Plant Health and Rapid Response to Protect Food Security and Livelihoods

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Proposal

September 28, 2021

Note to readers: please use the hyperlinks throughout the proposal for definitions, abbreviations, partners, references, etc.

Contents

Summary table 4
1. General information 4
2. Context 4
2.1 Challenge statement 4
2.2 Measurable 3-year (end-of-Initiative) outcomes 5
2.3 Learning from prior evaluations and impact assessments (IA) 6
2.4 Priority-setting 7
2.5 Comparative advantage 8
2.6 Participatory design process 9
2.7 Projection of benefits 10
3. Research plans and associated theories of change (TOC) 14
3.1 Full Initiative TOC 14
3.2 Work Package research plans and TOCs 15
4. Innovation Packages and Scaling Readiness Plan 52
5. Impact statements 53
5.1 Nutrition, health and food security 53
5.2 Poverty reduction, livelihoods and jobs 54
5.3 Gender equality, youth and social inclusion 55
5.4 Climate adaptation and mitigation 56
5.5 Environmental health and biodiversity 57
6. Monitoring, evaluation, learning and impact assessment (MELIA) 59
6.1 Result framework 59
6.2 MELIA plan 71
6.3 Planned MELIA studies and activities 73
7. Management plan and risk assessment 74
7.1 Management plan 74
7.2 Summary management plan Gantt table 75
7.3 Risk assessment 77
8. Policy compliance, and oversight 78
8.1 Research governance 78

8.2 Open and FAIR Data Assets 78
9. Human resources 78
9.1 Initiative team 78
9.2 Gender, diversity and inclusion in the workplace 79
9.3 Capacity development 80
10. Financial resources 81
10.1 Budget 81

Summary table

Initiative name	Plant Health and Rapid Response to Protect Food Security and Livelihoods
Primary Action Area	Resilient Agrifood Systems
Geographic scope	Global, with particular focus on selected low- and middle- income countries in Africa, Asia and Latin America
Budget	US$ 40,000,000

1. General information

- **Initiative name**: Plant Health and Rapid Response to Protect Food Security and Livelihoods
- **Primary CGIAR Action Area:** Resilient Agrifood Systems (RAFS)
- **Proposal Lead and Deputy:**
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List of acronyms used in the document

2. Context

2.1 Challenge statement

Effective plant health management is critical for improving the productivity, profitablity, sustainability and resilience of agrifood systems and for realizing genetic gains from improved varieties. Yet, farming communities, especially in the low- and middle-income countries (LMICs), continue to struggle against an array of pest and disease incursions/outbreaks. Each year, crop pests and diseases cause 10–40% losses to major food crops[1], costing the global economy US$220 billion[2], severely impacting food/feed security, safety and nutrition[3], and thus hampering realization of several Sustainable Development Goals (SDGs)[4,5]. Recent analyses[1,6] have shown that the highest losses due to plant health threats are in the food-deficit regions with fast-growing populations. The impacts of plant pests and diseases (P&D) are not limited to yield losses; in reality, all components of food security (food production, access, and utilization) are severely affected[7]. Moreover, mycotoxin contamination above permissible limits in crop produce is significantly affecting food safety, nutrition, public health, and trade[8,9,10]. Chronic exposure to mycotoxins is associated with significant health burden, especially child growth impairment[11] to increased mortality rates[12]. Increased trade and travel coupled with weak phytosanitary systems that lack capacity to effectively monitor soil-, seed- and air-borne and insect-vectored diseases and pests have accelerated the global spread of invasive plant health threats[13]. The situation is exacerbated by the effects of a changing climate and farming systems, driving the emergence and scale of new threats[14,15]. Emerging plant health threats (e.g., Fall armyworm[16,17,18]; Foc TR4[19]) pose serious challenges in

protecting the food security and livelihoods of millions of smallholders. The burden of all this is disproportionately borne by women and poorly resourced communities. Women, being very active in the area of plant health management, have to be active partners in solving the issues.

