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CGIAR Plant Health Initiative

CGIAR Plant Health Initiative: Summary of 2022 Results

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OneCGIAR Plant Health Initiative (PHI)

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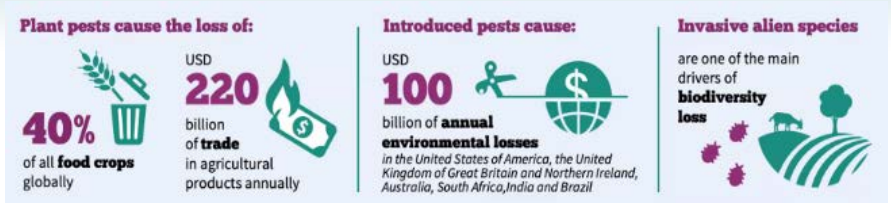
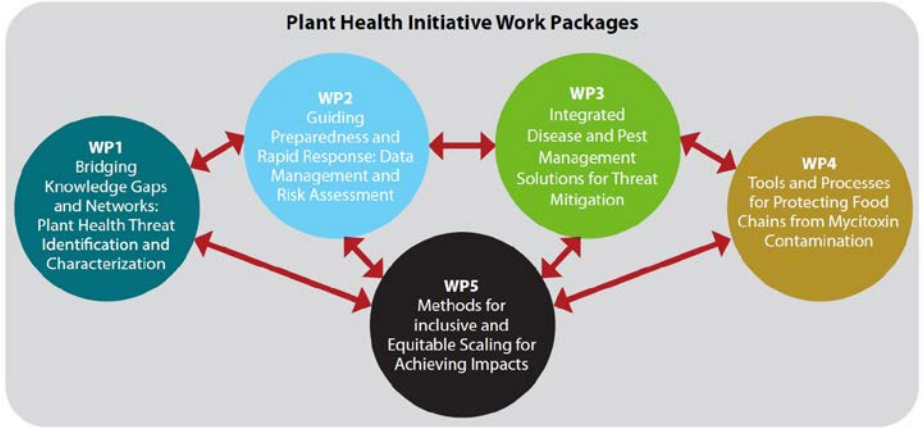


Healthy crops are indeed vital for a healthy planet!

The **CGIAR Plant Health Initiative** aims to protect key crops from pest incursions and disease outbreaks, reducing crop losses from pests and diseases using eco-friendly approaches, mitigating mycotoxin contamination, and helping target countries realize their potential in the agricultural sector and boosting the livelihoods of millions of smallholder farmers.



Prioritized Crop Pests/Diseases: Rice (African Rice Gall Midge, Stem borers, Brown Plant Hoppers, Bacterial Blight, Mycotoxins); Wheat (Rust, Blast, Fusarium head blight); Maize (MLN; Fall Armyworm; *Striga*), Banana (Bunchy Top, Fusarium Wilt, Xanthomonas Wilt), Potato (Late blight, Purple Top, Psyllid), Sweet Potato (Whitefly); Cassava (Whitefly, Brown Streak); Yam (Mosaic Virus); Food legumes (Pod borers, Parasitic weeds); Vegetables (Tomato leaf miner, Fruit worm, Aphids, Thrips & Fruit flies).

Focus Countries (2022-2024)

Ethiopia, Kenya, Uganda, Tanzania, Nigeria, Lebanon, the Philippines, Vietnam, Mexico, Peru **+ several Tier 2 and spillover countries in Africa, Asia, and Latin America.**

Partnerships

- **12** CGIAR centers
- **3** IARCs (*icipe*, CABI & WorldVeg)
- **86** non-CG partners, including NARES, NPPOs, and Innovation Partners, received sub-grants in 2022.

PHI Inception Meeting in Nairobi (May 12-13, 2022)

PHI Results in 2022: A Snapshot

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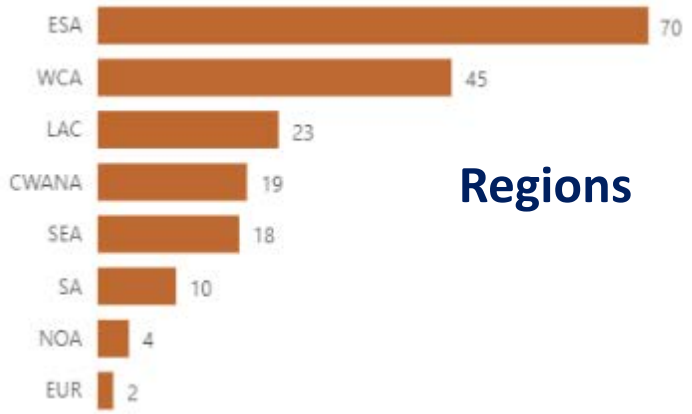
251 Results	6 SDGs	41 Capacity sharing for development	34 Innovation development	82 Knowledge products	85 Other outputs	9 Innovation use

