



Plant Health and Rapid Response to Protect Food and Livelihood Security

Initiative Lead and Co-Lead

Prasanna Boddupalli
Monica Carvajal Yepes

Primary CGIAR Action Area

Resilient Agri-food Systems

Estimated 2022 - 2024 Budget

\$30 - \$30 M

Challenge

Effective plant health management is critical for improving the productivity, sustainability and resilience of agri-food systems. Yet, smallholder farmers, especially in LMICs, continue to struggle against pest and disease incursions/outbreaks. Each year, plant diseases and pests cost the global economy US\$220 billion. Recent analyses showed that the highest losses due to pests and diseases are associated with food-deficit regions with fast-growing populations. Moreover, mycotoxin contamination of crop produce above permissible limits is significantly impacting food safety, public health and trade. Besides air-borne, seed-borne and insect-vector channels, increasing trade and travel coupled with weak phytosanitary systems are accelerating the global spread of devastating pests and diseases. The situation is exacerbated by the effects of changing climate, driving the emergence of new threats. The burden of all this falls disproportionately on women and poorly resourced communities. Diagnostic capacity, global-scale surveillance data and risk forecasting for major pests/diseases are still lacking, alongside rapid response and management systems. Inadequate knowledge and/or access to integrated and climate-smart control options is often leaving smallholders and marginalized communities unprepared or poorly equipped to respond to the biotic threats. Environmental effects of toxic pesticides, mycotoxin exposure, and acute unintentional pesticide poisoning are of major concerns globally. Despite its scientifically sound principles, integrated disease and pest management continues to have low adoption rates worldwide due to various reasons, including critical gaps in access to affordable technologies, especially to women and disadvantaged groups, and underinvestment in promotion and uptake of available plant health interventions.

[References for the Challenge Statement: <https://bit.ly/2Q0G1p9>]

Objective

The core purpose of this initiative is to protect agriculture-based economies of LMICs in Africa, Asia and Latin America from devastating pest and disease incursions/outbreaks, by leveraging/building viable networks across an array of national, regional and global institutions. The focus will be on high-impact and/or high-risk pests and diseases causing major food security shocks and severe economic impacts in the LMICs.

Together with innovation partners, the initiative will co-develop comprehensive research-for-development (R4D) approaches and analytical frameworks to identify, characterize, predict and manage plant health threats. Harnessing synergies with other thematic initiatives, this initiative will adopt robust and ecologically sustainable approaches to mitigate the effects of existing/emerging pests and diseases, and co-deploy integrated crop protection innovations in 20 target countries in the LMICs. By 2024, those frameworks and approaches will become routinely implemented by at least 10 national plant protection organizations (NPPOs) across the target LMICs in Africa, Asia and Latin America.

The specific objectives of the initiative will be: 1) Enabling critical R4D for rapid and accurate identification, characterization and assessment of plant health risks through coordinated and strengthened surveillance and diagnostics networks in LMICs; 2) Developing, validating and deploying conventional and novel integrated disease and pest management packages for mitigating the impacts of plant health threats (both existing and emerging) in the target regions through public-private partnerships; and 3) Bringing gender-responsive and socially inclusive plant health innovations to scale through novel partnerships, effective communications and outreach, and capacity development of local institutions.

Theory of Change

The Initiative aims to enable targeted LMICs in Africa, Asia and Latin America to respond effectively to the plant health threats, thereby protecting food security and livelihoods of smallholders and communities, especially in the face of climate change. It will implement components of the Global Surveillance System including laboratory diagnostic network, data management and risk assessment modeling, by leveraging CGIAR's network of plant health units together with the infrastructure and expertise of external partners (e.g., NPPOs/RPPOs, FAO-IPPC, etc.) (WP1). It will improve and integrate data management systems, epidemiological modelling and risk assessment analysis (WP2) to recommend sampling/surveillance efforts (WP1), and prioritize high-risk threats and target areas for co-developing and deploying gender-responsive, eco-friendly crop protection innovations through integrated disease and pest management (IDPM) packages (WP3), and mycotoxin risk assessment and management (WP4). The initiative will implement effective approaches for gender-responsive and socially inclusive scaling of plant health solutions, monitoring, evaluation and learning (MEL), and socio-economic impact assessment (WP5).