The lack of robust diagnostic capacity, global-scale surveillance system, and data sharing for risk assessment of major pests/diseases, alongside weak early warning, rapid response and management systems, are major issues that need to be tackled to improve plant health at a global scale[20]. Over the past decades, there has been a significant weakening of national agricultural research and extension services (NARES) in several countries in handling crop health in an effective and sustainable way; for example, across tropical Asia, integrated pest management (IPM) on rice, once a resounding victory, has become forgotten in many countries. Integrated pest and disease management (IPDM) is knowledge-intensive, and requires significant efforts on capacity building to help farmers understand the principles and implement relevant practices[21]; without this, smallholders and marginalized communities will be unprepared or poorly equipped to respond to the biotic threats. Private sector can play a significant role in sustainable adoption of plant health innovations, yet their engagement is not optimal in many LMICs[22].

Environmental effects of excessive use and misuse of pesticides[23], such as loss of biodiversity of beneficial insects (natural enemies of pests, insect pollinators and organic recyclers)[24,25], and acute unintentional pesticide poisoning of humans[26] are of major concerns globally, but especially in developing countries with weak national policies. Ecofriendly and natural IPDM options that minimize the dependence on synthetic pesticides need to be better assessed and used at scale. Despite its scientifically sound principles, IPDM continues to have low adoption rates worldwide due to several critical gaps[27,28], including lack of access to affordable technologies/innovations, especially to women and disadvantaged groups, weak regulations and compliance, inadequate policy[29] and institutional support[30], suboptimal public-private partnerships[22], and underinvestment in validation, capacity development, promotion and scaling of plant health innovations.

2.2 Measurable 3-year (end-of-Initiative) outcomes

By 2024, the Initiative aims to achieve the following specific end-of-Initiative (EoI) outcomes:

1. National Plant Protection Organizations (NPPOs) in at least 10 targeted LMICs (four in Africa, three each in Asia and Latin America) participate in the “Global Plant Diagnostic and Surveillance Network” dynamically exchanging data and knowledge on existing/emerging P&D.
2. At least 25 national partners in 10 targeted LMICs use the novel diagnostic and surveillance tools to effectively counter existing/emerging plant health threats.
3. At least 10 target NPPOs (seven in Africa, two in Latin America, one in Asia) increase their capacity to utilize epidemiological modelling data and decision support tools for pest risk assessment, and preparedness to counter prioritized P&D threats and new invasions.
4. A “Global Plant Health Consortium” comprising 60–70 institutions (from the Global North and Global South) is operational, codeveloping and deploying IPDM Innovation Packages and educational curriculum for effective plant health management
5. 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%).
6. At least 10 private sector partners in four focal countries in Africa (Nigeria, Senegal, Kenya and Mozambique) commercialize Aflasafe to ~200,000 farmers (~400,000 ha of maize), resulting in enhanced availability of safe and nutritious food and feed.
7. At least 300,000 smallholder households across five LMICs (Nigeria, Ghana, Burkina Faso, Kenya, Mexico) use affordable and easy-to-use pre- and post-harvest integrated mycotoxin management (IMM) innovations for mitigating mycotoxin contamination of food chain.

8. 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.
9. National and regional partners utilize validated scaling approaches for P&D detection and surveillance, IPDM and IMM.
10. 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.

2.3 Learning from prior evaluations and impact assessments (IA)

The Initiative team has reviewed the recommendations and learnings related to plant health from the independent evaluations of relevant CGIAR Research Programs (CRPs) (RICE, WHEAT, MAIZE, RTB, GLDC, A4NH; https://cas.cgiar.org/evaluation/crp-2020-review) and their synthesis (https://cas.cgiar.org/_evaluation/publications/2021-Synthesis), besides several bilateral project reports (e.g., AgResults Aflasafe Nigeria project; USAID-MLN Management Project in East Africa; USAID-FAW Management Project, etc.), and impact assessment studies undertaken so far on IPDM and mycotoxin mitigation innovations (https://bit.ly/3kJVtSQ; https://bit.ly/3kKZt5N]. Based on these, we have identified some key learnings and research gaps on impact assessment of plant health innovations, as below:

1. Methodologically, most papers either relied on before-after comparison without a control group or on comparison between adopters and nonadopters based on a cross-sectional data. We propose to improve the impact assessment methods to identify causality effects.
2. Gender, social inclusion, and dynamic effects have been rarely studied in these studies literature and we propose to investigate heterogeneous effects by gender, class, ethnicity and other key social markers, as well as dynamic effects.
3. Most papers focused on crop productivity, pesticide reduction and crop income gains as key outcomes. We can take stock of the limited literature that used other outcomes (poverty, food insecurity, and intrahousehold labor allocation). We will also expand the outcome variables to measure the positive effects of IPDM on food safety, biodiversity of natural enemies of crop pests and diseases.
4. Almost all the studies have relied solely on survey data. we will also explore the data sources other than household surveys, such as remote sensing and crowdsourcing.
5. Qualitative impact assessment remains limited and often isolated from a standard impact assessment method. We will employ mixed methods to explain context-specific mechanisms of adoption, social- and gender-based constraints and incentives.