Countries

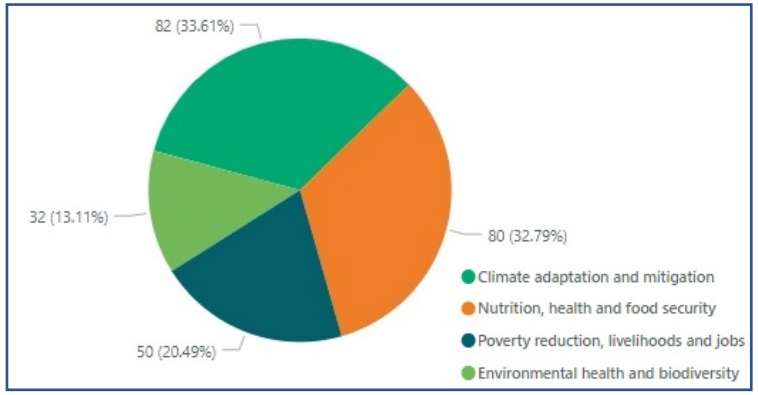
Regions



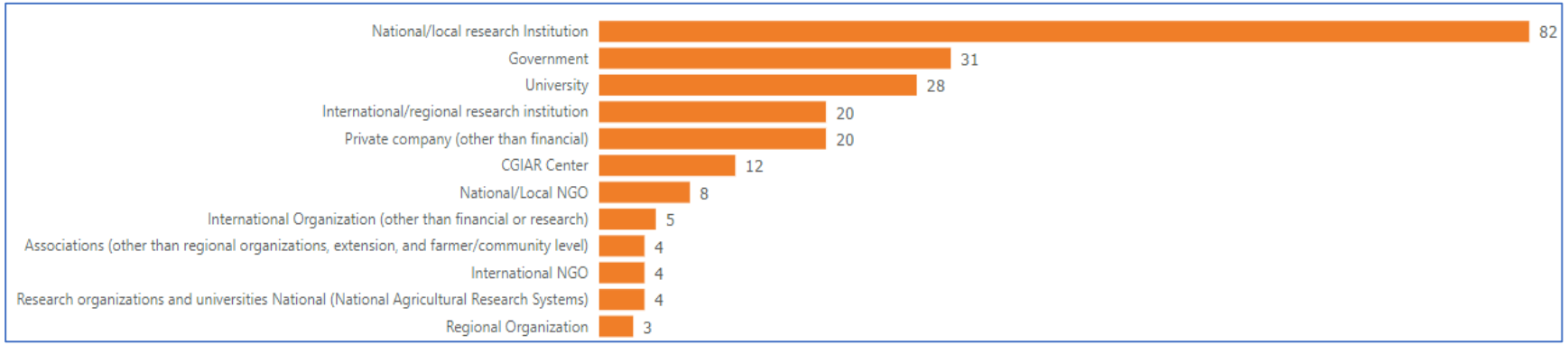
Key Result Stories

Type	No.	Center(s)	Target Geographies
Innovation development	9	ABC, CIP, CIMMYT, ICARDA, IRRI	Global, Asia, Ethiopia, Kenya, Honduras, Peru
Capacity sharing for development	3	ABC	Vietnam, Peru, Uganda
Knowledge Products	3	ABC, CIMMYT	Global
Innovation in use	1	IITA	Nigeria
Other Outputs	4	AfricaRice, ABC, CIMMYT, IITA	Global, Africa

Impact Areas



Partners



WP1: Bridging Knowledge Gaps and Networks: Plant Health Threat Identification and Characterization

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WP1-ToC Outputs

WP1-OP1
Key knowledge and capacity gaps on lab/field detection/characterization of P&D in targeted priority countries identified
5 Results

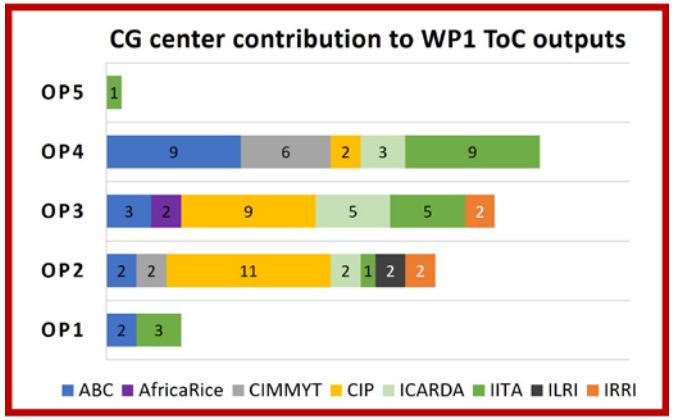
WP1-OP2
Regional diagnostic hubs and surveillance networks established
22 Results

WP1-OP3
Toolbox of validated/novel molecular, image-based (AI) detection tools for characterization, monitoring, and surveillance of targeted P&Ds.
25 Results

WP1-OP4
Surveillance reports and data provided to decision makers, and to WP2 for repositories and risk assessment analysis.
28 Results

WP1-OP5
Harmonized tools and protocols for mycotoxin diagnostics and monitoring, guiding WP4 activities
1 Result

EoI OC1: NPPOs in in LMICs participating in a Global and surveillance diagnostic network dynamically exchange knowledge on plant health threats and define coordinated response plans



