CGIAR

INITIATIVE ON
Plant Health

CGIAR Initiative on Plant Health

ANNUAL TECHNICAL REPORT 2022

CGIAR Technical Reporting 2022

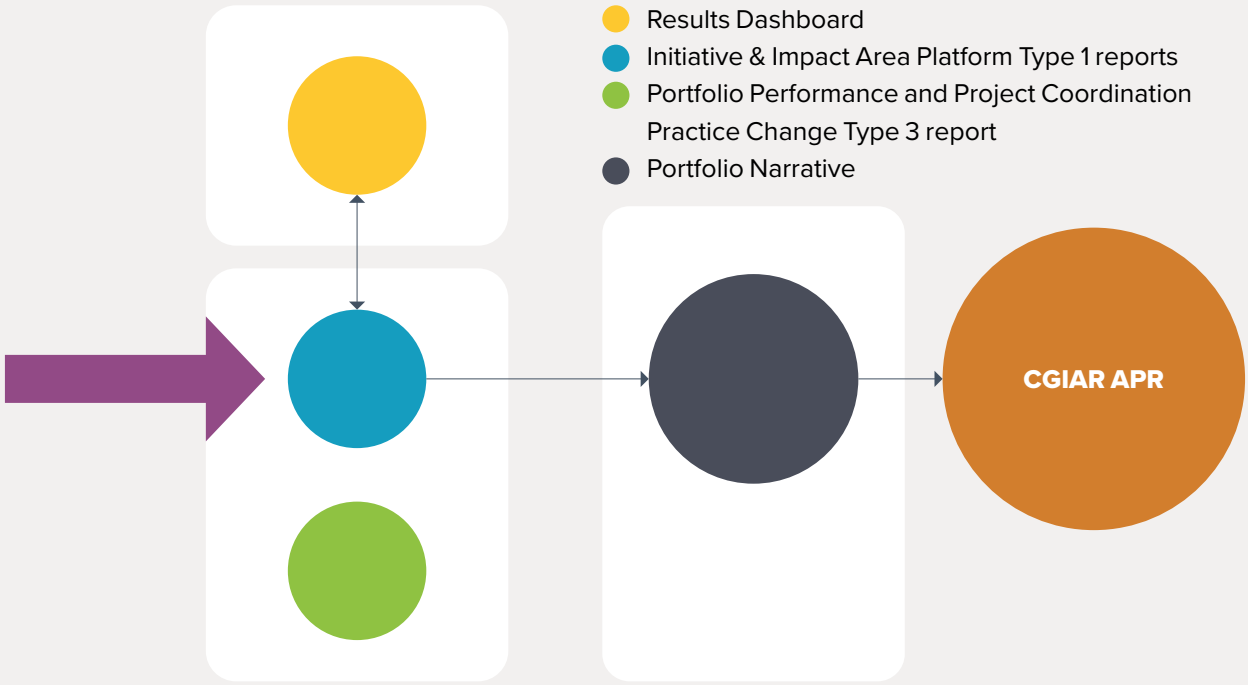
CGIAR Technical Reporting has been developed in alignment with the CGIAR Technical Reporting Arrangement.

This Initiative report is a Type 1 report and constitutes part of the broader CGIAR Technical Report. Each CGIAR Initiative submits an annual Type 1 report, which provides assurance on Initiative-level progress towards end-of-Initiative outcomes.

The CGIAR Technical Report comprises:

- Type 1 Initiative and Impact Area Platform reports, with quality assured results reported by Initiatives and Platforms available on the CGIAR Results Dashboard.
- The Type 3 Portfolio Performance and Project Coordination Practice Change report, which focuses on internal practice change.
- The Portfolio Narrative, which draws on the Type 1 and Type 3 reports, and the CGIAR Results Dashboard, to provide a broader view on portfolio coherence, including results, partnerships, country and regional engagement, and synergies among the portfolio's constituent parts.

The CGIAR Technical Report constitutes a key component of the CGIAR Annual Performance Report (APR).



US$	2022	2023	2024
Proposal Budget from initial submission	$11,000,000	$13,000,000	$16,000,000
Approved 2022 Budget	$9,334,443		

2022 Disbursement Target based on Approved FinPlan

Section 1 Fact sheet

Initiative name	Plant Health and Rapid Response to Protect Food Security and Livelihoods
Initiative short name	Plant Health Initiative (PHI)
Action Area	Resilient Agrifood Systems
Geographic scope	**Regions targeted in the proposal:** Central and West Asia and North Africa (CWANA); East and Southern Africa (ESA); Latin America and the Caribbean (LAC); South Asia; Southeast Asia and the Pacific; West and Central Africa (WCA) **Countries targeted in the proposal:** Focus countries: Bangladesh; Ethiopia; India; Kenya; Malawi; Mexico; Tanzania; Uganda; Viet Nam; Zambia Secondary/spillover countries: Benin; Bolivia; Burkina Faso; Burundi; Colombia; Côte d'Ivoire; Ecuador; Egypt; Ghana; Lebanon; Mali; Morocco; Mozambique; Niger; Nigeria; Peru; Philippines; Rwanda; Senegal; The Democratic Republic of the Congo; Tunisia; Sudan
Start date	Jan. 1, 2022
End date	Dec. 31, 2024
Initiative Lead	Prasanna Boddupalli – b.m.prasanna@cgiar.org
Initiative Deputy	Monica Carvajal-Yepes – m.carvajal@cgiar.org
Measurable three-year End of Initiative outcomes (EOI-Os)	**EOI-O1:** NPPOs in at least 10 targeted LMICs participate in a global plant diagnostic and surveillance network, dynamically exchanging data and knowledge on existing/emerging P&D.
	EOI-O2: At least 25 national partners in 10 targeted LMICs use the existing/novel diagnostic and surveillance tools to effectively counter existing/emerging plant health threats.
	EOI-O3: At least 10 target NPPOs increase their capacity to utilize epidemiological modeling data and decision-support tools for pest risk assessment, and preparedness to counter prioritized P&D threats and new invasions.
	EOI-O4: A Global Plant Health Consortium, comprising 60–70 institutions, is operational, co-developing and deploying IPDM innovation packages and educational curriculum for effective plant health management.
	EOI-O5: Adoption of eco-friendly and climate-smart IPDM innovations by at least 4 million smallholders across 10 targeted LMICs results in reduction in crop losses (by at least 5%) and use of toxic pesticides (by at least 10%).
	EOI-O6: At least 15 private sector partners in four focal countries in Africa commercialize Aflasafe to c. 200,000 smallholders (c. 400,000 ha of maize), resulting in enhanced availability of safe and nutritious food and feed.

	EOI-O7: At least 300,000 smallholder farmers use affordable and easy-to-use pre- and post-harvest innovations for mitigating mycotoxin contamination.
	EOI-O8: Plant health research community in at least 12 targeted LMICs uses needs assessment evidence and data to develop demand-driven, equitable, and scalable IPDM and IMM innovations.
	EOI-O9: National and regional partners utilize validated scaling approaches for P&D detection and surveillance, IPDM, and IMM.
	EOI-O10: Based on science-based Plant Health Policy Briefs, investors and decision-makers in targeted regions create an enabling environment for R4D and scaling of plant health innovations.
OECD DAC Climate marker adaptation score*	**Score 1: Significant:** The activity contributes in a significant way to any of the three CGIAR climate-related strategy objectives — namely, climate mitigation, climate adaptation, and climate policy, even though it is not the principal focus of the activity.
OECD DAC Climate marker mitigation score*	**Score 0: Not targeted:** The activity does not target the climate mitigation, climate adaptation, and climate policy objectives of CGIAR, as put forward in its strategy.
OECD DAC Gender equity marker score*	**Score 1B: Gender-responsive:** On top of the minimum requirements for 1A, the Initiative/project includes at least one explicit gender equality outcome, and the Initiative/project team has resident gender expertise or capacity. The Initiative/project includes gender equality indicators and monitors the participation of and differential benefits for diverse men and women.
Website link	https://www.cgiar.org/initiative/13-plant-health-and-rapid-response-to-protect-food-and-livelihood-security/

*The Organisation for Economic Co-operation and Development (OECD) Development Assistance Committee (DAC) markers refer to the OECD DAC Rio Markers for Climate and the gender equality policy marker. For climate adaptation and mitigation, scores are: 0 = Not targeted; 1 = Significant; and 2 = Principal.
The CGIAR GENDER Impact Platform has adapted the OECD gender marker, splitting the 1 score into 1A and 1B. For gender equality, scores are: 0 = Not targeted; 1A = Gender accommodative/aware; 1B = Gender responsive; and 2 = Principal.
These scores are derived from Initiative proposals, and refer to the score given to the Initiative overall based on their proposal.

Section 2 Initiative progress on science and towards End of Initiative outcomes

Staff from Peru's National Agrarian Health Service (SENASA) and the National Institute for Agrarian Innovation (INIA) attend a field training in early detection of Fusarium wilt TR4 and biosecurity measures in September 2022, Tumbes, Peru. Photo credit: Miguel Dita, CGIAR-ABC

Overall summary of progress against the theory of change

The CGIAR Research Initiative on Plant Health (PHI) Work Package 1, which focuses on bridging knowledge gaps and networks on plant health threat identification and characterization, has made significant progress in 2022 toward the establishment of regional plant health diagnostics and surveillance networks, as a preparedness strategy for existing and emerging threats. The collective work of nine CGIAR Centers, innovation partners, and demand partners focused on: (i) an online survey across 26 countries in the Global South, to map and identify the capacities of National Plant Protection Organizations (NPPOs), as well as the major challenges and needs on diagnostics and surveillance of pests and diseases (P&D); (ii) the development, improvement, and validation of molecular and image-based tools for detection, characterization, and monitoring a series of P&D; (iii) surveillance activities for more than 14 P&D affecting six major crops (banana, cassava, maize, potato, rice, and wheat) in 26 countries; and (iv) assessment of an inventory of protocols and methods for mycotoxin detection. A context-based capacity-strengthening plan will be developed jointly with partners in each region in 2023.

PHI Work Package 2, which focuses on risk assessment, data management, and preparedness for rapid response, undertook activities in 2022 that laid a strong foundation for improving P&D data management systems by inventorying P&D datasets available within CGIAR and identifying needs to enhance data-sharing for risk assessment studies. Temperature-based phenology models were developed for 10 pests and natural enemies to predict their emergence and optimize biological control. Tools such as ILCYM4.0, Nextstrain, and Tumaini were augmented for predicting P&D shifts and distribution maps. Remote sensing-based AI models were developed to map crops for risk prediction and support surveillance. A real-time AI tool was developed to track media reports on P&Ds to feed surveillance programs. Sentinel sites were established to monitor pathogen virulence changes to improve resistance breeding, understand insect-pest and pathogen population dynamics, and predict their geographic spread. The emergence of viruses infecting legumes in Ethiopia, as well as the banana bunchy top virus (BBTV) outbreak in Uganda and Tanzania, were tracked, and countermeasures were initiated.

PHI Work Package 3, which focuses on integrated pest and disease management (IPDM), with a team spread across six CGIAR Centers and an array of innovation and scaling partners in Africa, Asia, and Latin America, has made significant progress in 2022 by implementing multi-institutional and multi-disciplinary collaborative work on: (i) development and validation of eco-friendly and climate-smart innovations, including pheromones, biological control, biopesticides, decision-support tools, for integrated management of prioritized diseases (e.g., banana bunchy top disease (BBTD), banana *Fusarium* wilt TR4, maize lethal necrosis (MLN), etc.), insect-pests (e.g., Fall armyworm or FAW), and parasitic weeds in crops like Faba bean; (ii) development and use of decision-support tools (e.g., Tumaini app) for reducing fungicide sprays by 50% for potato late blight management; (iii) several training/capacity-building events on IPDM for a wide array of stakeholders; and (iv) establishment of Plant Health Innovation Platforms to integrate innovations from diverse institutions into IPDM packages, and identify/validate specific innovation packages that are cost-effective and scalable, in nine countries in the Global South; these platforms enable participatory engagement of national and international partners, extension personnel, and farming communities.