Review of the impact assessment literature on mycotoxin mitigation (WP4) has shown that subsidies and price premium can significantly increase uptake of Aflasafe, drying machines and post-harvest storage methods, and thus effectively reduce mycotoxin contamination in maize and groundnut. It will be useful to further investigate the sustainability aspects of this approach, and what could be other potential alternatives to effectively promote scaling of mycotoxin mitigation measures, such as Aflasafe, through the Initiative.

2.4 Priority-setting

Priority setting for various Work Packages in the Initiative was guided by demand partners' needs, including science-based risk assessment of invasion and spread of major P&D. The requirements of the demand partners include: a) strong capacity for P&D diagnostics and surveillance and forecasting; b) better understanding of factors contributing to the emergence of new/exotic P&D; c) developing and deploying inclusive, effective and scalable IPDM packages for threat mitigation; d) reducing mycotoxin contamination of food chains, and e) effectively reaching smallholders with cost-effective, environmentally safe, and scalable plant health innovations.

Prioritization of specific innovations under different Work Packages: Plant health experts from the CGIAR and selected non-CGIAR centers/organizations (e.g., FAO, CABI, icipe, WorldVeg, ARIs) are deeply engaged in the formulating the research questions (section 3.2.2) and identifying relevant fit-for-purpose solutions to address the needs of the stakeholders/demand partners in the target LMICs (sections 3.1 and 3.2). A template was created for preparing an inventory of innovations available with CGIAR and their partners to address the needs. CGIAR and selected Innovation Partners with strong plant health management programs across Africa, Asia and Latin America proposed a wide array of innovations, including various “Golden Eggs” from the CRPs, and outputs from previous and current efforts on plant health management.

The innovation proposals were categorized by target crop, P&D, geographic relevance, stage of development (development, pilot, or use), any IP restrictions for use, and appropriateness for further development/use as a standalone or as a component of an Innovation Package together with other relevant innovations for further development/piloting/scaling (see prioritization files for WP1–WP5). Rigorous prioritization of these innovations/Innovation Packages was then undertaken, based on several factors, including a) nature of the plant health threats addressed (established, persistent/sporadic, emerging); b) level of economic impact of the target P&D in CGIAR targeted regions; c) critical gaps to be addressed; and d) comparative advantage of One CGIAR and partners through the Initiative. Innovations/Innovation Packages that are ready for piloting or scaling were given priority, while proper balance also was attempted in including potentially impactful innovations under development. The Initiative team also received valuable inputs from representatives of three funding agencies (GIZ, USAID and BMGF) on the prioritized innovations and interface with other complementary Initiatives. The documents showing prioritized innovations in different Work Packages can be accessed here: **PHI Innovations Prioritization Process and Files (WP1 to WP5).**

Impact assessment: The Initiative team did online searches of impact assessment (IA) studies relevant to various innovations relevant to the Initiative, besides seeking focused information on impact assessment studies on plant health management work at the CGIAR and key partners. The team collected and reviewed 129 papers/reports (112 on IPDM, and 17 on mycotoxin management) in total (available at https://bit.ly/3kJVtSQ), and identified 27 most relevant ex-post impact assessment studies (18 on IPDM, and nine on mycotoxin management) [available at https://bit.ly/3kKZt5N]. Impact assessment approaches relevant for the Initiative were then discussed with the SPIA team through a virtual workshop and refined. The team then identified a set of innovations for qualitative and quantitative impact assessment, and causal impact evaluation.

Gender and social inclusion: The Initiative team has reviewed relevant literature on gender and plant health management and identified some key learnings and research gaps, for setting the priorities. These points are captured, along with supporting documentation in https://bit.ly/3AMm6wd.