PHI Global Diagnostic and Surveillance Networks

WP1: Key Achievements in 2022

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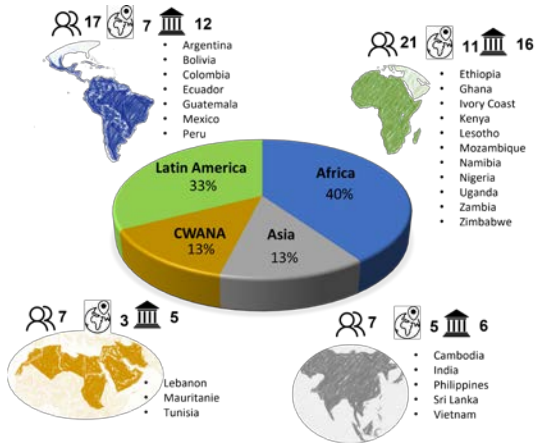
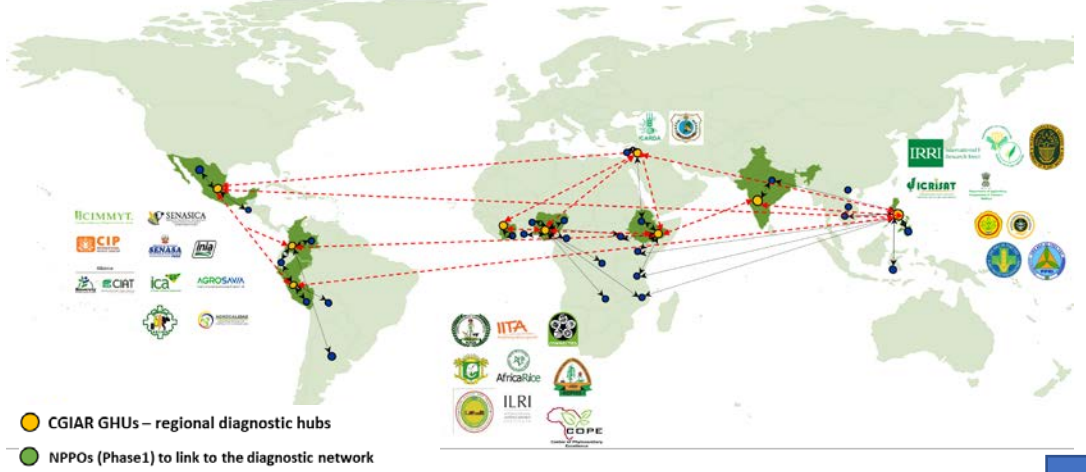
Global Online Survey and **Report on Diagnostics and Surveillance Needs**

Responses:
- ✓ 26 countries
- ✓ 39 institutions
- ✓ 52 people



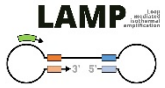
Identified and reported **key knowledge and capacity gaps** on diagnostics and surveillance of P&D in the **global south** to define a regional context-based capacity strengthening plan

Facilitated more than **11 training workshops and capacity sharing events** for strengthening NPPOs and NAREs in Africa, Asia and LAC.



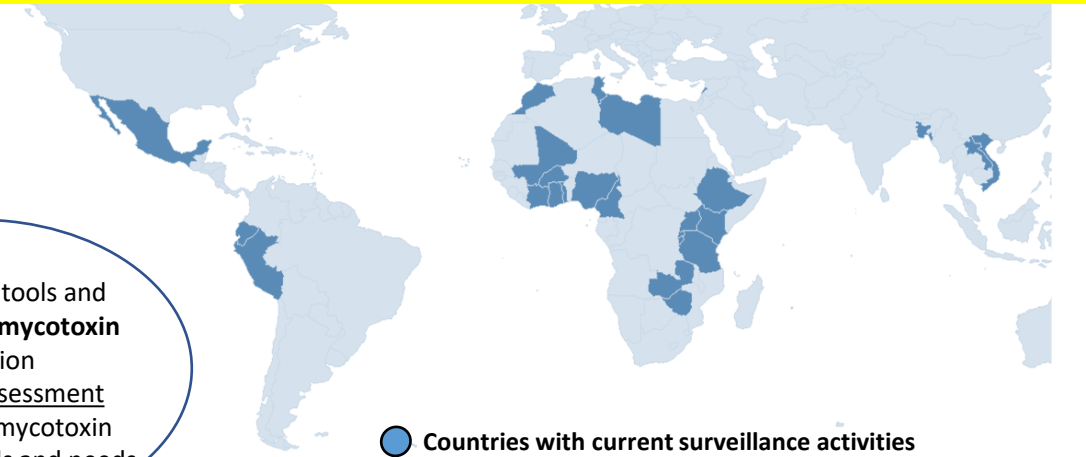
Validated/developed 6 **image-based** (AI) & 13 **molecular detection** tools for characterization, monitoring and surveillance **(Toolbox)**

Some examples:



- ✓ Estimate Potato late blight severity (Loayza H., CIP)
- ✓ Assess the health status of banana field (Selvaraj M., ABC)
- ✓ Early detection of CBSD in cassava (Peng, et al. 2022, IITA)
- ✓ LAMP for field detection of Potato virus (CIP)
- ✓ Draft Genome Sequence of Fusarium oxysporum TR4 from Peru, (ABC)
- ✓ RT-PCR assay for detection & characterization of seed-borne virus in legumes (ICARDA)
- ✓ **Extended portfolio** of protocols and methods for ~290 P&D (CGIAR, GHU/SGU)
- ✓ Advances in integrated approaches detection and guiding decision-making
- ✓ Farmer-Interface-Application (FIA) field scouting tool (IITA)