In 2022, the team for **PHI Work Package 4**, which focuses on integrated mycotoxin management, implemented activities for achieving six specific outputs. These resulted in: (i) research on improvement of bioprotectant dosage and usage; (ii) preparation and submission of dossiers for registration of aflatoxin biocontrol products to two regulatory agencies; (iii) surveys to determine the mycotoxins and crops on which to focus; (iv) efficacy trials in Mali, Niger, Sudan, Rwanda, Togo, Democratic Republic of the Congo, Burundi, Uganda and Mexico, to gather data to prepare and submit registration dossiers for aflatoxin biocontrol products; (v) renewal/signing of technology transfer and licensing agreements with private sector partners in several African countries for the biocontrol products; (vi) extendng partnerships with extension agencies and private sector partners in 11 countries to reach the targeted number of farmers; (vii) protection of crops of over 70,000 farmers in seven countries in sub-Saharan Africa (Nigeria, Kenya, Mozambique, Senegal, Burkina Faso, Ghana, and Mali) with aflatoxin management strategies; PHI has supplemented efforts by private sector partners. Overall, capacity of farmers, value chain actors, private sector, and regulators was strengthened to mitigate the adverse effects of mycotoxin contamination, through well-validated technologies, such as Aflasafe and nixtamalization.[1]

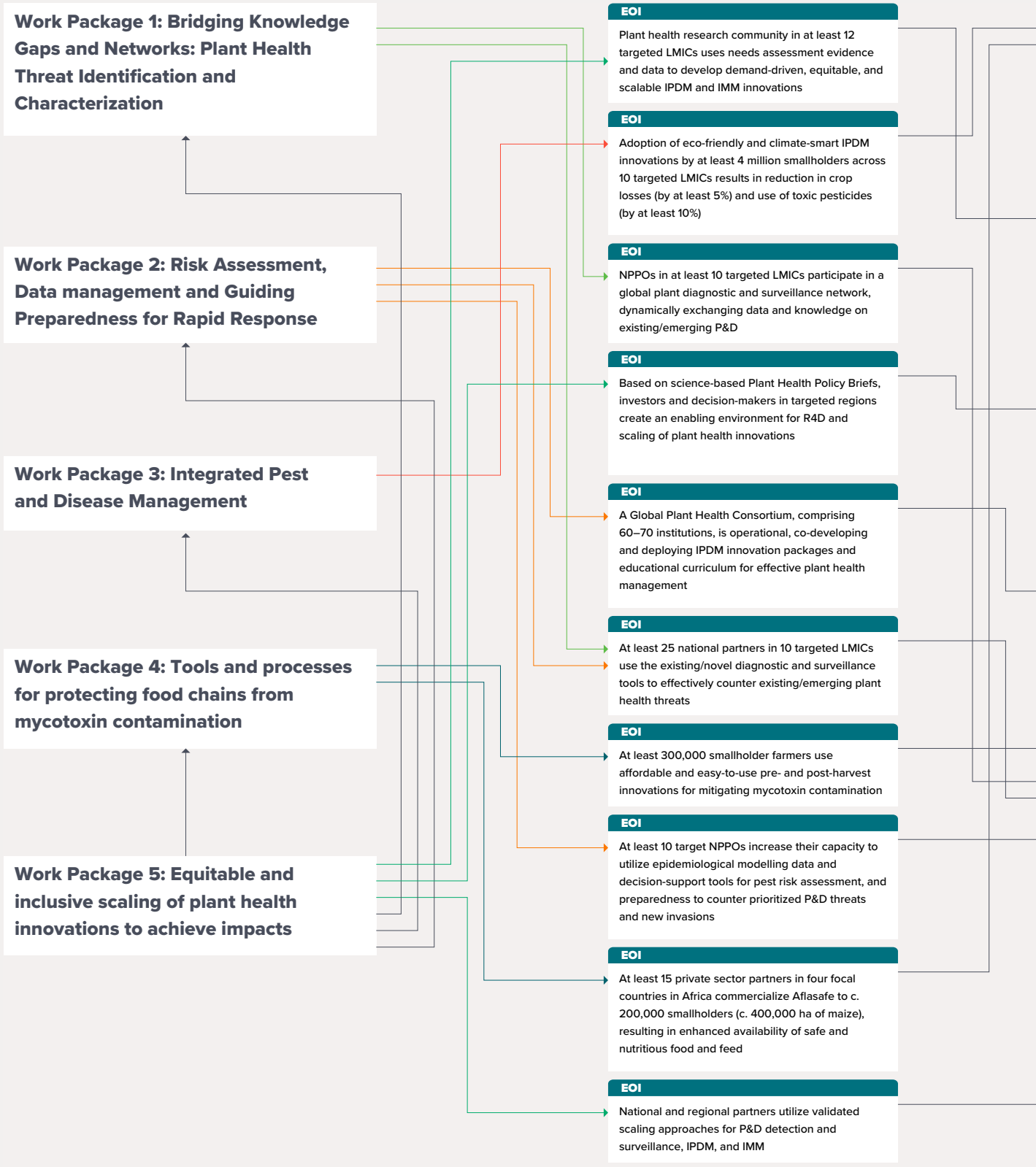
1 Nixtamalization is a traditional maize preparation process in which dried kernels are cooked and steeped in an alkaline solution, usually water and food-grade lime (calcium hydroxide). After that, the maize is drained and rinsed to remove the outer kernel cover (pericarp) and milled to produce dough that forms the base of numerous food products, including tortillas and tamales. Source: https://www.cimmyt.org/news/what-is-nixtamalization/#:~:text=Nixtamalization%20is%20a%20traditional%20maize,grade%20lime%20(calcium%20hydroxide

Aflasafe application by a woman farmer in Kenya. Photo credit: CGIAR-IITA

PHI Work Package 5, which aims at equitable and inclusive scaling of plant health innovations to achieve impacts, conducted interdisciplinary research and capacity development, involving six CGIAR Centers and three international partners, to address social and gender-related constraints in adoption of integrated pest management (IPM) innovations, surveillance, risk assessment, and extension approaches, and to evaluate short- and medium-term impacts of adopting IPM innovations on environment and household well-being. Achievements in 2022 include: (i) identification of gender-based knowledge gaps and needs of innovations for four prioritized P&D, namely FAW, MLN, banana *Fusarium* wilt TR4, and potato late blight; (ii) pilot case studies involving farming communities for disease monitoring and surveillance, specifically targeting women, using agricultural apps (Nuru, Tumaini, Plantix); (iii) improved capacity of partners to conduct interdisciplinary research and address research questions related to gender through Plant Health Regional Gender Research Networks; (iv) scoping study and intervention design of two impact evaluation case studies — Aflasafe in Nigeria and digital extension in Viet Nam; (v) a scoping study for impact evaluation of FAW and MLN management in Kenya; and (vi) external fundraising for impact evaluation of digital extension of plant health innovations in Kenya.

Initiative-level theory of change diagram

This is a simple, linear, and static representation of a complex, non-linear, and dynamic reality. Feedback loops and connections between this Initiative and other Initiatives' theories of change are excluded for clarity.



EOI — End of Initiative outcome

AA — Action Area

IA — Impact Area

SDG — Sustainable Development Goal

- Nutrition, Health, and Food Security
- Poverty Reduction, Livelihoods, and Jobs
- Gender Equality, Youth, and Social Inclusion
- Climate Adaptation and Mitigation
- Environmental Health and Biodiversity

Teams from CGIAR's three Action Areas — System Transformation, Resilient Agrifood Systems and Genetic Innovation — worked to develop an improved set of Action Area outcomes in October 2022. Since this was near the end of the reporting cycle for 2022, it was decided not to update the theories of change based on these new Action Area outcomes.
The exception to this is Genetic Innovation — for this Action Area, as the new outcomes had already been widely discussed among the relevant Initiatives, and with its advisory group of funders and other stakeholders, the decision was made to update their outcomes in time for the 2022 reporting cycle.

AA — Resilient Agrifood Systems

NARES and regional agricultural research institutes develop farming system innovations with the potential to increase the food security of smallholders in targeted areas

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IA

Stay within planetary and regional environmental boundaries: consumptive water use in food production of less than 2,500 km3 per year (with a focus on the most stressed basins), zero net deforestation, nitrogen application of 90 Tg per year (with a redistribution toward low-input farming system) and increased use efficiency, and phosphorus application of 10 Tg per year

IA

End hunger for all and enable affordable healthy diets for the 3 billion people who do not currently have access to safe and nutritious food

IA

Lift at least 500 million people living in rural areas above the extreme poverty line of US$1.90 per day (2011 PPP)

IA

Close the gender gap in rights to economic resources on, access to ownership of, and control over land and natural resources, for more than 500 million women who work in food, land, and water systems

IA

Equip 500 million small-scale producers to be more resilient to climate shocks, with climate adaptation solutions available through national innovation systems

SDG 1 NO POVERTY

SDG 2 ZERO HUNGER

SDG 3 GOOD HEALTH AND WELL-BEING

SDG 5 GENDER EQUALITY

SDG 12 RESPONSIBLE CONSUMPTION AND PRODUCTION

SDG 13 CLIMATE ACTION

SDG 15 LIFE ON LAND

SDG 17 PARTNERSHIPS FOR THE GOALS

Progress by End of Initiative outcome

EOI-O 1	Challenges, capacities, and knowledge gaps of NPPOs in 26 low- and middle-income countries (LMICs) were identified by the PHI team in 2022 through an online survey. This baseline information will enable developing and implementing (from 2023) an evidence-based and regional context-based capacity development plan to dynamically exchange data and knowledge within the targeted countries and regions, and across regions, for effective detection, characterization, and monitoring of a broad range of P&D.
EOI-O 2	Six image-based and 13 molecular tools for P&D detection were developed, improved, or validated in collaboration with innovation partners. These tools will be available as part of a toolbox to at least 25 national partners in 10 targeted LMICs, facilitating surveillance activities and in-lab detection of P&D by the NPPOs as a part of a Global South plant health diagnostic and surveillance network.
EOI-O 3	In 2022, remote sensing, phenology- and AI-based modeling tools were augmented and used by CGIAR scientists and NPPOs to assess the scenarios of P&D emergence and develop optimal control strategies, including mapping crop hosts and priority P&Ds (e.g., wheat rust, wheat blast, BBTV, FAW, etc.) to guide surveillance and control strategies. NPPOs in the target LMICs will benefit from these advancements, as demonstrated to counter BBTV emergence in Tanzania and Uganda, legume viruses in Ethiopia, and potato purple top in Ecuador. Efforts will continue to strengthen NPPO capacity in the target LMICs to utilize P&D data management systems for epidemiological modeling, risk analysis, and preparedness for countermeasures.
EOI-O 4	The PHI team forged stronger partnerships with an array of demand, innovation, and scaling partners, leveraging existing networks/consortia (e.g., FAW Research for Development (R4D) Consortium; BBTV Alliance etc.). In addition, through active participation in various forums, PHI established partnerships with USAID Innovation Lab for Current and Emerging Threats to Crops (CETC), Euphresco, CABI's Global Burden of Crop Loss, the United Nations Food and Agriculture Organization's Plant Health efforts etc. In 2023, we will formally launch a Global Plant Health Consortium, involving these partner networks to contribute more strongly to plant health management in the Global South.
EOI-O 5	An array of eco-friendly and climate-smart plant health IPDM innovations (including pheromones, biological control, biopesticides, ecological management, and decision-support tools) in diverse crops were co-developed/validated with partners in Africa, Asia, and Latin America. PHI has also identified/established nine Plant Health Innovation Platforms (e.g., FAW Innovation Platform at Kiboko, Kenya), which enable participatory engagement of researchers, extension personnel, and farming communities to identify/validate cost-effective, affordable, and scalable IPDM packages in the targeted crops.

EOI-O 6	Nine private sector partners continued to intensify their efforts for manufacturing and/or distributing aflatoxin biocontrol products for enhanced availability of safe and nutritious food and feed. The PHI Work Package 4 team is working with these partners to augment the upscaling of the technology. In the next two years, more partners will come on board in the targeted countries. By the end of the Initiative, well over 10 countries will be disseminating aflatoxin biocontrol technologies for improved food and feed safety.
EOI-O 7	Progress is being made to reach the target of 300,000 farmers using affordable and easy-to-use pre- and post-harvest innovations for mitigating mycotoxin contamination. In 2022, over 70,000 farmers protected their crops with mycotoxin mitigation technologies. With the ongoing work in various countries, plus additional scaling activities to start once aflatoxin biocontrol technology is registered in new countries (e.g., Mexico), the target of national partners and farming communities using affordable and easy-to-use pre- and post-harvest integrated mycotoxin management innovations will be achieved.
EOI-O 8	Through the results generated by the Work Package 1–5 teams through global online surveys, and interactions through various workshops (e.g., Work Packages 3–5), PHI has generated first-hand understanding of the needs of national partners and NPPOs engaged in plant health management in over 26 countries in the Global South. This forms a strong foundation for developing and deploying demand-driven, equitable and scalable IPDM and IMM innovations.
EOI-O 9	Work Package 1 organized several trainings for NPPOs to adopt validated protocols for detection of seed-borne pathogens of maize, rice, potato, and wheat in Ethiopia, Mexico, Peru, and the Philippines. Work Package 4 works with targeted national governments (e.g., Nigeria, Kenya) to scale IMM programs. These efforts are also converged with those of international partners (e.g., FAO, WFP, etc.). Work Package 3 activities in 2022 were implemented in over 20 countries globally; capacity-building of national partners, including farmers, on IPDM were undertaken in 11 target countries. Work Package 5 organized a workshop on Gender and Plant Health toward equitable scaling of IPDM in Southeast Asia, with participants from 15 NPPOs and universities in eight Association of South East Asian Nations (ASEAN) countries.
EOI-O 10	The Work Package 4 team worked on the development of aflatoxin-related policy documents to prevent aflatoxin contamination and exposure, and increase the usage of aflatoxin biocontrol products. These efforts resulted in the launch of policies by regional economic communities, such as the East African Community (EAC) and the Economic Community of West African States (ECOWAS), and individual governments (e.g., Ghana). In the coming years, Aflasafe scaling efforts will continue with other communities (e.g., ongoing work with COMESA) and with individual countries to promote policies that allow the production of safer food. Under Work Package 3, IPDM-related policy briefs will be developed in 2023, based on the work undertaken in 2022.