Target geographies: While most of the the Initiative work has global relevance and the outputs are in high demand (with several years of prior work), the Initiative team prioritized specific target regions and countries for different components of the five Work Packages, as shown in this document: https://bit.ly/3lWXiv2. Prioritization of the target regions/countries was based on the extent of occurrence of a specific plant health threat for which innovations are already existing or under advanced stages of development/validation, strength of innovation and scaling partners, history/track record of plant health programs addressing that threat in that country, etc. CGIAR Germplasm Health Units (GHUs) expressed willingness to contribute as diagnostic hubs of the global surveillance network and linkages with NPPOs in target countries.

Interface with other One CGIAR IDTs: Complementary outputs from other Work Packages of the Initiative and those from other global and Regional Integrated Initiatives (RIIs) (e.g., ABI, SeEdQUAL, Genebanks, EiA, HER+, Digital Tools, RIIs from ESA, ECA, CWANA, LAC, etc.) were identified through discussions with respective teams and captured in brief documents, which can be accessed here: **Interface with different One CGIAR Initiative Teams**. This has enabled formulation of theory of change (TOC) diagrams, and description of causal linkages.

2.5 Comparative advantage

- One CGIAR and its innovation partners have a strong presence, responsibility and track record in coordinating R4D efforts on plant health management through international collaboration in LMICs, bringing out a unique advantage of developing, validating, leveraging, integrating, and deploying innovations for effectively tackling existing and emerging threats[e.g.,1,2,3]. Some of the innovation partners in this Initiative — CABI, *icipe* and WorldVeg — are part of the AIRCA[4], and have been leading several collaborative networks to address major plant health threats (e.g., CABI's Plantwise[5], Action on Invasives[6], Crop Protection Compendium[7]).
- One CGIAR is the global leader in management of several major plant health threats through its impactful R4D on pests, diseases, and weeds[8,9]. The collaborative networks/alliances/consortia coordinated by One CGIAR (e.g., the Alliance for banana bunchy top disease control in Africa[10]; MusaNet[11]; FAW R4D International Consortium[12]; MLN Phytosanitary Community of Practice[1]; myctotoxins[13]) make crucial contributions to characterization, diagnostics, monitoring[e.g.,14], surveillance[e.g.,15,16,17], epidemiology, participatory experimentation, integrated management of existing and emerging pests[e.g.,18] and diseases, knowledge/technology transfer, etc.
- One CGIAR and innovation partners have excellent expertise and a strong track-record in developing and deploying impactful innovations, including host plant resistance[e.g.,8,19,20,21], biological control[e.g.,22,23,24], biopesticides[e.g.,25,26], agro-ecological approaches[e.g.,27,28] etc. for sustainable plant health management.
- There is often a lack of economic incentive for private companies to invest in holistic plant health solutions or context-specific IPDM approaches, especially for low-value crops that are critical for food and nutritional security. Investment by One CGIAR through the Initiative is important to fill this critical gap.
- The network of One CGIAR GHUs[29] across the tropical LMICs provides phytosanitary services for major food crops (e.g., cassava, banana, maize, wheat, rice, potato, food and feed legumes, etc.), supports production of clean seed/planting materials, and strengthens technical expertise of local institutions, including National Plant Protection Organizations (NPPOs).
- One CGIAR holds strong teams of social and biophysical scientists, including crop protection teams; these teams have been instrumental in impact assessment of plant health innovations, participatory evaluation of control methods, and prioritization of interventions. This multidisciplinary interface is critical for addressing gender equity and social inclusion issues[e.g.,30] that are major bottlenecks in the LMICs.

2.6 Participatory design process

The Initiative proposal is demand-driven and has been formulated based on: (i) specific interests and priorities of global partners on plant health management, that have emerged over the last few years through various stakeholder consultations organized by CGIAR and partners (especially through CRPs and special projects) at the national, regional, and global levels; (ii) emergence of major biotic threats affecting agrifood systems in Africa, Asia and Latin America (as stated in Section 2.1). To define specific priorities for Phase 1 (2022–2024), the team undertook an intensive exercise as described in Section 2.4. Specific P&Ds, target geographies, and innovations at different stages of readiness were identified by the IDT (including the reference group), based on the work done in collaboration with various national and international partners over the years. The initial list of priorities, innovations and the strategic plan across the five specific Work Packages were validated through two major channels: (i) interactions with national/regional stakeholders organized by different RIIs over the last two months, for better alignment of the priorities with the national/regional needs/interests; and (ii) direct consultations/discussions with key demand, innovation and scaling partners (during August-Sept 2021) and seeking their views on the Initiative R4D strategy and potential for scaling innovations.