Supported surveillance activities of **14** different **P&Ds** in **26 countries** that threaten **6 major crops**



Harmonized tools and **protocols for mycotoxin** detection
- Baseline assessment
Inventory of mycotoxin diagnostics tools and needs

WP2: Risk Assessment, Data management and Guiding Preparedness for Rapid Response

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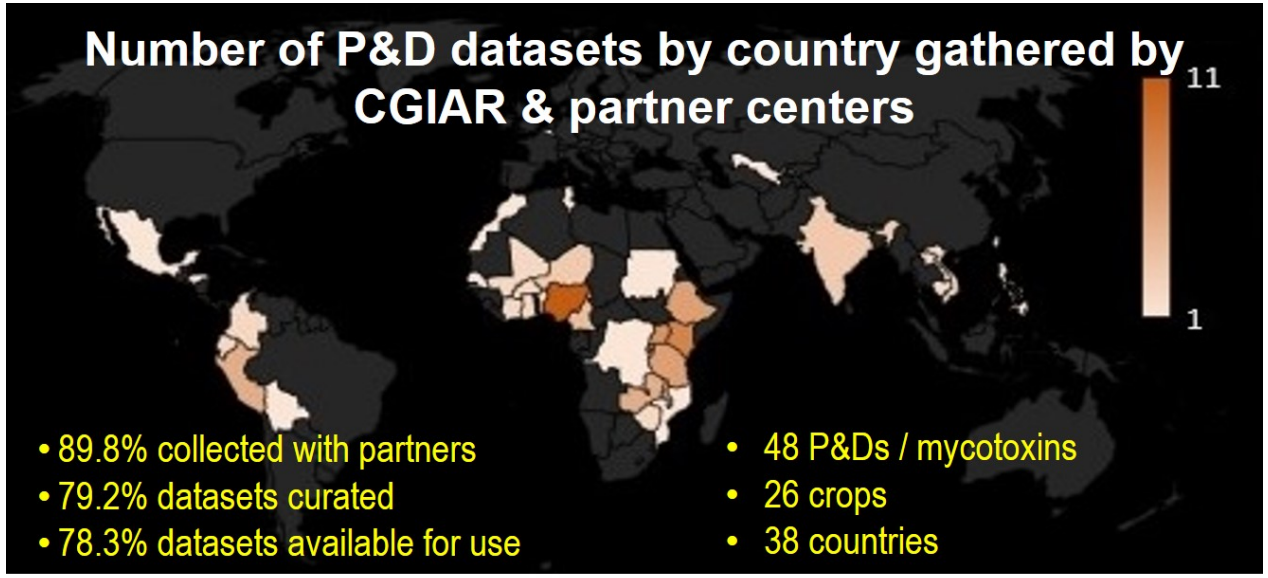
WP2-ToC Outputs

WP2-01	WP2-02	WP2-03	WP2-04	EOI OC2: At least 25 national partners in 10 targeted LMICS use the diagnostics and surveillance tools to effectively counter P&D	WP2-05	WP2-06	WP2-07	WP2-08	WP2-09	WP2-10	EOI OC3:
Baseline report on existing P&D datasets and tools available within CGIAR and partners	SWOT report with augmentation plans to integrate P&D data and improved data management systems	Standard procedures for equitable access and use of P&D data for risk assessment and modelling	Improved PH data management system with data harnessing tools		Models for predicting P&D risks and shifts due to climate change and other factors	Knowledge on P&D shifts & virulence variation with strategies for augmenting IDPM & breeding	Knowledge on biosecurity risks to seed delivery pathways and integrated seed health protection strategies	Strategies for sampling for mycotoxin testing prioritization for IMM interventions	Pest risk assessment and preparedness plans for at least 10 prioritized P&D cases	Communication, and capacity development strategies and policy briefs with actionable recommendations	At least 10 NPPOs in LMICs increase their capacity to utilize epidemiological modelling, decision support tools, PRA and preparedness to counter P&D threats



Partners: ABC, AfricaRice, CIMMYT, CIP, ICARDA, IITA, ILRI, IRRI, icipe & WorldVeg

Plant health risk assessment, modeling and preparedness plans targeting 11 P&D in 23 countries

Bunchy top: East and West Africa [Banana]
Cassava mosaic: Southeast Asia [Cassava]
Chickpea chlorotic stunt: East Africa [Chickpea & Lentil]
Fall armyworm: SSA [Maize and other crops]
Post-flowering stalk rot : South Asia [Maize]
Fusarium wilt TR4: Southern Africa [Banana]
Maize lethal necrosis: East Africa [Maize]
Potato Purple top: LAC [Potato]
Southern rice black-streaked dwarf virus: South Asia [Rice]
Wheat blast: South Asia and Southern Africa [Wheat]
Wheat stem rust: North & East Africa [Wheat]

WP2: Some Key Results (2022) & Upcoming Activities (2023)

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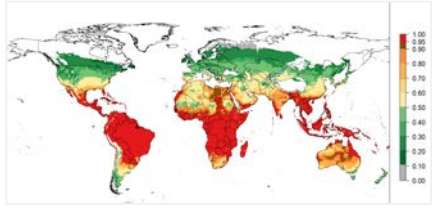
2022 Highlights

Gathering **knowledge on P&D shifts and virulence variation with strategies for augmenting IPDM and resistance breeding:** Maize (post-flowering stalk rots) and wheat (stem rust) by **CIMMYT**; Rice (rice yellow mosaic virus) by **AfricaRice**; Southern rice black steak virus by **IRRI**; Banana (black streak) and Yam (mosaic virus) by **IITA**; Chickpea stunt viruses by **ICARDA**; Purple top disease by **CIP**; and Cassava Mosaic Virus by **ABC**.