Strategic partnerships with key demand, innovation and scaling partners, including Governments, NARES, NPPOs/RPPOs, advanced research institutions, private sector, and local communities, and strong synergies with relevant OneCGIAR initiatives* will contribute to the initiative's outcomes and impacts. Through research-based analysis and recommendations, and leveraging and strengthening the capacities of local institutions, the initiative will lead to greater preparedness and effective response by national governments in 20 target LMIC countries to plant health threats. By 2030, the initiative's outcomes will benefit at least 150 million smallholders and disadvantaged groups in target geographies, enhancing resilience, productivity and sustainability of agri-food systems.

*GI: Market intelligence for more equitable and impactful genetic innovation; Genebanks; Farmer-preferred crop varieties; Delivering genetic gains in farmers' fields; RAFS: Excellence-in-Agronomy; Regional Integrated Initiatives; ST: Harnessing digital technologies; Leveraging gender and social equality, etc.

Plant Health and Rapid Response to Protect Food and Livelihood Security

Highlights

The initiative will develop and validate robust and versatile tools/protocols for cost-effective pest/disease diagnostics and surveillance, quarantine monitoring, high-throughput and efficient disease and pest phenotyping assays to aid resistance breeding programs, and seed health testing. Connecting diagnostics laboratories in LMICs to globally coordinated networks will ensure capacity strengthening and application of new tools and protocols.

The initiative will focus on bringing technological, institutional and structural transformations (e.g., IDPM packages, intensive public-private partnerships for scaling etc.) to enhance the effectiveness and impacts of crop protection systems.

Harnessing the synergies with several OneCGIAR initiatives and expertise of innovation and scaling partners (both public and private), the initiative will co-develop eco-friendly and climate-smart IDPM innovations, and deploy these using gender-responsive and socially inclusive scaling approaches in the target LMICs.

Together with innovation partners, the initiative will further develop tools for pest/disease risk assessment and prioritization, and will facilitate local-to-global and global-to-local exchange of diagnostics and pest occurrence data. This will contribute to enhanced preparedness and rapid response to existing and emerging pests/diseases and minimize transboundary spread.

The initiative will develop, test and deploy context-specific, gender-relevant scaling methods for innovation delivery to end-users. Frameworks will be established for effectively identifying and alleviating bottlenecks to scaling, improving stakeholder capacity development, and assessing the socio-economic impact of crop protection interventions.

Work Packages

	Scope of Work	3-year Outcomes
BRIDGING KNOWLEDGE GAPS AND NETWORKS: PLANT HEALTH THREAT IDENTIFICATION AND CHARACTERIZATION	Strengthening global phytosanitary systems by leveraging CGIAR and external partners' (e.g., FAO/RPPOs/NPPOs) diagnostic and field detection networks; Enabling partners for effective diagnostics, surveillance, monitoring and characterization of pests/diseases for rapid response; Research to bridge knowledge-gaps (e.g., climate-induced changes on pest/disease spectrum); high-throughput field-based pest/disease phenotyping assays; use of novel ICTs.	National plant diagnostic laboratories in 20 target LMICs are well-connected to regional/global diagnostic networks, and are capable of predicting, detecting, and managing existing and emerging pests/diseases, and prevent their transboundary spread.
GUIDING PREPAREDNESS AND RAPID RESPONSE: DATA MANAGEMENT AND RISK ASSESSMENT	Harness CGIAR and external partners' (e.g., FAO) capacities to improve and integrate plant health databases; Together with innovation partners, develop/validate/ update epidemiological models for guiding sampling/surveillance efforts by partners (WP1), identifying high-risk threats and target areas for implementing IDPM packages (WP3), and developing innovative tools/processes for reducing mycotoxin contamination (WP4).	Stakeholders, including policymakers, in the target LMICs access plant health databases and risk assessment analyses for taking informed decisions on strategies to mitigate the impacts of at least five devastating transboundary pests/diseases in target geographies.
INTEGRATED DISEASE AND PEST MANAGEMENT SOLUTIONS FOR THREAT MITIGATION	Integrated disease and pest management (IDPM) packages tailored to gender needs, agroecological and farmers' socio-economic contexts, and deployed against prioritized plant health threats in target geographies; Strategic R4D on mechanisms underlying host-pathogen/pest interactions for developing innovative solutions (in partnership with GI Initiatives)	Increased yield stability and reduced food security shocks due to containment of pest- and disease-induced crop losses at farmer- and landscape-levels, through deployment of gender-responsive and climate-smart IDPM packages against six prioritized plant health threats.
TOOLS AND PROCESSES FOR PROTECTING FOOD CHAINS FROM MYCOTOXIN CONTAMINATION	Innovative pre- and post-harvest mycotoxin management tools/processes developed, and deployed through national and regional scaling partners in targeted LMICs; Prediction models based on climate, agricultural and food safety information; Interdisciplinary communications campaigns and monitoring tools on food safety and nutrition.	Mycotoxin contamination significantly reduced in at least two major crop value chains in three target countries in Africa, resulting in more safe and healthy diets, and increased market access.
METHODS FOR INCLUSIVE AND EQUITABLE SCALING OF PLANT HEALTH INNOVATIONS TO ACHIEVE IMPACTS	Developing interdisciplinary approaches for sustainable, socially inclusive, and gender-equitable scaling of plant health innovations (from WP1-WP4) by national/regional (public and private sector) partners for benefiting women, youth and marginalized communities; Understanding and alleviating household/community constraints in adopting IDPM; Causal impact evaluation and evidence-based policy recommendations.	Gender-responsive and socially inclusive scaling of plant health innovations adopted in at least 10 target LMICs across Africa, Asia and Latin America, and socio-economic impact assessment undertaken for at least four major pests and diseases.