The Initiative has received an overwhelming support from diverse organizations including Ministries of Agriculture (e.g., Philippines, Mexico, Zambia), UN organizations (e.g., FAO-RNE), NARES (e.g., EIAR, KALRO-Kenya, NARO-Uganda, NAQS-Nigeria, NRCRI-Nigeria, NARC-Nepal, VAAS-Vietnam, INIA-Peru, etc.), IARCs (e.g., CABI, icipe, WorldVeg), regional bodies (e.g., APAARI, GrowAsia), regional plant protection organizations (e.g., RPPO-Latin America), multinational companies (e.g., Bayer, Corteva), SMEs (e.g., AMRU-Rice, AtoZ Textiles), Foundations (e.g., SFSA), Scientific societies (e.g., CONNECTED-UK, Arab Society of Plant Protection), etc. A summary document capturing the list of key partners providing the letters of support, and their major interests/priorities in the Initiative is available.

The support letters from partners clearly highlight the relevance of the Initiative to their institutional and country/regional strategies, including P&D diagnostics, surveillance, risk modelling, eco-friendly and climate-smart IPDM, mycotoxin management, capacity strengthening, etc. Partners also highlighted the importance of integrating gender-inclusive scaling methods to help accomplish the mission. Regional institutions (e.g., APAARI, GrowAsia, OIRSA-Latin America) and international agricultural research centers (IARCs) (e.g., CABI, icipe, WorldVeg, INRAE-France) expressed their keen interest to work together with the Initiative, jointly facilitating regional and global networking and scaling innovations to support technical capacity development programs and regional platforms for the benefit of stakeholders. Most of the stakeholders highlighted the need to increase and integrate capabilities, knowledge, assets, people, and global presence for interconnected and partnership-driven approaches. The private sector institutions (e.g., Bayer, Corteva), which are demand, innovation, and scaling partners, highlighted the importance of focusing on targeting innovations for using plat health data, risk assessment models, and evidence-based guidance frameworks for prioritizing biosecurity measures and rapid response to high-risk crop pests, including surveillance, sampling, field detection and deploying IPDM packages.

The Initiative team is cognizant of the need for continuing intensive consultation with stakeholders to understand their needs and to integrate to the extent possible in further design and implementation of the Initiative. Therefore, this process will continue even after proposal submission and during the inception phase. We will accordingly refine/fine-tune the plans based on national, regional and global needs, and understanding of the key knowledge and capacity gaps, to ensure that the Initiative is completely demand-driven.

2.7 Projection of benefits

The projections below transparently estimate reasonable orders of magnitude for impacts which could arise as a result of the impact pathways set out in the Initiative's theories of change. Initiatives contribute to these impact pathways, along with other partners and stakeholders.

For each Impact Area, projections consider breadth (numbers reached), depth (expected intensity of effect per unit) and probability (a qualitative judgement reflecting the overall degree of certainty or uncertainty that the impact pathway will lead to the projected order of magnitude of impact).

Projections will be updated during delivery to help inform iterative, evidence-driven, dynamic management by Initiatives as they maximize their potential contribution to impact. Projected benefits are not delivery targets, as impact lies beyond CGIAR's sphere of control or influence.

Adequate diagnostic capacity and surveillance systems are essential elements in preventing the establishment and/or spread of P&Ds. It enables countries to have better preparedness and rapid response when such incursions happen. Responding at the right stage, before the pest/disease causes significant negative impact, is critical to protect crops and ensure food security, human nutrition, biodiversity, and the livelihoods of the farmers and consumers. it is well known that without barriers for entry, invasive P&D can expand their range, colonize new territories, and cause considerable economic and environmental damage (1). With delay in discovery of invasive P&D, the likelihood of eradication decreases while the cost of control/management/eradication increases dramatically. In essence, the benefits from WP1 and WP2, including diagnostics, surveillance, risk assessment and preparedness, and capacity strengthening of the national partners, especially NPPOs, influence all the five CGIAR Impact Areas in a major way. However, it is a herculean task to realistically project the anticipated benefits of these actions, but it can in no way be discounted considering the enormous loss caused by invasive species and its threat to food and nutritional security.

