, Victoria/Asante, Shangi, Tigoni) were produced in the biosafety greenhouse at ILRI/BecA facilities by CIP for future planting in Kenya and Nigeria.
- KALRO pathology activities (baseline information, new collection sites, procedures) were coordinated with the Global Resource Lead for Disease Resistance Management.

Nigeria:

- Certification to work with genetically engineered potato was obtained from NBMA by NRCRI. In addition, an application to conduct a CFT was submitted to NBMA towards the end of the reporting period.

3.1.2 Implementation Challenges

- Activities were delayed due to regulatory approvals, pending agreements, and project geographic shift.

3.1.3 Expected Activities for Remainder of Year

Bangladesh:

- MLT application will be submitted to regulatory authorities for approval to plant in November 2022. Materials will be submitted to USAID for Biosafety Review and IEE amendment.
- Two Diamant events will be maintained in vitro by BARI and by MSU.

Bangladesh/Indonesia:

- Minitubers produced at MSU of Diamant and Granola events and non-transgenic counterparts will be shipped to Bangladesh and Indonesia, respectively, for planting in CFTs.

Indonesia:

- The MLTs at two locations for the 3 Granola events will be planted if the subaward agreement is finalized, or tubers will be planted at IVEGRI for seed multiplication.
- In vitro Granola events (3) and non-transgenic Granola produced at MSU will be shipped to Indonesia to maintain in the labs at ICABIOGRAD/IVEGRI.

Kenya:

- The CFT will proceed after receiving the permits and after the start of the rainy season. If CFT permit is not granted, testing will be conducted in the KALRO biosafety greenhouse with artificial inoculation.
- Pathogen samples will be collected, and FTA cards sent to University of Idaho for genotyping.

Nigeria:

- An application for biosafety review and IEE amendment for CFT in Nigeria will be submitted to USAID.
- The seed tubers from CIP Kenya and MSU will be shipped to NRCRI.
- The seed tubers will be planted in the CFT after the start of the rainy season (June-July).
- Towards the end of the first year, CFT will be harvested, and yield estimated.
- Pathogen samples will be collected during the rainy season and FTA cards sent to Idaho University for genotyping.

3.2 Workstream 2: Regulatory Submission for General Release of the 3 R-gene LBR Potato

3.2.1 Major Activities and Achievements

Bangladesh/Indonesia/Nigeria:

- MSU T-DNA regulatory analysis of the 3 R-gene LBR from Diamant and Granola events is underway, and a new efficient technique is being tested. Molecular experiments completed and bioinformatic data was collected which is ready for analysis.
- MSU conducted an NPTII expression test on the 3 R-gene LBR Diamant and Granola events.

Kenya/Nigeria:

- CIP molecular characterization of the fifth variety (Jalene) continued with copy number analysis by droplet digital PCR and Southern blotting, PCR scanning of the T-DNA, and backbone vector sequence absence. The best characterised transgenic events were tested for resistance to LB by detached leaf assays.

- A new version of the regulatory studies on agronomic performance of Vic.172 was completed by CIP.

3.2.2 Implementation Challenges

- Regulatory authorities in Bangladesh and Indonesia are requesting studies on toxicity and nontarget effects to be conducted for the regulatory submission. These studies are not necessary for environmental or food safety assessments with the R genes. The project will need a strategy to inform the regulators on these issues.

3.2.3 Expected Activities for Remainder of Year

- Global Resource Lead for Regulatory Affairs will organize and conduct a series of in person or virtual regulatory planning meetings for the project in all countries, starting Y1Q3-Q4.
- MSU will continue molecular characterization of the 3 R-gene events which includes T-DNA analysis and insert location analysis. Backbone analysis, RNA and Protein studies will be prepared and initiated.
- Target enrichment using Xdrop technology and Oxford Nanopore sequencing will be applied to candidate lead transgenic events from the fifth variety (Jalene) for testing in Kenya and Nigeria. Bioinformatic analysis and relevant PCR assays will be used to identify transgenic events meeting regulatory requirements.

3.3 Workstream 3: Product Deployment Through Biotech Seed System and Stewardship

3.3.1 Major Activities and Achievements

- The new Ag-Economist position was advertised by CIP and 2 top candidates were selected.
- CIP strengthened the team with the involvement of an ex-ante socioeconomic expert at IFPRI for technical backstopping.
- Workstream 3 objectives were refined, and road map adjusted.

3.3.2 Implementation Challenges

- Lack of successful candidates for the Ag-Economist required the project to reassess the position requirements which caused a delay in hiring.