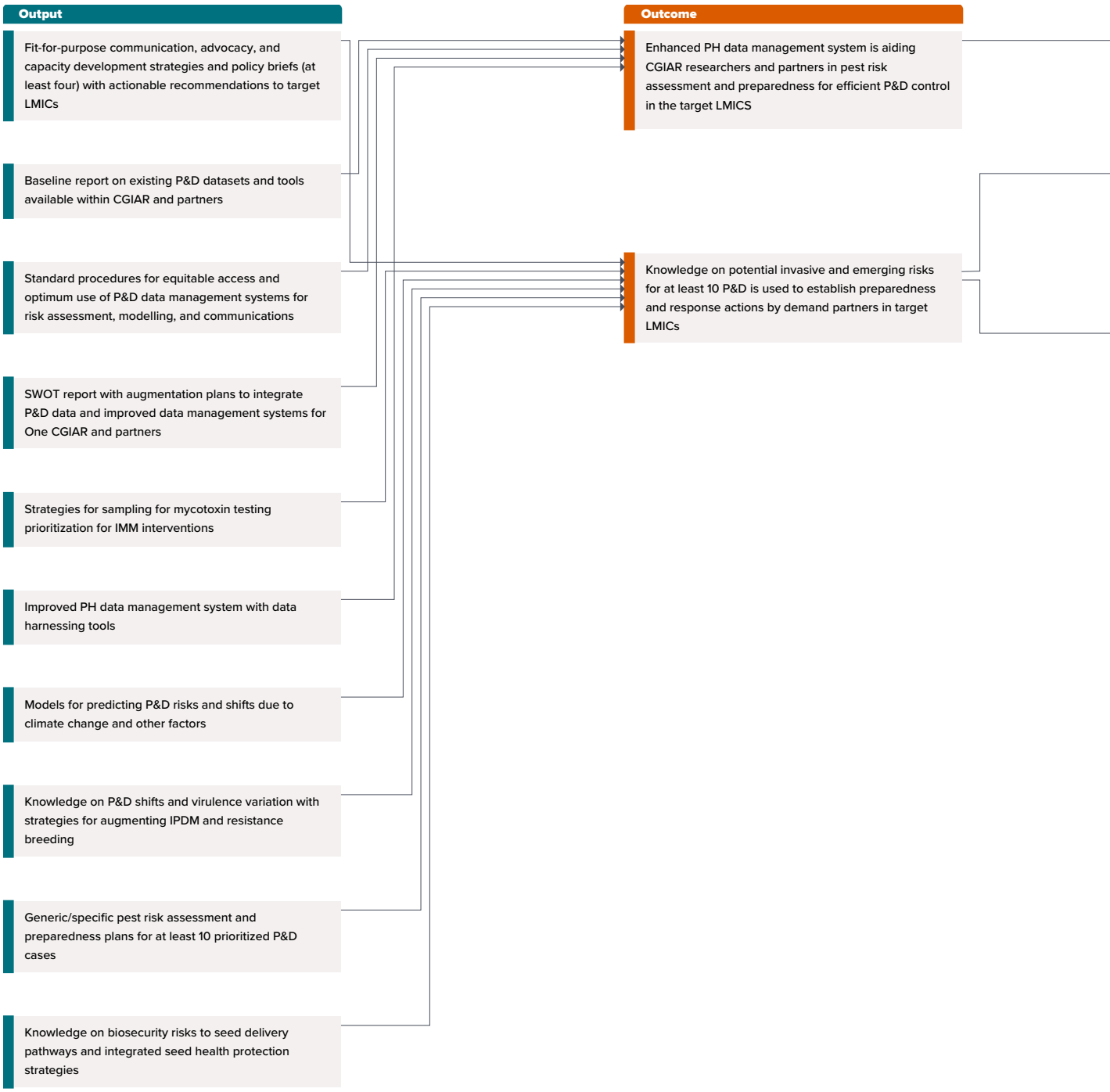
Section 3 Work Package-specific progress

Work Package 1:
Bridging knowledge gaps and networks: Plant health threat identification and characterization

Work Package 1 progress against the theory of change

Work Package 1 made notable progress toward each of its five TOC outputs (OP1–OP5). We identified and reported on the capacities, major challenges, and expectations of NPPOs in 26 countries across the Global South to join regional networks, including capacity gaps on lab/field detection, characterization, and surveillance of P&Ds. The responses provide a baseline for defining an evidence-based and regional context-based capacity-strengthening plan for 2023 (**WP1-OP1**). The PHI team across seven CGIAR Centers facilitated more than 11 workshops and capacity-sharing events on surveillance and diagnostics to NPPOs and National Agricultural Research and Extension Systems (NARES) in Bangladesh, Guatemala, Lebanon, the Philippines, and Peru. For example, on: (i) seed health testing, for keeping the seed clean from various seed-borne pathogens affecting wheat, maize, and rice; (ii) methods for surveillance and screening of wheat blast; and (iii) use of loop-mediated isothermal amplification (LAMP) for pathogen diagnosis in potato and sweetpotato, etc. (**WP1-OP2**). PHI team, together with innovation partners, developed/ improved/validated six image-based AI (examples here 1, 2) and 13 molecular tools (examples here 1, 2, 3, 4, 5) for detection, characterization, monitoring, and surveillance of P&Ds, as part of the PHI Toolbox to be available for NPPOs and NARES in the regional diagnostics hubs (**WP1-OP3**). The Alliance of Bioversity International and CIAT, AfricaRice, International Maize and Wheat Improvement Center (CIMMYT), International Potato Center (CIP), International Institute of Tropical Agriculture (IITA), and International Center for Agricultural Research in the Dry Areas (ICARDA) supported national institutions in 26 LMICs (including PHI target countries) with surveillance activities of 14 different P&Ds, affecting 6 major crops (banana, cassava, maize, potato, rice, and wheat) (**WP1-OP4**). A baseline assessment survey was conducted to understand the level of use, constraints, and opportunities for methods to detect mycotoxins **(WP1-OP5)**.

Work Package 2:
Risk assessment, data management and guiding preparedness for rapid response



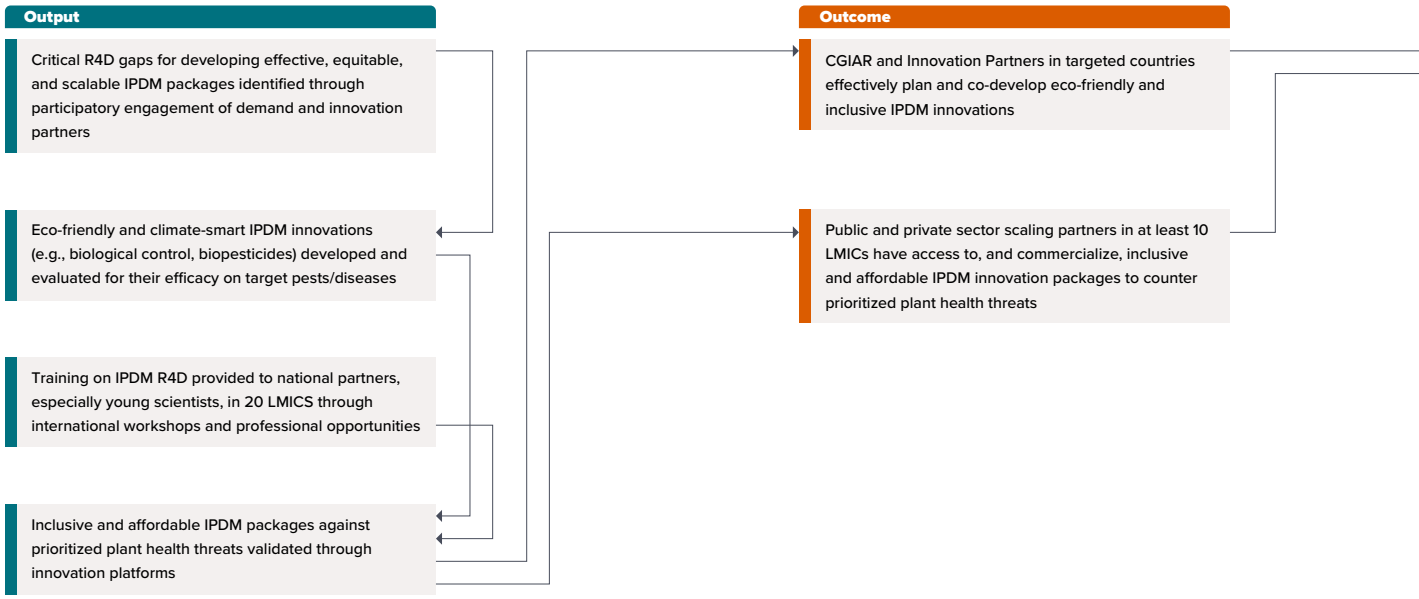
Work Package 2 progress against the theory of change

Work Package 2 activities were implemented as planned in 2022 to accomplish outputs contributing to the End of Initiative outcomes. To enhance the P&D data management systems, a baseline survey was conducted within CGIAR; this revealed 48 datasets collected jointly with partners from 38 LMICs covering 26 crops (**WP2-OP1**). The lack of organized data management systems is identified as one of the major constraints for P&D data sharing (**WP2-OP3**), which Work Package 2 will address as part of its 2023 plans. Temperature-based phenology models have been developed to predict pest emergence, and optimize biological control efficiency under climatic and ecological scenarios for important P&Ds and natural enemies. Various modelling tools are being deployed to predict the influence of climate and ecological conditions, including ILCYM4.0 for insect phenology; Nextstrain for visualizing genomic-based virus distribution; an improved Tumaini artificial intelligence (AI) tool for disease distribution maps; and a real-time AI tool to track media reports on P&Ds to feed surveillance programs (**WP2-OP5**). Sentinel sites have been established in disease "hot spots" (in partnership with the **Accelerated Breeding** Initiative) for monitoring shifts in pathogen virulence (e.g., post-flowering stalk rots in maize; wheat rust), for improving breeding decisions on resistant gene deployment, and pathogen population dynamic studies (**WP2-OP6**). Biosecurity risk identification and management procedures were developed to control spread of seed-borne rice bakanae disease (**WP2-07**). The team developed an inventory on mycotoxin diagnostics data for modelling studies (**WP2-08**), to assess vulnerable regions, and conditions favoring mycotoxin contamination. An early warning system for wheat blast risk assessment and management was developed for use in Bangladesh; the same will be adopted in 2023 in Zambia. Remote sensing-based AI models were developed to map the wheat rust risk in major production areas, and banana mapping in heterogenous farming systems for risk analysis to support BBTV surveillance in Africa. The Work Package 2 team also tracked the re-emergence of viruses infecting lentil and chickpea in Ethiopia; and BBTV outbreak, which is spreading rapidly in Uganda and Tanzania. Countermeasures, such as delimitation surveillance surveys, awareness creation on control measures, and eradication campaigns, were initiated to contain these outbreaks (**WP2-OP9**). Capacity development workshops and advocacy campaigns were organized, which have helped to reinforce countermeasures against emerging threats such as BBTD (**WP2-OP10**).