Secondly, impacts of the Initiative are codependent on several complementary Initiatives. For example, Initiatives under Genetic Innovations, especially on Accelerated Breeding (ABI) and Seed Systems (SeEdQUAL), develop and deploy elite varieties with resistance to key crop P&D through breeding pipelines, while RAFS: Excellence in Agronomy (EiA) Initiative has a critical role to play in providing complementary agronomic innovations (e.g., cultural control of pest, management of parasitic and other weeds, soil-borne diseases and enhancement of crop resilience). In turn, the work done through Initiative team is complimentary for "protecting the genetic gains" and incorporate improved genetics and agronomy. Therefore, it must be recognized that impact pathways and projected benefits of the Initiative (especially under WP3 and WP4) have huge synergies with various Initiatives. Thus, the results across each of these areas (genebanks, breeding, seed systems, agronomy, plant health) influence each other significantly, and thus, the projected benefits. Conversely, absence or inadequacy in terms of performance of any one component will reduce the overall success.

The data sources, core assumptions, and approach towards estimation of the benefits of plant health innovations are described in https://bit.ly/3ieY0mo. The summary of the results of projected benefits exercise are captured in two worksheets (WP3 and WP4) in the file here: https://bit.ly/3zO2jex, while the folder with individual files project benefits estimations for different innovations is here: https://bit.ly/2XZOIUH.

Summary of the Initiative's project benefits (2022–2030)

Breadth	Depth	Probability
Impact Area: Nutrition, health and food security Impact Indicator: # of people benefiting from relevant CGIAR innovations		
Integrated mycotoxin management: Aflasafe as a bioprotectant in maize and groundnut to mitigate mycotoxin contamination Consumption of mycotoxin contaminated crops is linked to malnutrition, immunosuppression, stunting, liver cancer, among other maladies. For children exposed to mycotoxins, there are severe impacts on their growth, development, and immune system (Ismail et al. 2021). Effective intervention strategies are needed to reduce exposure and associated negative effects. Indeed, it has been demonstrated that aflatoxin and fumonisin management interventions in maize value chain can reduce mycotoxin exposure and stunting in children thereby improving child health. IMM strategies that are part of WP4 will contribute to improved health, economic, social, and development sectors, and this in turn can help fulfill several of the SDG targets (Ortega-Beltran and Bandyopadhyay 2021).	**Transformative** **Total beneficiaries:** >110 million poor people; >16 million HH; >6 million ha of maize and groundnut across 6 countries in SSA. **Estimated impact on the poor:** >46 million poor people; >6.7 million HHs	**High**
Impact Area: Poverty reduction, livelihoods and jobs **Impact Indicator:** # of poor people benefiting from relevant CGIAR innovations		
IPDM of major pests of vegetable crops and food legumes Vegetables and food legumes are key crops to ensure nutritional security for resource-poor farmers. Vegetable are high value crops, and their cultivation and trade enhance the income of smallholders and increases their access to food. Vegetable production leads to 3–14 times higher profits per hectare than in cereal farming, and vegetables provide more employment opportunities per hectare than cereals. Management of these vegetable pests is largely undertaken with chemical pesticides often to the detriment of the environment and the health of the grower and consumers. IPDM technologies for these pests have been developed (or continue to be developed); however, their availability and use by smallholders has been a challenge. The Initiative will, therefore, focus on building partnerships, addressing technological and institutional bottlenecks in the scaling of IPDM technologies for food and nutritional security, especially for women and children and resource-poor farmers.	**Significant** **Total beneficiaries:** >27 million people; >6 million HHs; >3 million ha across 13 target countries (2 in Asia; 11 in ESA) **Estimated impact on the poor:** >9 million poor people; >1.7 million HHs	**Medium**
Impact Area: Gender equality, youth and social inclusion Impact Indicator: # of women benefiting from relevant CGIAR innovations		