3.3.3 Expected Activities for Remainder of Year

- Complete the literature review and identify the knowledge gap for each country, design country specific data collection protocols.
- Train the country partners.
- Conduct a pilot test and revise the data collection instruments and data analysis methods.
- Develop the terms of reference and conduct the Potato Expert Elicitation workshop.

3.4 Workstream 4: Second Generation of Disease Resistant (DR) Potato

3.4.1 Major Activities and Achievements

- Material Transfer Agreements for research-only:
 - The Sainsbury Laboratory covering the transfer of materials belonging to TSL/2Blades.
 - Plant Science Limited (PBL) covering the transfer of materials by The Sainsbury Laboratory.
 - USDA GAENTRY vector construct.
- MSU has received the following genes: Late Blight resistance genes *amr1*, *amr3*, *mcq1*,

- *vntI*, and the PVY resistance gene.
- MSU completed a test of the USDA GAANTRY system by developing a construct consisting of 3 marker genes and transforming it into potato. Transformants were identified which contained and had function of all 3 genes.
- CIP has conducted bioassays to test resistance to *Ralstonia solanacearum*, the pathogen responsible for bacterial wilt (BW), as well as strain characterization using *pflp* and *efr* transgenic potato. More optimisation of the assay will be needed as it is influenced by external temperature into the glasshouse during the hot season.
- An application to develop contained research on BW and PVY virus resistance was developed and submitted to NBA to obtain the authorization to import transgenic events from The Sainsbury Laboratory.

3.4.2 Implementation Challenges

Kenya:

- BW bioassays are notoriously difficult to manage due to sensitivity to experimental and environmental conditions. The previous experienced staff left CIP and a new staff with no BW bioassay experience was hired. The importation of the BW resistant transgenic events from The Sainsbury Laboratory was not authorised under the current permits because these events have a different set of transgenes.

3.4.3 Expected Activities for Remainder of Year

- Finalize the transfer of materials to the MSU laboratories and obtain the relevant MTA from provider and owners of the IP on the materials.
- MSU will use the GAANTRY system and develop the 2nd Gen. DR construct(s). Using sequencing, PCR, restriction digests, the integrity of the construct(s) will be confirmed.
- MSU will prepare agreements for the transfer of materials to host countries for in-country potato transformations.
- Finalize the agreement between MSU and Simplot for Intellectual Property rights for the Simplot events.
- CIP will continue BW bioassays using the *pflp* and *efr* transgenic events including tolerant and susceptible controls until results reach satisfactory qualities.
- After obtaining the permit from NBA to do contained research, transgenic events with transgenes conferring BW and PVY resistance will be imported to BecA/ILRI biotech facilities by CIP. Plants will be multiplied for developing first BW bioassays.

3.5 Workstream 5: Communication and Advocacy

3.5.1 Major Activities and Achievements

- Personal Services Contract fully executed with FFB; Senior Manager for Communications and Advocacy hired at FFB.
- Personal Services Contract initiated with IndoBIC.
- Project website built and live.
- Project social media accounts on Twitter and Facebook live and active.

3.5.2 Implementation Challenges

- Geographic project shift resulted in delay of public project announcement which delayed social media deployment and other public facing communication materials.
- Delay of signed agreements with partner country NARS in Bangladesh and Indonesia delayed activity of planned workshops.

3.5.3 Expected Activities for Remainder of Year

- Electronic newsletters to be issued quarterly.

- Finalize Personal Services Contract with IndoBIC.
- Further promote social media accounts through Facebook and Twitter.
- Further enhance the project website.
- Potato value chain stakeholder mapping in Indonesia and Bangladesh in collaboration with project workstream 3 activities.
- Project and biotechnology workshop for BARI scientists in Bangladesh.
- Risk communication workshop to support Indonesia CFT's.

3.6 Project Management

3.6.1 Major Activities and Achievements

- Subaward agreements initiated with project partners.
- Establishment of Technical Advisory Board.
- Submission of Annual Workplan, Branding Strategy and Marking plan, and Monitoring, Evaluation and Learning Plan.
- Project launch meeting with all partners.
- Weekly meeting with the core management team.
- Monthly briefs with the lead countries.
- Monthly briefs with the AOR and Activity Manager.
- Project update meeting with Bangladesh mission.
- Establishment of Smartsheet as project management and MEL platform.
- Scientific presentation at the Potato Expo January 2022.

3.6.2 Implementation Challenges

- Some project activities delayed due to the processing of the subawards.

3.6.3 Expected Activities for Remainder of Year

- Continue weekly and monthly team meetings.
- Monthly briefs with the AOR and Activity Manager.
- Operationalize Smartsheet as a platform for project management and MEL reporting.
- Develop Year 2 Workplan.
- Technical Advisory Board meeting.
- Meetings with USAID Missions in Kenya, Nigeria, and Indonesia.