Plant Health and Rapid Response to Protect Food and Livelihood Security

Impact Area Contributions

Nutrition, health & food security	Reduced risks to human health due to increased deployment of eco-friendly solutions (e.g., biological control, pest/disease-resistant varieties, etc.) in place of toxic pesticides. More safer diets through lowered incidence of mycotoxin contamination along the food chain. Improved food security due to increased protection of crop yields, and yield stability.
Poverty reduction, livelihoods & jobs	Improved livelihoods of smallholders due to increased yield stability and containment of pest- and disease-induced crop and food losses at the field- and landscape-levels.
Gender equality, youth & social inclusion	Increased access to and benefits from plant health innovations by women and vulnerable social groups. Inclusive approaches (e.g., participatory surveillance, monitoring and rapid response) foster co-ownership and resilience of farming communities. Increased youth involvement in developing innovative plant health solutions (e.g., digital surveillance and monitoring tools/technologies).
Climate adaptation & greenhouse gas reduction	Improved capacity of development partners (e.g., NPPOs/NARES/NGOs/Private sector) in sub-Saharan Africa, Asia and Latin America to predict climate-induced changes in pest and disease spectrum and intensity, and to prepare/respond with effective management options.
Environmental health & biodiversity	Reduction in use of toxic pesticides and associated safety hazards, including pesticide residues in the environment, due to IDPM deployment. Protection of natural biodiversity and ecologies from devastating invasive pests/pathogens and toxic pesticides. Effective use of microbial or insect biodiversity as biocontrol agents by local partners to protect crops.

Impact on SDGs



Regions

Global East and Southern Africa (ESA), Latin America and the Caribbean (LAC), South Asia (SA), South East Asia and the Pacific (SEA), West and Central Africa (WCA)

Countries



Plant Health and Rapid Response to Protect Food and Livelihood Security

Innovations

A diagnostics and surveillance toolbox (including low-cost and robust assays, and genomics & bioinformatics-based tools for pest/disease diagnosis and diversity assessment, and ICT tools for real-time data collection and crowdsourcing) developed and deployed to NPPOs, public/private agencies and farming communities in LMICs to effectively survey, monitor and manage pests/diseases.

Interoperable databases/repositories, risk assessment models, and evidence-based guidance frameworks co-developed with demand and innovation partners, for supporting Governments/NPPOs/FAO, prioritizing biosecurity measures and rapid response to high-risk pests/diseases, including surveillance, sampling and field detection (WP1), and recommending target sites for deploying IDPM packages (WP3).

Eco-friendly and sustainable integrated pest and disease management packages, including resistant varieties, biological control, environmentally safer pesticides and agro-ecological approaches, developed, validated and deployed against major plant health threats (existing and emerging) in target LMICs.

Robust, sensitive and affordable mycotoxin diagnostic tools/protocols, coupled with improved risk assessment tools and integrated management solutions, developed for use in the target LMICs.

Gender-responsive and socially inclusive approaches for plant health management, including capacity development of local and regional institutions for preparedness, diagnostics, and rapid response, and evidence-based policy recommendations for scaling innovations through effective public-private partnerships.