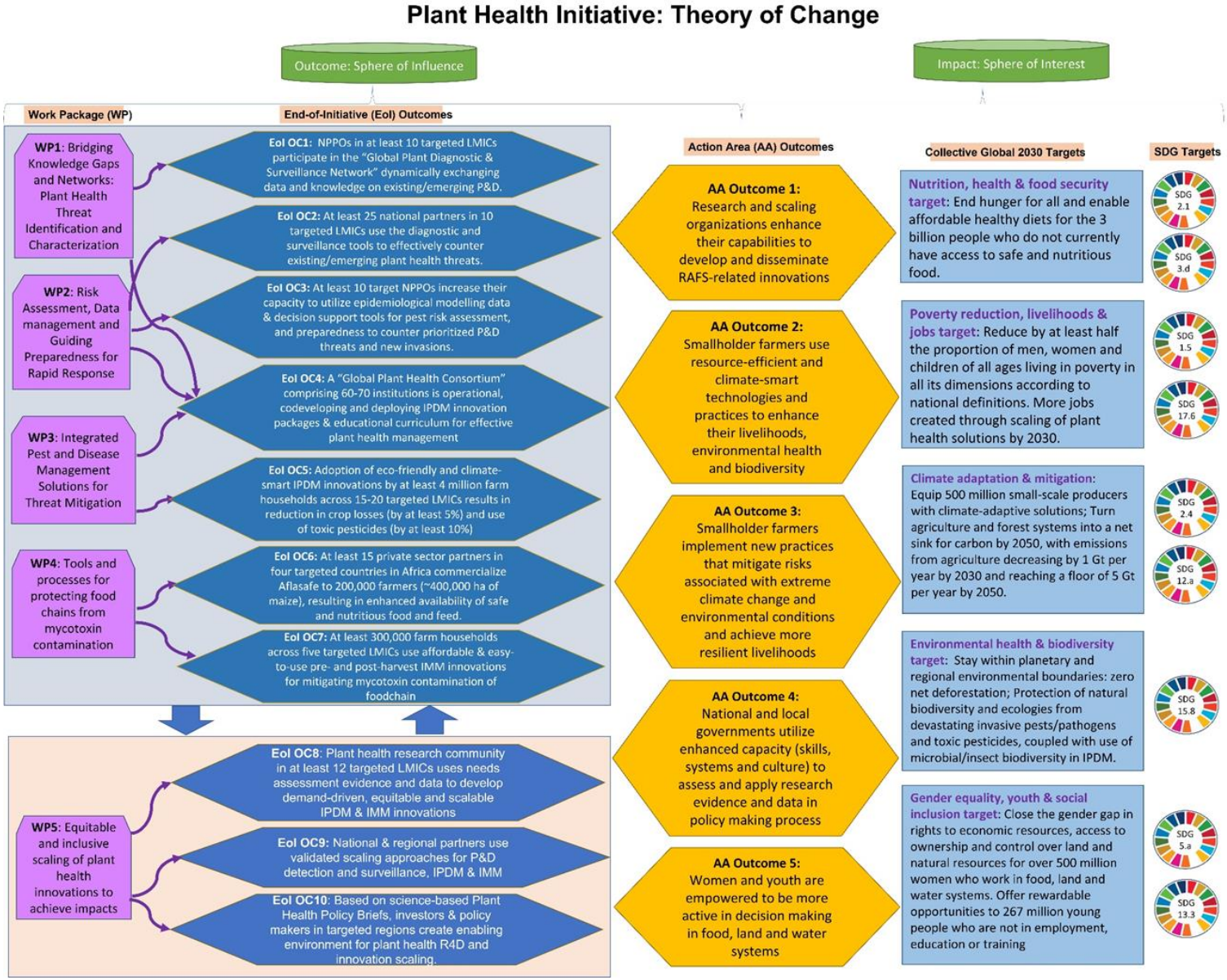
Integrated management of pests and diseases of sweet potato, cassava, yam, and vegetable crops. The Initiative will target crops of high significance to women, resource-poor young farmers, and ethnic minorities as they have significant autonomy in growing, processing, and/or selling those crops (Kawarazuka et al. 2020). We will reach them through customized IPDM programs targeting their interests by co-designing and adjusting innovations and its scaling approaches to control P&D, especially viruses, insects and nematodes, constraining crop yields and income. This participatory process will allow them to have a notion of co-ownership of innovations, thereby increasing the recognition of their contribution to plant health and overall production improvement, facilitating scaling of innovations through women's and youth's networks within and between communities.	**Significant** **Estimated Impact on the Poor and Marginalized Communities:** >14 million poor people (~7–8 million women); >2.8 million poor HHs	**Medium**
Impact Area: Climate adaptation and mitigation Impact Indicator: # of people benefiting from climate-adapted innovations		
Integrated management of Banana diseases (Fusarium, BBTV, BXW) Banana is cultivated across tropical and sub-tropical regions of Asia, Africa, and Latin America, especially by smallholders for whom the crop is a source of food security and income (FAOSTAT, 2021). Various transboundary diseases, including BBTV, Fusarium wilt, and Xanthomonas wilt, highly impact banana productivity (Blomme et al., 2017; Dita et al., 2018; Staver et al., 2020). Climate change further exacerbates disease spread and incidence, e.g., higher temperatures favor insect vector transmission of BBTV and Xvm at higher elevations. As part of the WP3, climate-smart IPDM will be advocated in focus countries and regionally through collaborative work with RIIs to prevent the exacerbation of banana diseases and their spread into new areas and ensure the availability of bananas throughout the year and contribute to food security. Biosecurity measures to prevent the introduction and spread of BBTV and Fusarium wilt of banana, which once introduced cannot be eradicated, will have a substantial positive impact on food security, household incomes, and protection of the environment.	**Significant** **Total beneficiaries:** >8 million people; >1.27 million HHs; >1.2 million ha across 11 target countries in SSA. **Estimated impact on the poor:** >2.86 million poor people; >0.45 million HHs	**Medium**
Impact Area: Environmental health and biodiversity Impact Indicator: # of ha under improved management		