Developing **models for predicting P&D risks and shifts due to climate change and other factors** concerning Fall Armyworm (by **IITA/CIMMYT/icipe**); Remote sensing data-based models for predicting wheat blast and rust (by **CIMMYT**); and Banana Bunchy Top (by **IITA & ABC**).

Organizing **specific P&D risk assessment and preparedness** for controlling the emerging Banana Bunchy Top Disease in East Africa, Southern rice black streak disease in Southeast Asia; Cassava mosaic in East Asia; and Potato Purple Top in Latin America **(IITA, ABC, IRRI CIP)**



Developing **phenology models to assess the shifts in environmental suitability** for P&D establishment, including for *Bemisica tabaci, Bactericera cockerelli, Cotesia icipe, Chelonus bifoveolatus, Charops diversipes, Tuta absoluta* etc. **(CIP, icipe, IITA, WorldVeg)**

Developing and disseminating tools for monitoring P&D shifts, including use of Nextstrain platform for Cassava Mosaic (**CIP**); Tumani AI platform for Banana diseases (**ABC**); Amplicon sequencing *Phytophthora infestans* (**CIP**), LAMP/RPA tools for Banana and Potato viruses, sRSA method for Sweet potato, Yam and Cassava **(ABC, CIP & IITA).**

Upcoming Scale-up Activities in 2023

- Extend the pest and disease data management survey widely among partners and finalize P&D data management strategy for PHI.
- Review P&D risk assessment modelling studies for targeting priority emerging risks
- Develop policy briefs with recommendations for at least four priority P&Ds in LMICs

WP3: Integrated Pest and Disease Management

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WP3-ToC Outputs

WP3-OP1 Critical R4D gaps in developing effective, equitable and scalable IPDM packages identified

WP3-OP2 Eco-friendly and climate-smart IPDM innovations developed and evaluated

WP3-OP3 Training on IPDM R4D provided to national partners, especially young scientists, in 20 LMICs

WP3-OP4 Inclusive and affordable IPDM packages validated through Innovation Platforms

EoI OC4: A "Global Plant Health Consortium" comprising 60-70 institutions is operational, codeveloping and deploying IPDM innovation packages

WP3-OP5 Decision support tools developed for scaling gender-equitable & inclusive innovations

WP3-OP6 Drivers and bottlenecks for adoption of IPDM factored into IPDM scaling strategies

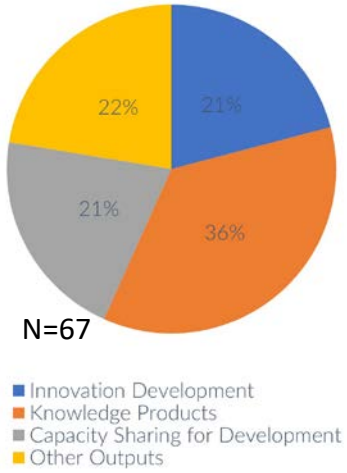
WP3-OP7 IPDM knowledge and skills of farming communities improved through formal and informal training workshops

WP3-OP8 Public-private-producer partnerships established/strengthened for effectively scaling IPDM innovations

WP3-OP9 IPDM-based policy briefs developed and disseminated in target LMICs

EoI OC5: Adoption of eco-friendly and climate-smart IPDM innovations by at least 4 million smallholders in 15 LMICs results in reduction in crop losses (by at least 5%) and use of toxic pesticides (by at least 10%).

Output Type



Partners: ABC, AfricaRice, CIMMYT, CIP, ICARDA, IITA, IRRI; CABI, icipe, WorldVeg, NARES in Ethiopia, Kenya, Uganda, ……..

Innovation development	Crops(s)	Targeted Pest/Disease
Pheromone	Cowpea	Pod borer & Sucking bug
Biological control	Rice	AfRGM
Biopesticides	Maize; Rice; Food legumes	FAW; AfRGM & Stem borers; Aphids & Pod borers
Ecological management	Rice	Multiple
IPM Innovation Platform	Maize	FAW
IPM	Wheat; Maize; Cassava; Faba bean	Wheat blast; MLN; Whitefly; Parasitic weeds & Gall disease
Decision support tools	Potato; Maize; Cowpea	Late blight; FAW; Cowpea pod borer & Sucking bugs

WP3: Some Key Results (2022) & Upcoming Activities (2023)

Plant Health Initiative

Fall Armyworm Innovation Platform for validating IPM packages through participatory engagement of researchers, extension personnel & farmers in Kenya

A set of 18 FAW IPM combinations (including host plant resistance, biological control, biopesticides, Push-Pull, and synthetic pesticides) evaluated by over 100 farmers and extension personnel (from 5 Counties in Kenya), and best IPM packages identified based on efficacy and cost-effectiveness. **[CIMMYT, KALRO, *icipe*, CABI]**

Upcoming: Intensifying partnerships on IPDM co-creation and validation at other eight Innovation Platforms against targeted pests and diseases.