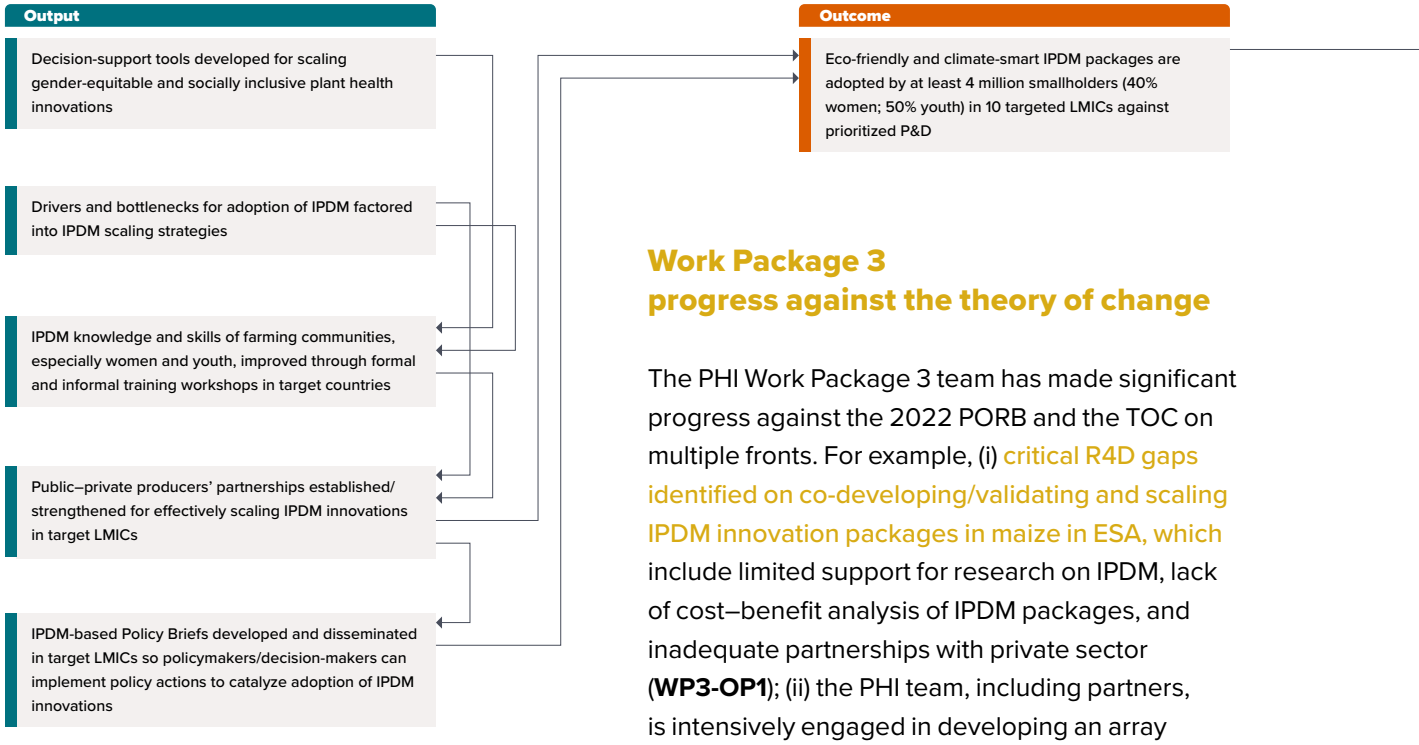
Work Package 3:
Integrated pest and disease management

Integrated Pest and Disease Management

Pathway 1: Effective, scalable and inclusive integrated pest and disease management (IPDM packages developed/va



Pathway 2: Accelerated and increased adoption of IPDM packages in the targeted MICs, mitigating the adverse effe

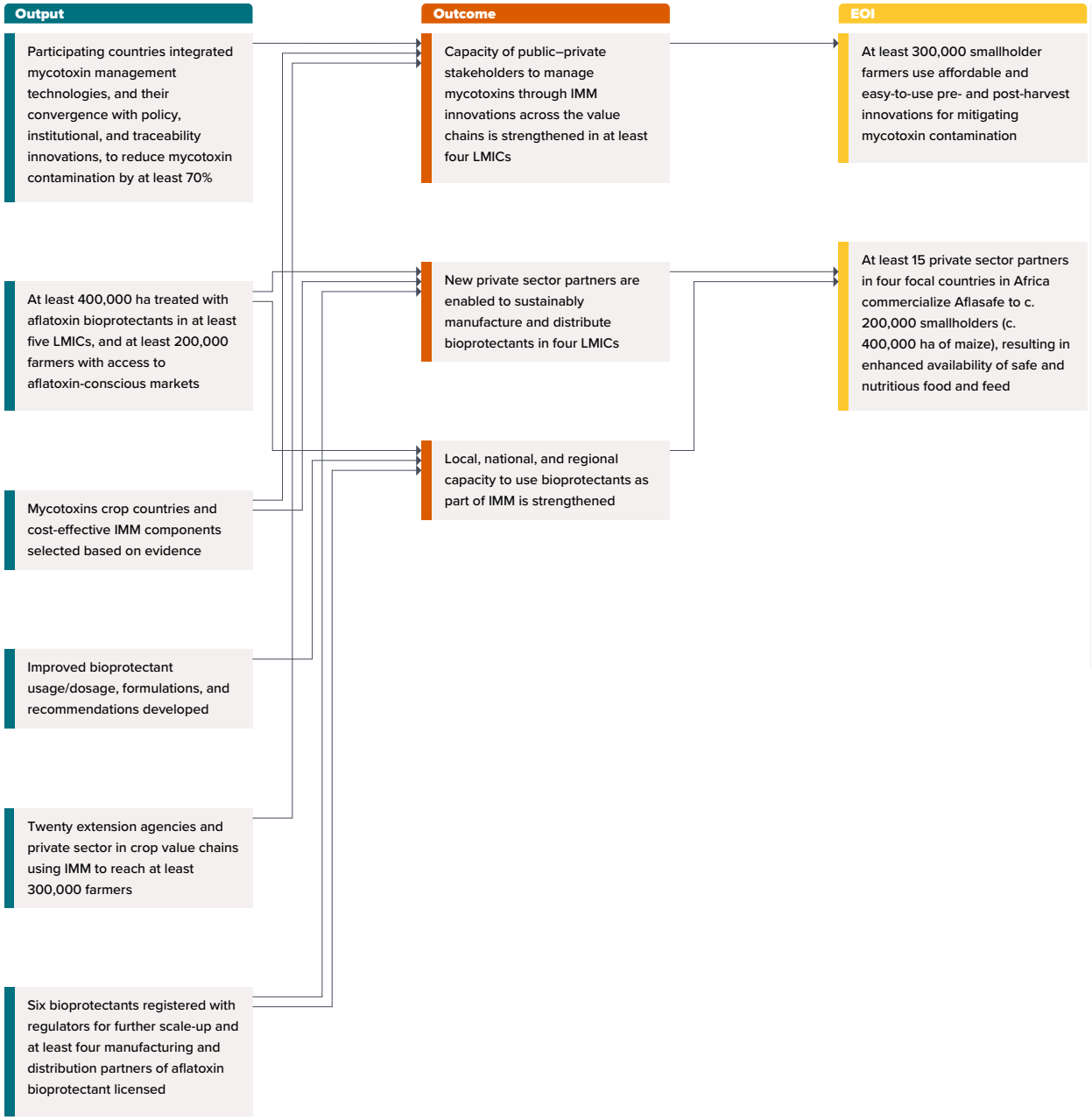


Work Package 3 progress against the theory of change

The PHI Work Package 3 team has made significant progress against the 2022 PORB and the TOC on multiple fronts. For example, (i) critical R4D gaps identified on co-developing/validating and scaling IPDM innovation packages in maize in ESA, which include limited support for research on IPDM, lack of cost–benefit analysis of IPDM packages, and inadequate partnerships with private sector (**WP3-OP1**); (ii) the PHI team, including partners, is intensively engaged in developing an array

of innovations, including pheromones, biological control, biopesticides, decision-support tools, to address plant health threats across diverse crops/cropping systems in the Global South (**WP3-OP2**); (iii) capacity-building of 984 national partners (44% women), including researchers and extension personnel, in 12 countries covering 6 crops, on various aspects of IPDM, including production and exchange of pathogen-free clean seed/planting materials, integrating host plant resistance with compatible IPDM practices, community-based biopesticide production against cowpea insect-pests, gender and social inclusion in plant health management, etc. (**WP3-OP3**); (iv) for the first time, nine Plant Health Innovation Platforms (seven of these in NARES stations) have been established/identified in different countries (Kenya, Uganda, Benin, Cameroon, Nigeria, Lebanon, Philippines, Ecuador, and Colombia) for integrating and co-developing IPDM innovation packages through participatory engagement of researchers, extension personnel, and farmers — such as the FAW Innovation Platform in Kiboko, Kenya, which is now enabling integration of various IPM-based innovations, and identifying effective, affordable, and scalable IPM packages (**WP3-OP4**); (v) hand-held decision-support tool for potato late blight management was validated in Honduras, Peru, and Kenya, and farmer interface application for managing FAW and cowpea pests tested in Benin and Mali (**WP3-OP5**); (vi) major bottlenecks for adoption of IPM practices by farming communities have been identified (e.g., cowpea IPM in Burkina Faso and Niger) — such as inadequate extension services, expensive registration procedures for IPM innovations like biopesticides, limited regional harmonization, poor communication strategies to end users (**WP3-OP6**); (vii) IPDM knowledge and skills of 9,112 farmers (4,121 women; 45%) were improved through formal/informal training in nine countries against specific plant health threats, including first release of natural enemies against FAW in farmers' maize fields in Cameroon, rice insect pests, banana *Fusarium* wilt TR4, BBTD, parasitic weeds and gall disease in grain legumes, potato late blight (**WP3-OP7**); and (viii) strong linkages established by PHI with complementary global projects/Initiatives on plant health management (e.g., CABI's Global Burden on Crop Loss; USAID Innovation Lab for CETC; FAO's Plant Health efforts; Euphresco) toward operationalizing a Global Plant Health Consortium (**WP3-OC1**). Thus, the work done by PHI Work Package 3 team in 2022 serves as a strong foundation for achieving the desired End of Initiative outcomes.

Work Package 4:
Tools and processes for protecting food chains from mycotoxin contamination



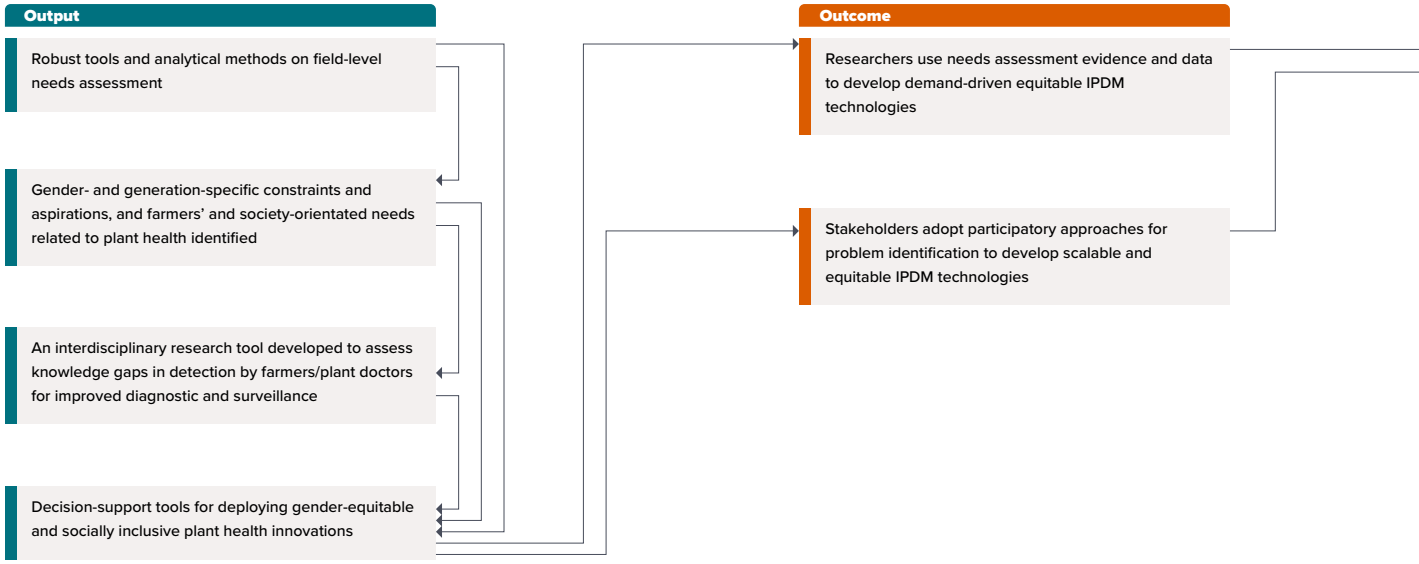
Work Package 4 progress against the theory of change