Key Partners

Demand	Government	Ministries of Agriculture, Environment, Food, and Planning Commissions in the target LMICs in Africa, Asia and Latin America; African Union; The Australian Centre for International Agricultural Research (ACIAR).
		National Plant Protection Organizations: e.g., KEPHIS-Kenya, Nigerian Agricultural Quarantine Services, Plant Protection and Regulatory Services Directorate, Directorate of Plant Protection, Quarantine and Storage, India, ICA-Colombia, SENASA-Peru, Agrocalidad-Ecuador, etc.
	International NGO	Examples: African Forum for Agricultural Advisory Services (AFAAS), FLAR (Latin America), Catholic Relief Services, etc.
	Multilateral	International/Regional Agricultural Development Bodies/Organizations: e.g., FAO, ECOWAS, CORAF, SADC, COMESA, ASEAN, SAARC, IAPSC, PACA, CARDESA, PACA, etc.
	Private Sector	Examples: International Seed Federation, African Seed Trade Association, Asia-Pacific Seed Association, HarvestFields Industries, KOPPERT Biologicals, A to Z Textiles Ltd., BAMTAARE, etc.
Innovation	Academic, Training and Research	Advanced Research Institutions / Universities: USDA-ARS, CSIRO-Australia, Aarhus University, PennState, Kansas State University, University of Florida, CAAS, ICAR, University of Warwick, University of Bristol, Plant Health Institute-Montpellier, University of Twente, University of Cambridge, JIC, Cornell University, JIC, Rothamsted Research, Keele University, University of Missouri, Colorado State University, Ohio State University, The Sainsbury Laboratory, Wageningen University, EMBL-EBI (European Bioinformatics institute), Washington State University, etc.
		International Agricultural Research Centers (IARCs): e.g., icipe, CABI, USAID CETC Innovation Lab, CIRAD, IRD, JIRCAS, ICRISAT, WorldVeg etc.
		National Agricultural Research and Extension (NARES) Organizations: e.g., KALRO, NARO, TARI, RAB, ICAR, BARI, INIA, INIAP, AGROSAVIA, etc.
	Multilateral	Phytosanitary research & coordination networks: AU-IAPSC, FAW R4D International Consortium, Euphresco, Crop Trust, BBTD Alliance, CGIAR GHU network, NPDN-USA, etc.
	Private Sector	Examples: Corteva, Syngenta, Bayer, Plantix, UPL, Biobest, Koppert, Russell IPM, ElephantVert, BCRL, UPL, etc.
Scaling	Government	National Agricultural Research & Extension System (NARES): e.g., KALRO-Kenya, NARO-Uganda, EIAR-Ethiopia, ICAR-India, BARI-Bangladesh, NRCRI-Nigeria, CRI-Ghana, IER-Mali, TARI-Tanzania, ZARI-Zambia, RAB-Rwanda, CAAS-China, etc.
		Regional/National Plant Protection Organizations (RPPOs/NPPOs): Inter-African Phytosanitary Commission (IAPSC), Asia and Pacific Plant Protection Commission (APPPC), Comunidad Andina (CAN), North American Plant Protection (NAPPO), KEPHIS-Kenya, Plant Health Services-Tanzania, NAQS-Nigeria, ICA-Colombia, Inter-American Institute for Cooperation on Agriculture (IICA), SENESA-Peru, etc.
	Multilateral	UN/Conventions: e.g., FAO, IPPC, ASARECA, CORAF, CCARDESA, SADC, COMESA, ECOWAS, etc.
	Private Sector	'Green' agrochemical and seed companies: e.g., Syngenta, Corteva, Bayer, Biobest, Koppert, Russell IPM, ElephantVert, FCI-Africa, etc.
	Public Private Partnership	International Alliances: e.g., PABRA (Africa), FAW R4D International Consortium, TAAT, etc.

Theory of Change – Plant Health and Rapid Response to Protect Food and Livelihood Security

Linkages and Synergies with CGIAR Initiatives

- 1 GI: Market intelligence for more impactful genetic innovations
- 2 GI: Market-preferred crop varieties
- 3 GI: Delivering genetic gains in farmers' fields
- 4 GI: Conservation and use of genetic resources
- 5 RAFS: Excellence-in-Agronomy
- 6 RAFS: Regional Integrated Initiatives
- 7 ST: Harnessing digital technologies
- 8 ST: Leveraging gender and social equality

Challenges

- Each year, plant diseases affect the global economy to a tune of US\$220 billion, and invasive insects around US\$70 billion, with highest losses in food deficit regions with fast-growing populations.
- Mycotoxin contamination of crop produce above permissible limits is significantly impacting food safety, public health, and trade.
- Weak diagnostic capacity and lack of global-scale surveillance data and risk forecasting for major pests/diseases, resulting in poor response and management systems.
- Environmental effects of toxic pesticides and acute unintentional pesticide poisoning are now major concerns globally
- Low adoption rates of integrated disease and pest management worldwide due to critical gaps in access to affordable technologies especially to women and disadvantaged groups, and underinvestment in promotion and uptake of available plant health interventions