Fungicide sprays are reduced by up to 50% when farmers use a decision support tool for potato late blight management in Kenya and Honduras

The hand-held decision support tool is simple and efficient. This can help resource-poor farmers improve management of potato late blight globally. **[CIP, KALRO, IICA]**

Upcoming: The estimated number of farmers using the tool is ~1000, but the target is to reach at least 100,000 farmers by 2030.

WP3-OP7: Banana Bunchy Top Disease (BBTD) Management in Uganda and Rwanda


Under PHI, **ABC** and **IITA**, have partnered with **RAB-Rwanda**, **NARO-Uganda**, **Ministry of Agriculture Animal Industry and Fisheries-Uganda**, and **TARI-Tanzania** in 2022 to create momentum in field surveillance and mapping of BBTD spread, awareness creation on disease symptom recognition and integrated measures to protect key banana production regions.

Upcoming: Scaling innovations to effectively manage BBTD and Fusarium Wilt TR4.

Parasitic weed management to bring back Faba Bean in the cropping systems of Ethiopia


Scaling of integrated management practices against parasitic weeds on Faba bean by awareness creation and capacity building of farmers and key stakeholders in 5 Districts in the Amhara region of Ethiopia. **[ICARDA, EIAR]**

Upcoming: Validation and scaling of integrated parasitic weed management in food legumes (against *Orobanche* sp.), and maize (against *Striga* sp.)

WP4: Tools and processes for protecting food chains from mycotoxin contamination

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WP4-ToC Outputs

WP4-OP1
Improved bioprotectant usage/dosage, formulations and recommendations developed

WP4-OP2
Six bioprotectants registered, and at least 4 partners licensed for aflatoxin bioprotectant scaleup

WP4-OP3
400,000 ha treated with aflatoxin bioprotectants in at least 5 LMICs and over 200,000 farmers have access to aflatoxin-conscious markets

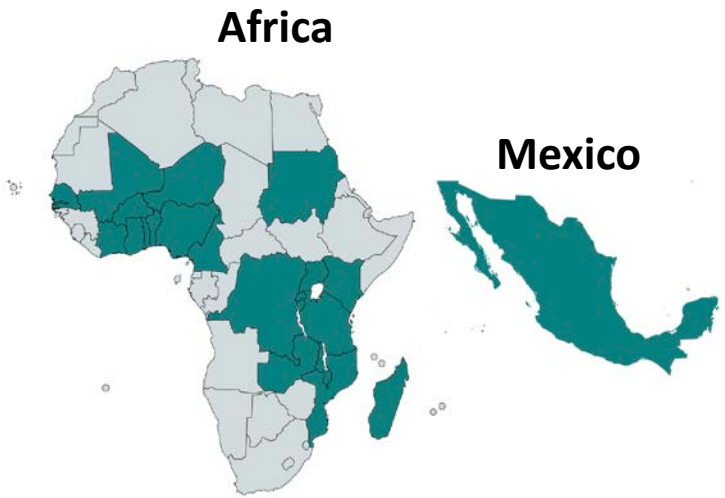
EoI OC6. At least 10 private sector partners in four focal countries in Africa commercialize Aflasafe to ~200,000 farmers

WP4-OP4
Mycotoxins-crop-countries & cost-effective IMM components selected based on evidence

WP4-OP5
Pre- and post-harvest technologies converged with policy, institutional & traceability innovations

WP4-OP6
20 extension agencies and private sector in crop value chains using IMM to reach at least 300,000 farmers

EoI OC7. At least 300,000 smallholder households across five LMICs (Nigeria, Ghana, Burkina Faso, Kenya, Mexico) use affordable & easy-to-use pre- and post-harvest IMM innovations



WP4 Outputs

- **Innovation Use: 9**
- **Capacity Sharing: 11**
- **Knowledge Products: 8**
- **Other Outputs: 12**

Partners: IITA, CIMMYT, AfricaRice + several demand, innovation, and scaling partners

55 professionals from public & private sectors, including development, educational & research organizations, participated in the **Food Convergence Innovation Stakeholder Convention** in Oct 2022 to discuss the sustainable management of aflatoxins in Nigeria. Organized by IITA, FAO, Harvestplus, GAIN & McGill Centre for the Convergence of Health and Economics.

WP4: Some Key Results (2022) & Upcoming Activities (2023)

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CIMMYT, KALRO, Jomo Kenyatta University & **Seed Savers Network-Kenya** conducted capacity building on Nixtamalization to partners in **Kenya** to mitigate mycotoxin contamination

Upcoming: Aflsafe registration in 2023

AfricaRice built capacity of 27 researchers from **NARS of 13 SSA countries** to manage mycotoxin contamination of rice at pre- and post-harvest stages

2022: Scale-up of Aflasafe Technology

- **IITA** renewed the non-exclusive distribution agreement with **SAPHYTO** in **Burkina Faso** for 3 years (2022-2024).
- Investors' Forum conducted in **Zambia** to identify potential Aflasafe manufacturers and/or distributors.
- With support from PHI and World Bank, a commercialization strategy for Aflasafe in **Burundi** was completed.