Work Package 4 activities to accomplish the six planned outputs were implemented as planned: (i) research to improve aflatoxin bioprotectant dosage and usage was undertaken, indicating that simple treatments to the formulation can improve the performance of the products (**WP4-OP1**); (ii) biocontrol efficacy trials to gather data to prepare registration dossiers continued in Mali, Niger, Sudan, Rwanda, Togo, Democratic Republic of the Congo, Burundi, Uganda, and Mexico — preliminary data confirmed efficacy in all countries, and registration will allow for following the science to scale, an approach to commercializing the biocontrol products in those countries and scaling activities; (iii) dossiers for registration of aflatoxin biocontrol products were prepared and submitted to regulatory agencies in Rwanda (the Rwanda Inspectorate, Competition and Consumer Protection Authority; RICA), and in Mali (Le Comité Sahélien des Pesticides of Comité Inter-Etate pour la Lutte contre la Sécheresse au Sahel; CSP/CILSS) (**WP4-OP2**); (iii) over 70,000 farmers protected their crops with aflatoxin management strategies in seven countries (Nigeria, Kenya, Mozambique, Senegal, Burkina Faso, Ghana, and Mali) (**WP4-OP3**); (iv) post-harvest innovations for mycotoxin management were validated in Côte d'Ivoire and Mexico, besides multi-mycotoxin analysis in rice from sub-Saharan African markets (**WP4-OP4**); capacity-building of 27 scientists from 13 African countries to minimize mycotoxin contamination of rice was organized; and 30 stakeholders in Kenya belonging to the Seed Savers Network were trained for the first time on nixtamalization for integrated mycotoxin management (IMM) (**WP4-OP5**); (v) work continued with extension agencies (e.g., extensionists of INERA in Burkina Faso, Ministry of Agriculture in Ghana) and private sector partners (e.g., Koppert Biological Systems in Kenya, AflaLivre in Mozambique, Harvestfield Industries Limited in Nigeria) in 11 countries to reach the target number of farmers with IMM options; for most farmers, this will be the first time that they will have access to knowledge and packages of technologies to effectively mitigate aflatoxin contamination (**WP4-OP6**).

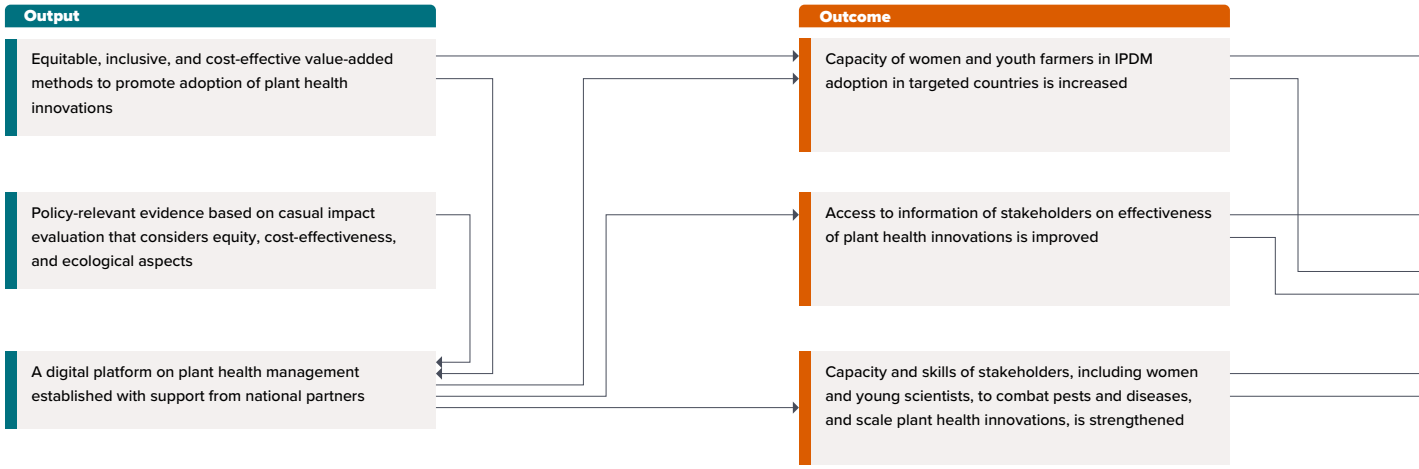
Work Package 5:
Equitable and inclusive scaling of plant health innovations to achieve impacts

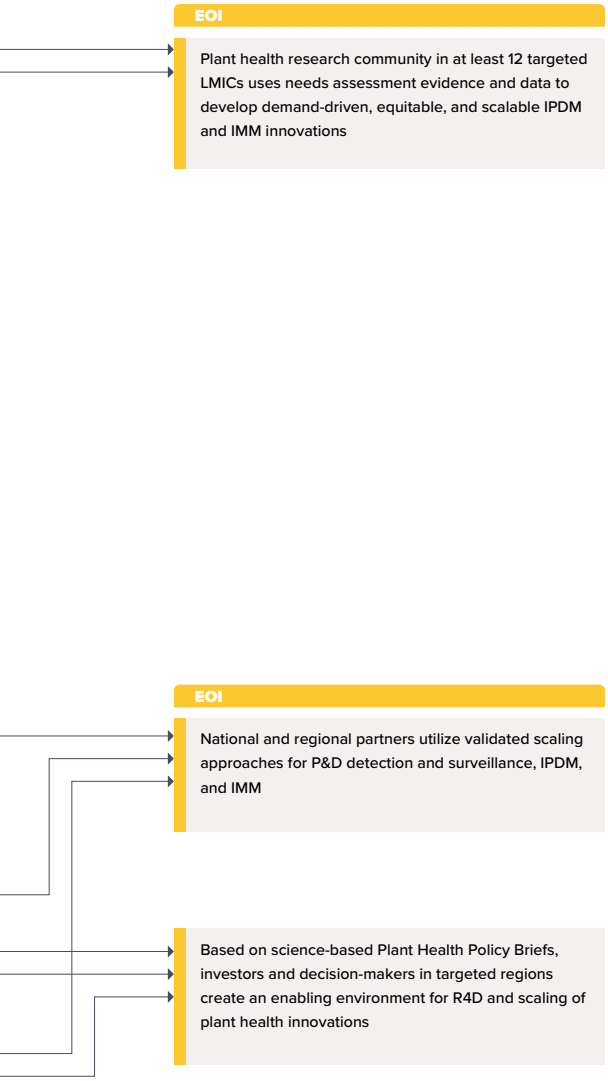
Equitable and Inclusive Scaling of Plant Health Innovations to Achieve Impacts

Pathway 1: Gender-responsive and socially-inclusive needs assessment, context analysis to inform technology/tool development and adjustment



Pathway 2: Facilitating scaling of innovations by evidence-based communications for policy change





Work Package 5 progress against the theory of change

PHI Work Package 5 focuses on gender equality and social inclusion, impact assessment, and communications in close interface with other Work Packages, for a targeted outcome on gender equality. In 2022, seven CGIAR Centers and three international partner organizations worked together on Work Package 5, resulting in four major achievements: (i) gender-based needs assessment and validation studies were undertaken to understand a usability of a digital app for identification of banana diseases, a potato late blight decision- support tool, and integrated management for rice pests and diseases; the results will be used to adjust the innovations to be useful to women farmers for equitable scaling (**WP5-OP1 and WP5-OP2**); (ii) methods to involve farming communities in surveillance, such as agricultural apps and mobile-phone messaging services, were tested as pilot cases in Lam Dong and Hanoi, Viet Nam (**WP5-OP3**); this enables the Initiative to design interventions for bottom-up participatory surveillance (Work Package 1) and risk assessment (Work Package 2); (iii) impact assessment designs to understand the impacts of gender-responsive plant health innovations on smallholder farmers, such as FAW and MLN management, Aflasafe scaling, and a digital extension service (Plantix, Nuru) were developed; this forms the base for generating evidence for policy change (**WP5-OP4 & WP5-OP5**); and (iv) the establishment of a Plant Health Regional Gender Research Network in Southeast Asia to facilitate gender-integrated interdisciplinary research and interventions; this included capacity development of 45 participants from 15 organizations in 8 countries (including Viet Nam, Cambodia, Laos PDR, and Indonesia). This model will be applied to other targeted regions in 2023 and 2024.

Work Package progress rating

WORK PACKAGE	TRAFFIC LIGHT / RATIONALE	
1		**Work Package 1** activities in 2022 were well aligned with the proposed Plan of Results and Budget (PORB), and the TOC for Work Package 1, as described above. For the first time, PHI has enabled establishment of regional diagnostic and surveillance networks that were linked with the CGIAR Germplasm Health Units (GHUs). An online survey conducted by PHI Work Package 1 in 2022 found that, in the Global South, the crops that are most commonly subject to P&D diagnostics are banana/plantain, maize, potato, and rice. Confirmation of these priority crops enables us to set priorities for addressing critical gaps in diagnostic methods, sharing protocols across regions, and strengthening the diagnostic capacity of national partners as a part of preparedness for dealing with emerging pests and future incursions. Additionally, these six crops are those for which PHI Work Package 1 has supported surveillance activities by the national partners. In addition, a series of training workshops were conducted in 2022 to increase the diagnostics and surveillance capacity of NPPOs and to strengthen inter-institutional collaboration as part of the regional diagnostic networks. PHI supported surveillance activities of *Bactericera cockerelli* in potato, BBTV, *Fusarium* wilt TR4 in banana, cassava rotting, FAW, MLN, rice blast, root mealybug (*Paraputo ensete*), wheat blast, wheat rust, and *Fusarium* head blight in wheat.
2		**Work Package 2** progress is in line with the PORB, and the TOC for Work Package 2. The team has successfully established a platform for strengthening data-based decision-support systems for optimal policies and P&D decisions to anticipate, prepare, and counter emerging, re-emerging, and invasive P&D threats. These developments signify a shift from predominantly outbreak-response-based actions to pre-emptive control to prevent pest outbreaks and outbreaks from becoming epidemics and pandemics. Work Package 2 will continue development of appropriate data management systems, standards, and policies for P&D data access, risk assessment, and guiding preparedness, which are crucial to accomplish End of Initiative outcomes.
3		**Work Package 3** progress is well aligned with the 2022 PORB and TOC, with several key achievements, including: (i) identification of critical R4D gaps in scaling IPDM in consultation with stakeholders; (ii) co-creating eco-friendly and climate-smart IPDM innovations against targeted plant health threats in various crops, including rice, maize, wheat, grain, legumes, potato, banana, cassava, yam, tomato; (iii) establishing/identifying for the first time Plant Health Innovation Platforms in nine countries (seven platforms in NARES stations) for co-developing/validating the most effective, affordable, and scalable IPDM packages; (iv) training of over 10,000 partners, including researchers, extension personnel, and farmers on IPDM for effective scaling; and (v) establishing strong linkages with complementary Initiatives/projects led by non-CGIAR institutions toward a Global Plant Health Consortium for coordinated implementation of plant health management, especially in the Global South.

WORK PACKAGE	TRAFFIC LIGHT / RATIONALE
4	 Although scaling of mycotoxin mitigation strategies is complicated, **Work Package 4** progress is in line with both the 2022 PORB and the TOC. Work Package 4 works closely with stakeholders across the value chain in each participating country to design management strategies through a value chain approach. Interactions with regulators, standards authorities, manufacturers, processors, farmers' associations, among others, are routinely conducted to increase adoption of technologies in the Work Package 4 to minimize risks to achieve the success of the Work Package. Aflatoxin biocontrol is now well recognized by NARES (e.g., KALRO in Kenya, INERA in Burkina Faso, ZARI in Zambia), private sector partners (e.g., Koppert Biological Systems in Kenya, AflaLivre in Mozambique, Harvestfield Industries Limited in Nigeria), relief agencies (e.g., FAO-Nigeria, FAO-The Gambia, WFP-Kenya), national governments (aflatoxin biocontrol included in national agricultural investment plans in Senegal, The Gambia, Tanzania, Malawi, Nigeria, Uganda) and several other stakeholders as key component of management strategies to prevent aflatoxin contamination. Because of the somewhat limited funds for all partners, additional funds are continuously being sought to complement the research and delivery activities in the Work Package 4. Proposals will be prepared and submitted in 2023 to scale up activities in the current and new countries where the three partner centers (IITA, CIMMYT, and AfricaRice) operate or have strong partnership networks.
5	 **Work Package 5** progress is in line with both the 2022 PORB and the TOC. The team has established interdisciplinary research collaboration with all other Work Packages to improve surveillance, technology adoption, and scaling approaches to be more efficient, gender-equitable and inclusive. The team incorporated gender and social aspects in standard plant health survey questionnaires, which are ready to be used by partner organizations, enabling regional comparative research to be conducted. The team also successfully conducted planned research on needs assessment for priority P&D, including FAW in maize, potato late blight, and *Fusarium* wilt TR4 in banana. Pre-analysis plans for impact assessment for three key plant health innovations have been completed for randomized control trials in which gender-related questions are addressed. Communication activities will begin in 2023 based on partnerships established in 2022.