Objectives

- Enable faster and accurate identification, characterization and assessment of plant health risks through coordinated surveillance and diagnostics networks
- Develop, validate and deploy integrated disease and pest management solutions for mitigating existing and emerging plant health threats in target regions
- Scale-up gender-responsive and socially inclusive innovations through novel partnerships, effective communications, outreach and capacity development of local institutions

Work Packages

- WP1: BRIDGING KNOWLEDGE GAPS AND NETWORKS: PLANT HEALTH THREAT IDENTIFICATION AND CHARACTERIZATION** (7)
- WP2: GUIDING PREPAREDNESS AND RAPID RESPONSE: DATA MANAGEMENT AND RISK ASSESSMENT** (7)
- WP3: INTEGRATED DISEASE AND PEST MANAGEMENT SOLUTIONS FOR THREAT MITIGATION** (1, 2, 3, 4, 5)
- WP4: TOOLS AND PROCESSES FOR PROTECTING FOOD CHAINS FROM MYCOTOXIN CONTAMINATION** (2, 3, 5)
- WP5: METHODS FOR INCLUSIVE AND EQUITABLE SCALING FOR ACHIEVING IMPACTS** (8)

Outputs

- A diagnostics and surveillance toolbox (including low-cost and robust assays, and genomics & bioinformatics-based tools for pest/disease diagnosis and diversity assessment, and ICT tools for real-time data collection and crowdsourcing) by NPPOs, public/private agencies and farming communities in LMICs.
- Interoperable databases/repositories, risk assessment models, and evidence-based guidance frameworks co-developed with demand and innovation partners, for supporting Governments/NPPOs/FAO, prioritizing biosecurity measures and rapid response to high-risk pests/diseases, including surveillance, sampling and field detection (WP1), and recommending target sites for deploying IDPM packages (WP3).
- Eco-friendly and sustainable integrated pest and disease management packages, including resistant varieties, biological control, environmentally safer pesticides and agro-ecological approaches, developed, validated and deployed against major plant health threats (existing and emerging) in target LMICs.
- Robust, sensitive and affordable mycotoxin diagnostic tools/protocols, coupled with improved risk assessment tools and integrated management solutions for use in target LMICs.
- Gender-responsive and socially inclusive approaches for plant health management, including capacity development of local and regional institutions for preparedness, diagnostics, and rapid response, and evidence-based policy recommendations for scaling innovations through effective public-private partnerships.

Outcomes

- National plant diagnostic laboratories in 20 target LMICs are well-connected to regional/global diagnostic networks, and are capable of predicting, detecting, and managing existing and emerging pests/diseases, and prevent their transboundary spread. (6, 7, 8)
- Stakeholders, including policymakers, in the target LMICs access plant health databases and risk assessment analyses for taking informed decisions on strategies to mitigate the impacts of at least six devastating transboundary pests/diseases in target geographies.
- Increased yield stability and reduced food security shocks due to containment of pest- and disease-induced crop losses at farmer- and landscape-levels, through deployment of gender-responsive and climate-smart IDPM packages against six prioritized plant health threats.
- Mycotoxin contamination significantly reduced in at least two major crop value chains in three target countries in Africa, resulting in more safe and healthy diets, and increased market access.
- Gender-responsive and socially inclusive scaling of plant health innovations adopted in at least 10 target LMICs across Africa, Asia and Latin America, and socio-economic impact assessment undertaken for at least four major pests and diseases.

CGIAR Impact Areas

- Nutrition, health and food security**
Improved food security due to increased protection of crop yields, and yield stability; More safer diets due to reduced mycotoxin contamination
- Poverty reduction, livelihoods and jobs**
Improved smallholders' livelihoods due to reduction in pest-/disease-induced crop and food losses at the field- and landscape-levels.
- Gender equality, youth & social inclusion**
Increased access to and benefits from plant health innovations by women, youth and vulnerable social groups.
- Climate mitigation and adaptation**
Improved capacity of development partners in target LMICs to predict climate-induced changes in pest and disease spectrum and intensity, and to prepare/respond with effective management options.
- Environmental health and biodiversity**
Reduction in use of toxic pesticides and associated safety hazards, due to IDPM deployment; Protection of natural biodiversity and ecologies from devastating invasive pests/pathogens and toxic pesticides.



Sustainable Development Goals