Upcoming Scale-up activities in 2023

- Distribution agreements to be renewed by **IITA** with private sector partners in Nigeria (**HarvestField Industries Ltd**), Senegal (**BAMTAARE SA**), and Kenya (**KALRO; Koppert Biologicals**).
- Commissioning of Aflasafe factories in **Mozambique**, **DR Congo**, and **Uganda**.

- Around **700 metric tons** of Aflasafe products manufactured in **Nigeria, Kenya, Senegal, and Tanzania**.
- **70,000 ha of aflatoxin-susceptible crops in 10 countries protected** from aflatoxin contamination, and smallholder farmers able to reach premium markets.

WP5: Equitable and inclusive scaling of plant health innovations to achieve impacts

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WP5-ToC Outputs

WP5-OP1 Gender-responsive needs assessment

WP5-OP2 Inclusive decision-support tools

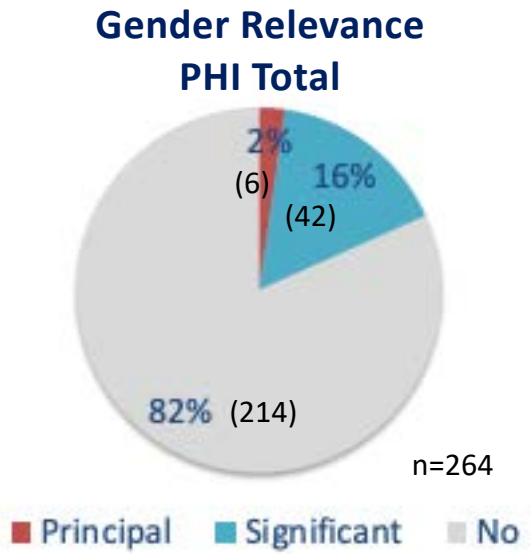
WP5-OP3 Inclusive diagnostic and surveillance

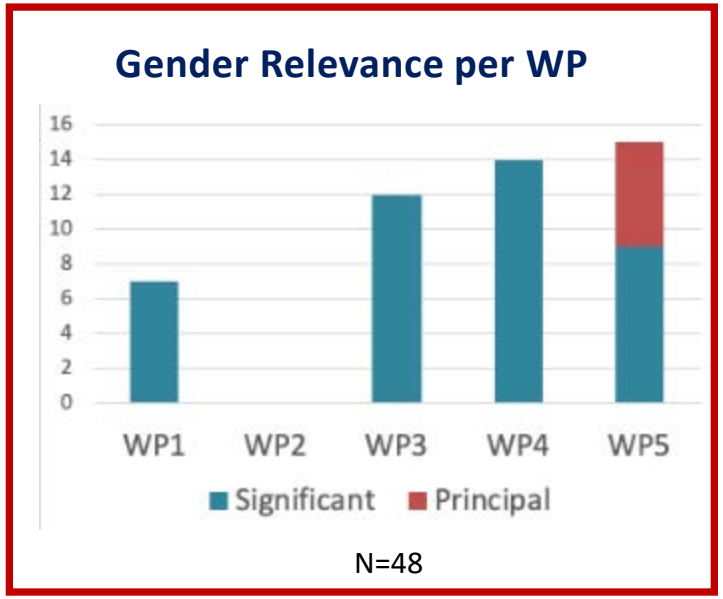
WP5-OP4 Equitable and cost-effective scaling approaches

WP5-OP5 Generating evidence for policy change

WP5-OP6 Improved communication through a digital platform

EoI Outcome: Equitable and inclusive scaling of plant health innovations to achieve impacts





Partners: ABC, CIP, CIMMYT, IFPRI, IITA,IRRI, icipe & WorldVeg

WP5: Some Key Results (2022) & Upcoming Activities (2023)

Plant Health Initiative

Gender and Plant Health Regional Research Networks
(WP5-OP1, OP2 & WP3)

Gender and Plant Health Network was established in Southeast Asia with 50 participants from 8 countries, 80% of them pathologists, entomologists and agronomists. (the link to blog)

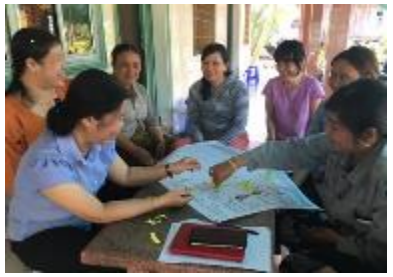
Upcoming: Conducting cross-county cross-crop gender research in SEA, and establishing networks in SA, SSA and LAC in 2023 and 2024.