KEY	
On track	 • Annual progress largely aligns with Plan of Results and Budget and Work Package theory of change • Can include small deviations/issues/ delays/risks that do not jeopardise success of Work Package
Delayed	 • Annual progress slightly falls behind Plan of Results and Budget and Work Package theory of change in key areas • Deviations/issues/delays/risks could jeopardise success of Work Package if not managed appropriately
Off track	 • Annual progress clearly falls behind Plan of Results and Budget and Work Package theory of change in most/all areas • Deviations/issues/delays/risks do jeopardise success of Work Package

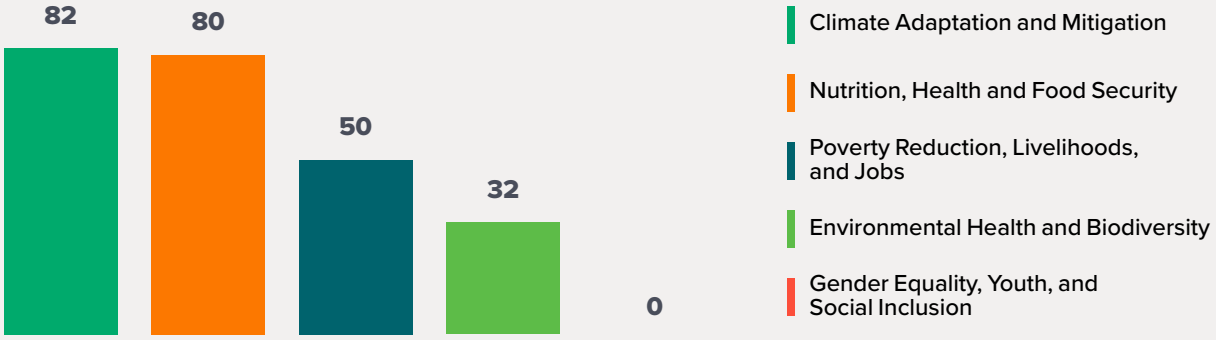
Section 4 Initiative key results

This section provides an overview of 2022 results reported by Plant Health. These results align with the CGIAR Results Framework and Plant Health theory of change. Further information on these results is available through the CGIAR Results Dashboard.

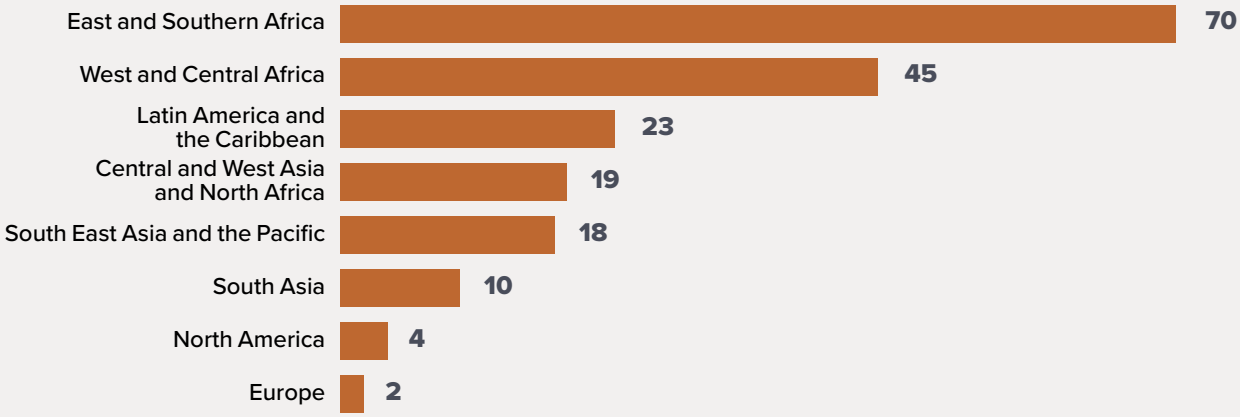
Overview

Results	Outputs					Outcomes
251	6 SDGs	41 Capacity sharing for development	34 Innovation development	82 Knowledge products	85 Other outputs	9 Innovation use

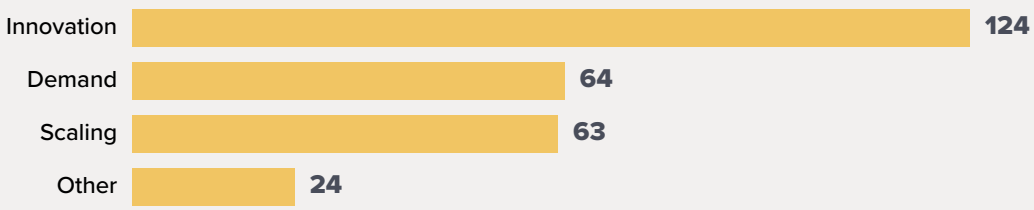
Impact Area contributions



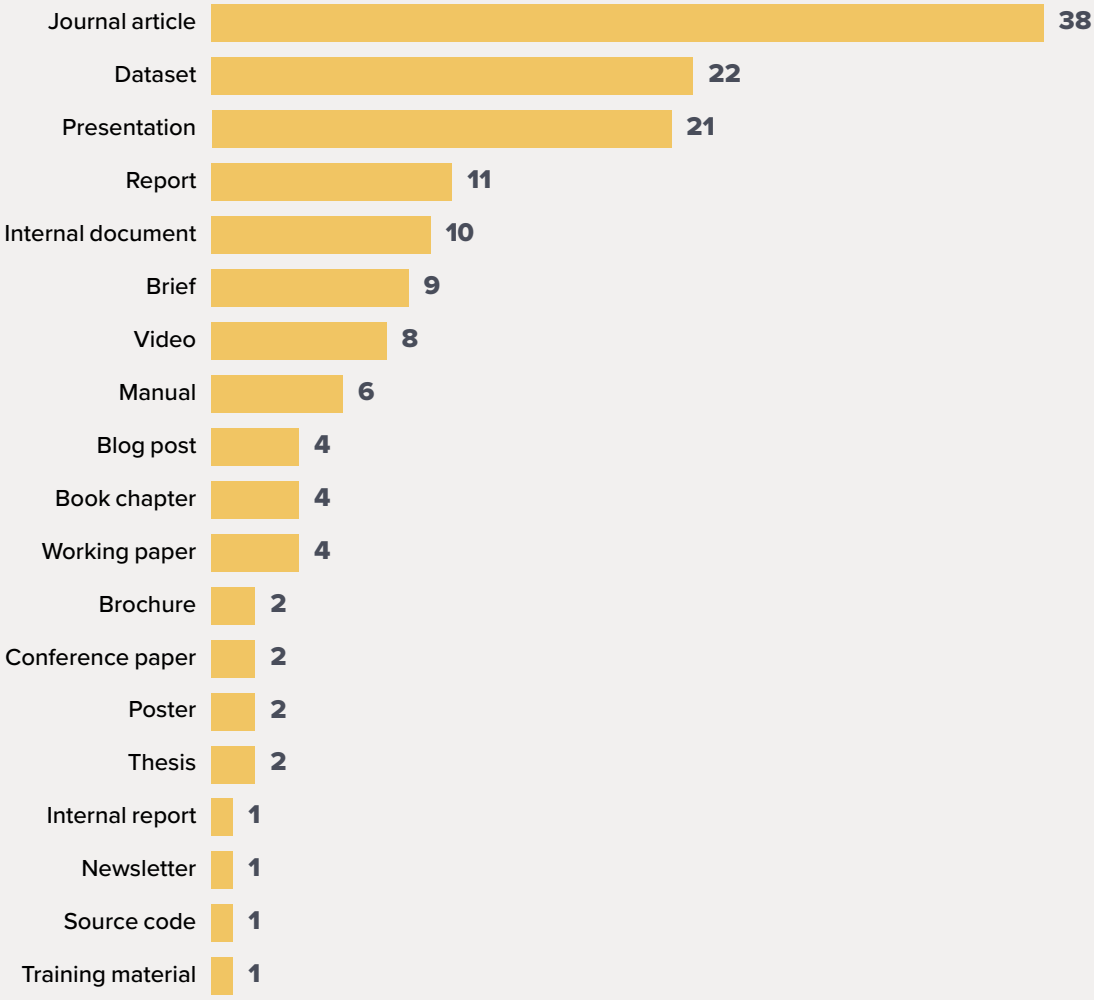
Results by region



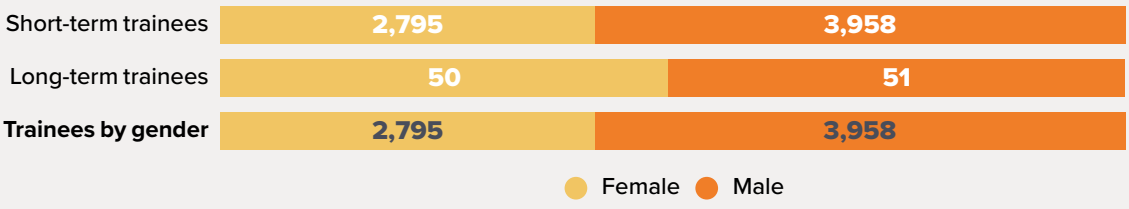
Partners by main delivery type



Knowledge products by category



Capacity development trainees by term

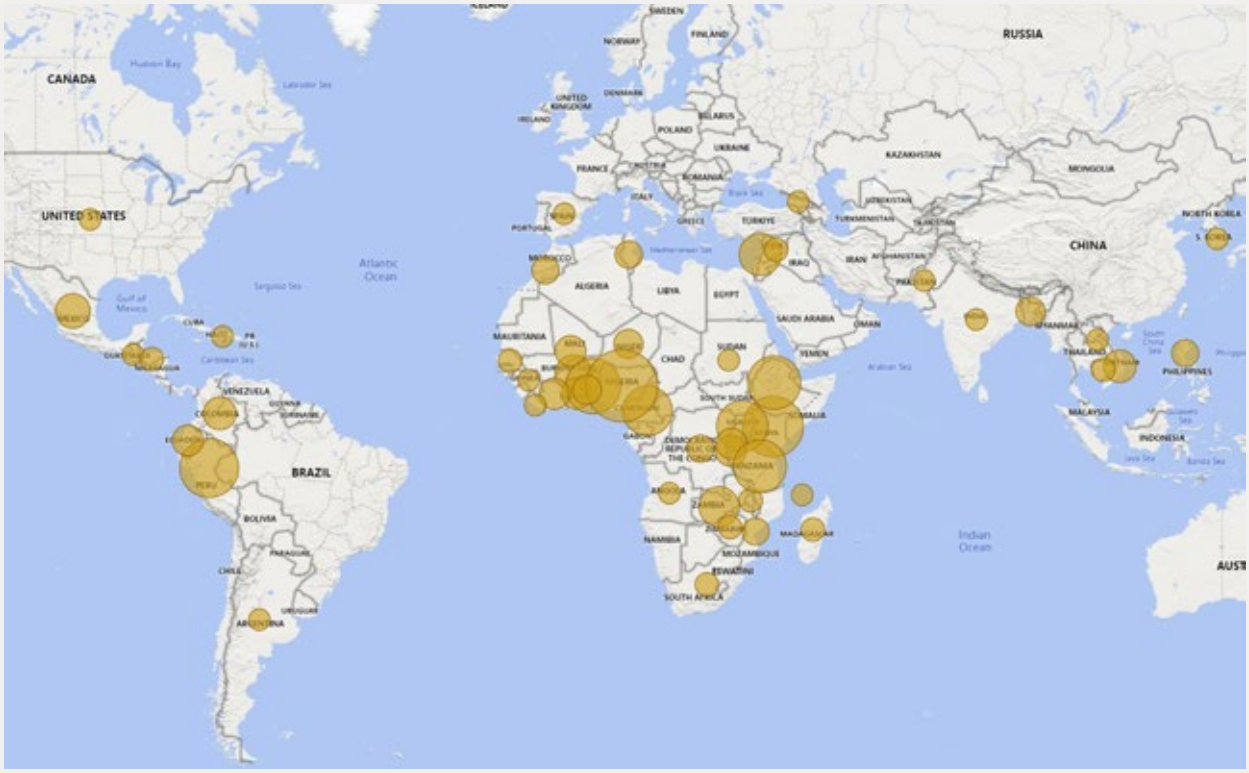


Innovations by readiness level

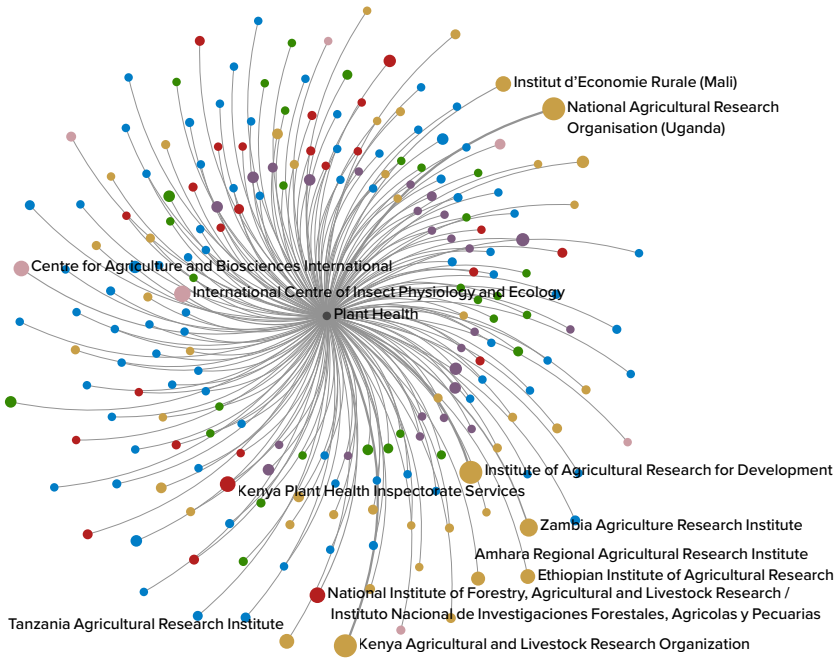
Pipeline overview
Number of innovations

9	PROVEN INNOVATION – The innovation is validated for its ability to achieve a specific impact under uncontrolled conditions	1
8	UNCONTROLLED TESTING – The innovation is being tested for its ability to achieve a specific impact under uncontrolled conditions	4
7	PROTOTYPE – The innovation is validated for its ability to achieve a specific impact under semi-controlled conditions	7
6	SEMI-CONTROLLED TESTING – The innovation is being tested for its ability to achieve a specific impact under semi-controlled conditions	7
5	MODEL/EARLY PROTOTYPE – The innovation is validated for its ability to achieve a specific impact under fully-controlled conditions	1
4	CONTROLLED TESTING – The innovation is being tested for its ability to achieve a specific impact under fully-controlled conditions	2
3	PROOF OF CONCEPT – The innovation's key concepts have been validated for their ability to achieve a specific impact	3
2	FORMULATION – The innovation's key concepts are being formulated or designed	1
1	BASIC RESEARCH – The innovation's basic principles are being researched for their ability to achieve a specific impact	6
0	IDEA – The innovation is at idea stage	2

Results by country



Section 5 Impact pathway integration – External partners



Partners typology	# of partners	% of partners
Research organizations and universities (National)	81	38.0%
Research O&U (NARS)	45	21.1%
Government (National)	25	11.7%
Private company (other than financial)	25	11.7%
Research O&U Intl. (General)	7	3.3%
All Other Categories	30	2.3%

Top 5 Institution Types

All other categories · Government (National) · Not applicable · Private company (other than financial) · Research O&U Intl. (General) · Research O&U (NARS) · Research O&U (National) (Universities)

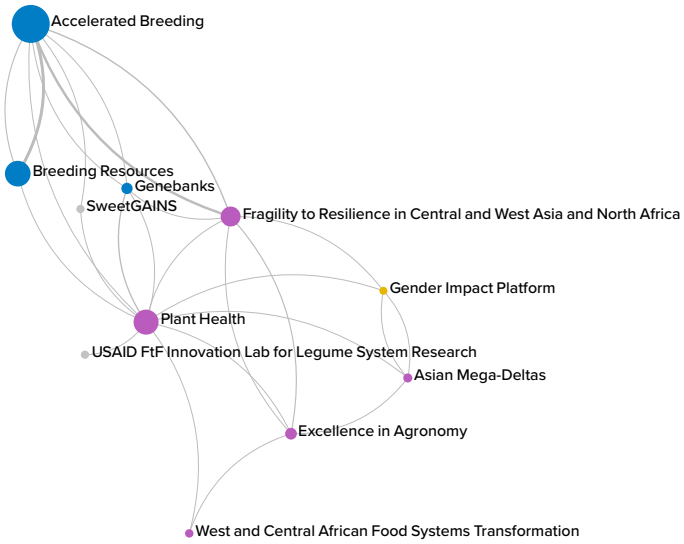
Note: CGIAR Centres are excluded from the analysis. Partners and edges are sized by the number of results. Labels are shown for the partners involved in the most results.

Partnerships and PHI's impact pathways

The CGIAR Research Initiative on Plant Health (PHI) has over 120 demand, innovation, and scaling partners in the Global South, including governments, NARES, international agricultural research centers (e.g., CABI, International Centre of Insect Physiology and Ecology (icipe), World Vegetable Center), private sector institutions engaged in plant health management, and farmers' groups. Several of the innovation partners with complementary expertise are part of already established networks (e.g., FAW R4D International Consortium; BBTV Alliance). Scaling partners, especially from the private sector, are contributing (through their own investments) delivery of well-validated innovations (e.g., Aflasafe) to farming communities in different countries in Africa.

In 2022, a total of **127 non-CGIAR partners** have contributed to the implementation of different PHI Work Packages and to their TOCs. Note that not all partners received Initiative/pooled funding; most of the partners are working collaboratively as they are interested in plant health management, including the protocols, innovations, capacity-building, etc. In 2022, PHI has disbursed sub-grants amounting to a total of **US$870,367** to **48 non-CGIAR partners** (East and Southern Africa 20; West and Central Africa 4; Central and West Asia and North Africa 4; Asia 9; Latin America and the Caribbean 7; Europe 4) for implementing specific workplans with deliverables that contribute to the success of different work packages. While some of the partners have contributed to one specific Work Package, others have contributed to multiple Work Packages (e.g., CABI, icipe, IRAD, KALRO, KEPHIS, NARO, ZARI). Some partners are part of ongoing efforts under bilateral projects that PHI is leveraging to expand, adopt, and/or scale plant health innovations in the Global South.

Section 6 Impact pathway integration – CGIAR portfolio linkages



Name	Action Area	Total connections	Total results
Accelerated Breeding	GI	8	151
Breeding Resources	GI	3	91
Plant Health	RAFS	58	88
Fragility to Resilience in Cent. & W. Asia and N. Africa	RAFS	7	63
Excellence in Agronomy	RAFS	5	23

Note: Initiatives, non-pooled projects, and the connections are sized by the number of results. The table includes the given initiative's top connections and is sorted by Total Results. The network and summary table include all connections for the given initiative, as well as the connections between the given initiative's connections (i.e. the ego network)

Portfolio linkages and PHI's impact pathways

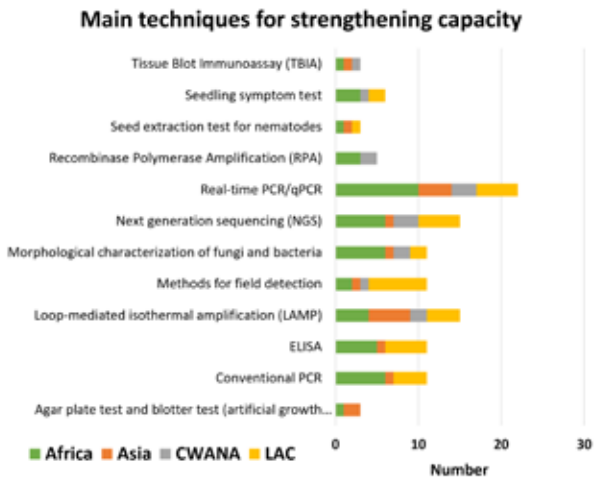
During 2022, PHI worked closely with nine CGIAR Initiatives from three science areas. Linkages and joint outputs were reported in collaboration with four Initiatives under Genetic Innovations, four under Resilient Agrifood Systems, and one under Systems Transformation (Gender Platform). Some examples are: (i) **Accelerated Breeding** and **Seed Equal** Initiatives contributed to breeding and deployment of improved varieties with host plant resistance (resistance to disease/parasitic weed/insect-pest), against various plant health threats, including resistance to wheat blast and *Fusarium* head blight (FHB), MLN, FAW, and striga in maize, bacterial leaf blight (BLB) in rice (**Work Package 3**); and sentinel sites for monitoring P&D shifts and R gen response (**Work Package 2**); (ii) **Genebanks** Initiative supported the development/improvement/validation of diagnostic tools/protocols, and socialization of regional diagnostic hubs with NPPOs (**Work Package 1**), and contributed to the P&D data inventory (**Work Package 2**); (iii) **Breeding Resources** Initiative supported the collection of aerial images and machine learning methods to emulate the late blight severity in potato (**Work Package 1**); and sentinel sites for shifts in P&D (**Work Package 2**). Resilient Agrifood Systems Initiatives contributed to the TOCs for Work Packages 3, 4 and 5; this included interactions with the **Fragility to Resilience in Central and West Asia and North Africa** Initiative to strengthen the capacities of Georgian national technicians on healthy potato seed production (**Work Package 3**), the **Excellence in Agronomy** Initiative to gain understanding of gender-based roles in rice-based systems, and diversification of cropping systems for pest management, and the **Asian Mega-Deltas** Initiative for establishing a Plant Health Regional Gender Research Network in Southeast Asia for more equitable and inclusive impacts (**Work Package 5**). More details are here. These linkages have supported progress toward the End of Initiative outcomes, OC1, OC2, OC3, OC5, OC8, and OC10.

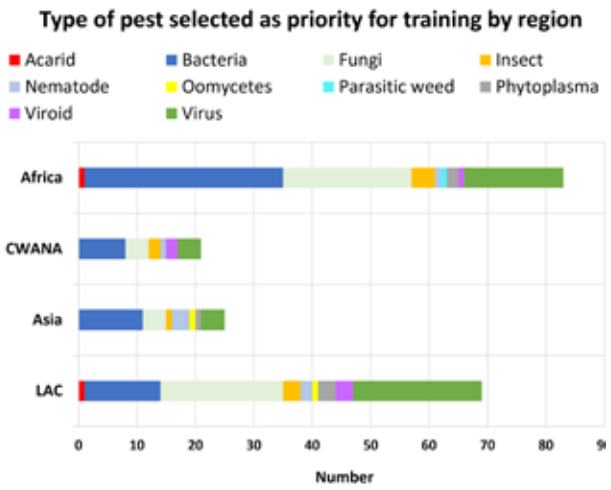
Section 7 Adaptive management

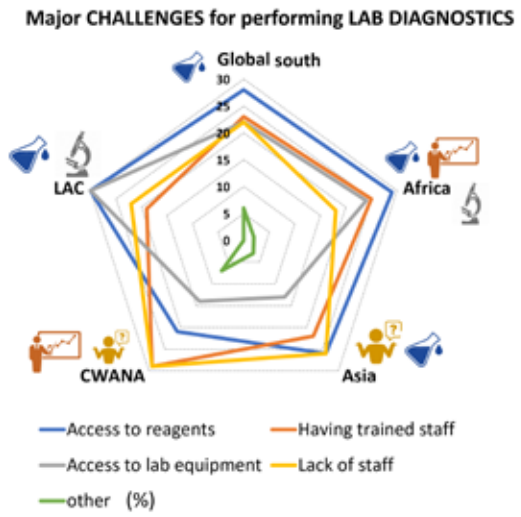
RECOMMENDATION	SUPPORTING RATIONALE
PHI Work Package 1: Through the 2023 workplan, facilitate internal connections among PHI Work Packages to effectively leverage the P&D surveillance data gathered under Work Package 1 in 2022 — e.g., for risk assessment in Work Package 2 to identify higher risk areas of P&D emergence and transboundary movement; use of results from surveillance activities to identify areas with specific needs for deployment of IPDM packages through Work Package 3.	In 2022, PHI Work Package 1 together with national partners surveyed in the field 14 different P&Ds affecting 6 major crops in 26 countries. In 2023 and 2024, this data should be used in coordination with countries to identify high-risk areas for preventing P&D emergence or dispersion as well as to identify "hot spots" for IPDM interventions.
PHI Work Package 2: In partnership with Accelerated Breeding, Seed Equal, Genebanks, Market Intelligence, Excellence in Agronomy, and Digital Initiatives, create a data automation interface to harness climate and P&D incidence data from CGIAR and partner trial sites and third-party databases.	Need to generate and analyze big data to monitor the dynamics of native and exotic pests for data-based decisions to anticipate threats and P&D management.
PHI Work Package 3: Strengthen participatory engagement with international and national institutions (both public and private), extension personnel, and farming communities for co-creating, validating, and deploying IPDM packages.	In 2022, PHI has established nine Plant Health Innovation Platforms in different countries, and work has been already initiated at the FAW Innovation Platform in Kiboko, Kenya. In 2023, we expect the CGIAR Centers and partners to implement focused activities on IPDM.
PHI Work Package 4: Strengthen collaboration with complementary One CGIAR Initiatives on IMM for greater synergies and impact.	Several CGIAR Initiatives can potentially collaborate with Work Package 4; these include One Health, Rethinking Food Markets, Mixed Farming Systems, etc. In 2023, we will formalize interface with these Initiatives, with clear deliverables.