Gender-responsive Needs Assessment for Scaling PHI Innovations
(WP5-OP1, OP2 & WP3)

- **Late blight (Peru):** The Decision-Support Tool (DST) is complicated to use for women. Alternative dissemination channels and training to women will be developed in 2023.
- **FAW & MLN (Kenya):** Men have more access to extension service. Men invest in pesticides and resistant seed while women tend to choose measures using their own labor rather than financial investment
- **Ecological Engineering (Cambodia)**: Data was collected in 2022 with gender-responsive methods and will be analyzed soon.
- **Banana Fusarium Wilt (East Africa):** Data was collected and will be analyzed soon.

Inclusive Diagnostic and Surveillance by Involving Farming Communities (WP5-OP3; WP1 & WP2)

- **FAW in Kenya**: Women can better recognize symptoms on FAW, but they tend to over-estimate their knowledge
- **Rice diseases in Vietnam**: Both men and women have capacity to monitor major diseases, but women have deeper knowledge. Farmers depend on their self assessment to diagnose, have less interest in using AI-based digital app
- **Institutional Gender and Diversity Assessment**: Online survey with WP1: Women and early carrier scientists should be prioritized for training and information sharing



Upcoming: Pilot interventions for identification and diagnostics of pests and diseases by farmers in Vietnam (Vegetables, Banana), Kenya (Cassava, Maize & Potato).

Impact Evaluation Pre-analysis Design Towards Equitable Scaling
(WP5-OP4, OP5, WP3 & WP4)

Four Randomized Controlled Trials (RCTs) pre-analysis design developed. All of these include at least one research question related to gender.

- Adoption of FAW push and pull technology + hybrid seed + extension worker incentives in Uganda (Baseline in 2023)
- Adoption of digital app + online extension for vegetables in Vietnam (Intervention in 2023)
- Adoption of digital app and in-person extension for maize, cassava and potato in Kenya (Pilot study in 2023)
- Adoption of Aflasafe and health intervention in Nigeria (Intervention in 2023)

PHI's Synergies with Other Initiatives in 2022

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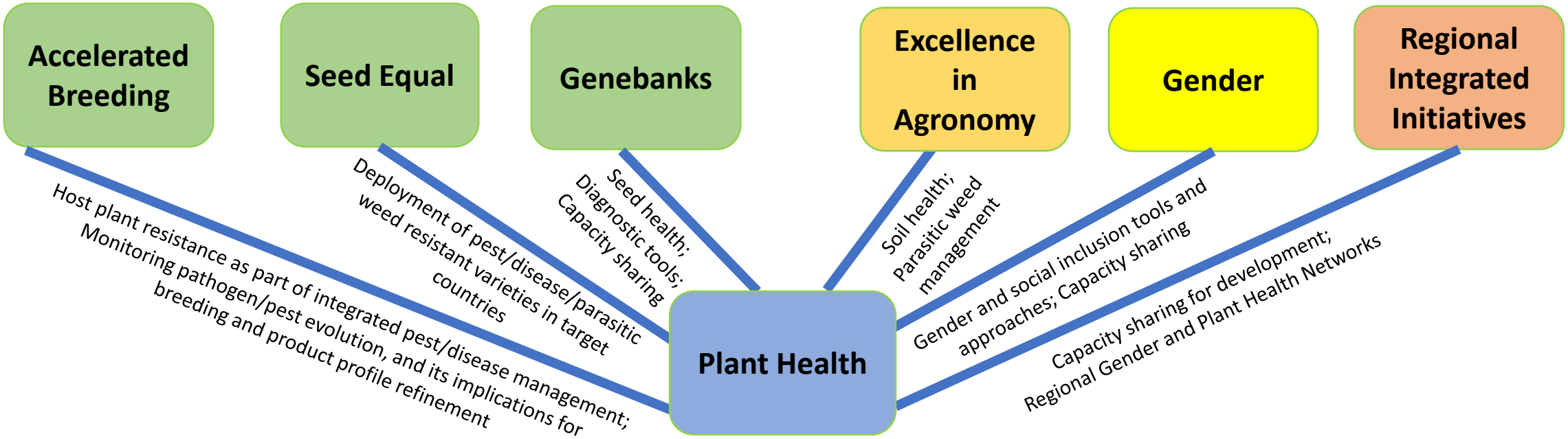

In addition, in 2022, PHI has also established strong interface with **USAID CETC-Innovation Lab**, **Euphresco**, **CABI's Global Burden on Crop Loss**, **FAO's Plant Health efforts**.

In 2023:

- Continued collaboration with **ABI, Seed Equal, Genebanks, Excellence-in-Agronomy, and Gender**.
- **RIIs:** Expand the collaboration beyond SE Asia and CWANA.
- **OneHealth:** WP4 (Integrated Mycotoxin Management) linkages with animal and human health.
- **Rethinking Markets:** Scaling Aflasafe in target geographies/regions.
- **Digital Initiative:** Digital tools/approaches for scaling plant health innovations.

A Few Major Challenges (2022) & Suggested Mitigation Measures

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S.N.	Challenge	Proposed Mitigation Measures
1	Budget reductions and POR changes in 2022	Need to have a more stable funding for the Initiative, for better planning and implementation.
2	Promotion of silver bullets as solutions for pest / disease / mycotoxin management	Intensifying communications on the effectiveness and sustainability of multi-pronged integrated management.
3	Gender and social inclusion as integral part of each work package	Good beginning made by PHI, but work still needs to be done, including focused workshops for greater interface.

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