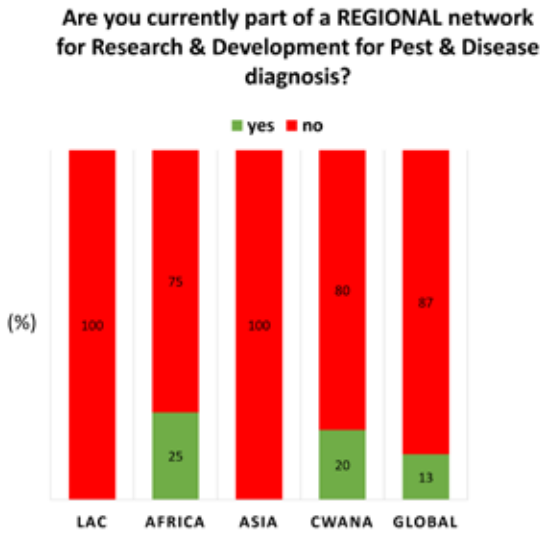
RECOMMENDATION	SUPPORTING RATIONALE
PHI Work Package 5: Based on lessons learnt from 2022, further improve the capacity of national partner institutions to undertake gender-responsive interdisciplinary research to address specific social and institutional constraints for adoption and scaling of plant health innovations.	In 2022, the Gender and Plant Health Research Network was established in Southeast Asia with 15 national institutions/universities from 8 countries. In 2023, we plan to apply this model in other regions.
Communications: Intensify communications both internally and externally through various channels for enhanced visibility of the Plant Health Initiative.	Several key result stories have emerged from the five Work Packages of PHI. These need to be communicated more effectively to the stakeholders, including governments and policymakers.
Reporting: Ensure that all scientists who are leading PHI activities, including those at key non-CGIAR partner organizations, are given direct PRMS access for reporting their own results (subject to review/approval by designated Work Package/Technical Lead). Also, ensure that partner grant reporting obligations and timelines (as captured in subgrant agreements) are better aligned with the One CGIAR reporting calendar and procedures.	Many important results achieved in 2022 were not reported in PRMS, especially those that were implemented through sub-grants to non-CGIAR partners. Centralization of the uploading of results to PRMS by a limited number of selected CGIAR focal points created a bottleneck.
Work planning and monitoring: Implement the Scriptoria Project Management Centre (PMC), an online tool for project work planning and monitoring.	This same tool is already being implemented by other CGIAR Initiatives with generally favorable feedback so far. It will improve visibility for managers and team members for improved collaboration and monitoring implementation of activities.

Section 8 Key result story









CGIAR-led Plant Health International Network has mapped the priorities for pest and disease detection and response efforts in the Global South.

Monica Carvajal-Yepes et al. (2022) Feedback from the NPPOs on priority techniques and pest types, major challenges for promoting lab diagnostics, and current status of their participation in regional networks.

The CGIAR Research Initiative on Plant Health (PHI) team interfaced with plant health specialists and social scientists across 26 countries across Africa, Asia, and Latin America and the Caribbean, through an online survey to identify major research and capacity gaps of NPPOs, to be addressed through a Global South plant health diagnostic and surveillance network. This mapping exercise on an unprecedented scale is the foundation for a much-needed cross-border

coalition to deliver faster and more effective responses to the existing and emerging plant health threats.

Plant pests and diseases impact heavily on global food security, costing over US$220 billion every year, according to a recent FAO study. Pests and disease outbreaks are predicted to increase due to climate change, trade, and agricultural intensification, among other drivers. How to respond to these threats is primarily the responsibility of NPPOs. However, many NPPOs lack the capacity to properly carry out the necessary diagnosis, surveillance, and extension work at the scale and speed required to contain such crop disease and pest crises, particularly in the low- and middle-income countries in the Global South.

Together with plant health specialists and social scientists across 4 continents and 26 countries in the Global South, the CGIAR Research Initiative on Plant Health (PHI) has identified the key knowledge and capacity gaps in pest and disease surveillance and response strategies (Carvajal-Yepes et al., 2022). This mapping exercise of unprecedented scale found that banana/plantain, maize, potato, and rice were the crops most targeted for pest and disease surveillance efforts. Confirming priority crops will help set priorities for developing common diagnostic methods, sharing protocols across regions and support/share knowledge to improve the diagnostic capacity as a preparedness strategy for emerging pests.

Results indicate that the major challenges for performing lab diagnostics in the Global South are identified as access to reagents and laboratory equipment, while the main in-field detection challenges include lack of trained staff, capacity to identify the right pest or disease symptoms in certain crops, and limited resources for field visits. The survey also revealed the need to bridge NPPOs' digital divide to expand the use of real-time low-cost plant disease diagnostics. Young scientists could play a crucial role for this digital transformation to raise the standards in data management over the next few years. Women's participation in the survey was limited especially in Africa and responses revealed some gender challenges in a male-dominant plant protection and health sector. PHI will make its training gender-sensitive and prioritize women's participation in capacity-building activities.

To roll out the pest and diagnostics and surveillance roadmap across Africa, Asia, Latin America and the Caribbean, and Central and West Asia and North Africa regions, PHI will rely on the regional diagnostic hubs hosted by the CGIAR Germplasm and Seed Health Units across the continents.

Most survey participants are not part of any regional research and development network despite the transboundary nature of plant pests and diseases (an example of which was seen during the FAW outbreaks in Africa). This worldwide survey, benefiting from the long-term partnerships of CGIAR Germplasm and Seed Health Units, could be seen as the foundation block of an urgently needed global plant health diagnostics and surveillance network to counter the growing risks of future plant disease and pest outbreaks.

“To prevent emerging pest incursion, it is important to increase the collaboration between plant protection agencies and countries involved to build a harmonized phytosanitary system. One crucial step is to improve the technical skills and knowledge of staff engaged in pest detection and surveillance work. The One CGIAR Plant Health Initiative is helping us to achieve this.”

Dr Kazeem Shakiru Adewale, Assistant Comptroller of Quarantine/Plant Pathologist, Nigeria Agricultural Quarantine Service (NAQS), Ibadan, Nigeria.

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1 *Carvajal-Yepes M, Cuervo M, Kreuze J, Alakonya A, Kumar L, Onaga G, Dawit W, Castillon M, Kumari S, Sharma R, Kawarazuka N, Bui T (2022) Report of the global online survey to identify key knowledge and capacity gaps on diagnostics and surveillance of pests & diseases in targeted countries,* https://hdl.handle.net/10568/128097

2 *Prasanna BM, Carvajal Yepes M, Kumar L, Kawarazuka N, Liu Y, Mulema AA, McCutcheon S, Ibabao X (2022) Sustainable management of transboundary pests requires holistic and inclusive solutions. Food Security 14: 1449–1457.* https://cgspace.cgiar.org/handle/10568/120011?show=full

LINKS TO IMPACT AREAS

Primary Impact Area:

Other relevant Impact Area(s):

Which collective global targets for the relevant Impact Area(s) from the CGIAR 2030 Research and Innovation Strategy does the key result contribute to?

- End hunger for all and enable affordable healthy diets for the 3 billion people who do not currently have access to safe and nutritious food.

LINK TO CGIAR RESEARCH PROGRAMS

Yes. CGIAR Germplasm Health Unit (GHU) network was developed as part of the Genebank Platform; this has also received funding from the Agrifood Systems-CGIAR Research Programs (AFS-CRPs) on roots, tubers, and bananas (RTB), maize, wheat, rice, and grain legumes and dryland cereals (GLDC).

We would like to thank all funders who supported this research through their contributions to the CGIAR Trust Fund.

GEOGRAPHIC SCOPE

Region: Africa, Asia, Central and West Asia and North Africa, Latin America and the Caribbean
Country: 26 countries contributed to the survey — 12 from Africa (Côte d'Ivoire, Ethiopia, Ghana, Kenya, Lesotho, Mauritania, Mozambique, Namibia, Nigeria, Uganda, Zambia, Zimbabwe); 7 from Latin America and the Caribbean (Argentina, Bolivia, Colombia, Ecuador, Guatemala, Mexico, Peru); 5 from Asia (Cambodia, India, Philippines, Sri Lanka, Viet Nam); and 2 from Central and West Asia and North Africa (Lebanon, Tunisia). Of these 26 countries, Ethiopia, Kenya, Lebanon, Mexico, Nigeria, Peru, the Philippines, Tanzania, Uganda and Viet Nam, are the focus countries for 2022–2024.

KEY CONTRIBUTORS

Contributing Centers
Primary: Alliance of Bioversity International and CIAT (ABC) – CIAT (Centro Internacional de Agricultura Tropical) Regional Hub
Contributing Centers: AfricaRice – Africa Rice Center; CIMMYT – Centro Internacional de Mejoramiento de Maíz y Trigo / International Maize and Wheat Improvement Center; CIP – Centro Internacional de la Papa / International Potato Center; ICARDA – International Center for Agricultural Research in the Dry Areas; ICRISAT – International Crops Research Institute for the Semi-Arid Tropics; IITA – International Institute of Tropical Agriculture; ILRI – International Livestock Research Institute; IRRI – International Rice Research Institute.
Contributing external partner(s)
35 institutions, including National Plant Protection Organizations (NPPOs), in 26 countries in the Global South; of the overall respondents, 35% were female, and 65% male.

COVER PHOTO: Kenyan potato farmers learning how to use handheld visual decision tool to halve their use of fungicide sprays against late blight disease (Njabini Agriculture Training Center, Central Kenya, July 2022). Photo credit: Shadrak Nyawade, CGIAR-CIP

Annex 1 Additional key result stories from PHI in 2022

NOTE: In addition to the Key result story reported above on "CGIAR-led Plant Health International Network has mapped the priorities for pest and disease detection and response efforts in the Global South", PHI has several additional key result stories emanating from the work done with partners globally in 2022 under different Work Packages (Work Packages 1–5); 14 of these can be accessed through the **hyperlinks** below.

PHI RESULT CODE IN THE CGIAR RESULTS DASHBOARD	PHI WORK PACKAGE (WP)	KEY RESULT STORY
3035	WP1	Portable sequencing technology for rapid identification of plant pathogens and pests
3038	WP1	Tracking the evolution of emerging cassava viruses using the Nextstrain tool
3693	WP1	PathoTracer, a tool for monitoring bacterial leaf blight (BLB) disease of rice in Asia
4065	WP1	Tracing the origins of rice blast disease in sub-Saharan Africa (SSA) to guide rice health management strategies across borders
3341	WP2	Equipping lentil and chickpea farmers in North Shoa zone in Ethiopia with effective virus identification and management capacity
2245	WP2	Plant Health Initiative (PHI) emergency action to contain the banana bunchy top virus (BBTV) spread in East Africa
3314	WP2	From Latin America to Africa and South Asia, thousands of farmers and extension personnel use an AI plant health management tool to act against invasive banana diseases
3186	WP3	Plant Health Initiative builds the momentum for banana bunchy top disease (BBTD) awareness creation and management in Uganda and Rwanda
2975 & 3174	WP3	Peruvian and Vietnamese banana stakeholders are better equipped to fight against banana *Fusarium* wilt Tropical Race 4 (TR4)
3867	WP3	Fall armyworm Innovation Platform for validating IPM packages through participatory engagement of researchers, extension personnel, and farming communities in Kenya
4273	WP3	Potato farmers in Kenya and Honduras use a visual decision tool for potato late blight management to boost their incomes while protecting their health and environment
2768	WP3	Manage parasitic weeds and revitalize Faba bean in Ethiopia's cropping system
3435	WP4	The Food Convergence Innovation (FCI) Stakeholder Convention in Nigeria enables a sustainable approach to aflatoxin management in Nigeria
3011	WP5	Toward achieving equitable impacts at scale: Plant Health Regional Gender Research Network in the ASEAN