IPM of Fall Armyworm on maize in Africa and Asia The impact of FAW is not only through the yield losses in highly affected crops like maize, but also on environmental health and biodiversity due to extensive and indiscriminate application of toxic synthetic pesticides, besides increased labor and cost to the resource-constrained smallholders (Prasanna et al. 2021). A recent study (Yang et al. 2021) examining the response of farmers to FAW in the Yunnan province in China showed that the full cost of pesticide-based crop protection increased from US$81 per hectare per crop season in 2018 to US$276 in 2020. The study also showed that at the FAW infestation levels present, some farmers were applying, on average, as many as 6.4 pesticide applications per crop season in 2020. The situation may not be significantly different in SSA. This underscores the need for implementing an IPM-based approach for FAW control in both Asia and Africa. Eco-friendly and climate-smart IPM innovations (e.g., FAW-tolerant maize hybrids; biopesticides, conservation and augmentative biological control, push-pull, etc.) deployed through the Initiative will substantially reduce the application of toxic synthetic pesticides (by at least 15–20%), with positive effects on environmental health and biodiversity of natural enemies.	**Transformative** **Total:** >9 million ha of maize only across 13 countries SSA (estimates to be done for targeted countries in Asia). **Estimated impact on the poor:** >5 million HHs; >24 million poor people.	**High**

3. Research plans and associated theories of change (TOC)

3.1 Full Initiative TOC

3.1.1 Full Initiative TOC diagram



3.1.2 Full Initiative TOC narrative

WP1 and **WP2** are complementary and will address the critical gaps in diagnostics and surveillance methods, data access and sharing, and risk assessment tools and preparedness strategies to address current and future biotic threats to plant health. By creating a common platform, in collaboration with national, regional, and transcontinental partners, for data sharing, standardized tools and methods for diagnostics, surveillance and P&D modelling, and risk assessment, a global diagnostic and surveillance network will be established. This network will generate scientific knowledge on invasive and emerging P&D and will appropriately guide **WP3** and **WP4** teams in effectively managing plant health threats in the targeted agrifood systems (**AA OC1 and AA OC2**).

WP3 is at the core of the Initiative provides smallholder farmers in the targeted LMICs with IPDM packages to tackle prioritized P&D while building the capacity of national partners in developing functional R4D pipelines to create and deliver new IPDM innovations to face emerging plant health threats. Outputs from **WP1 and WP2** will continuously inform **WP3** on what specific IPDM innovations to focus on or to modify in the face of changing climates, and farming systems. Complementing **WP3** further down the food value chain, **WP4** will address mycotoxin contamination by creating integrated management practices and ensuring wider adoption of available innovations, such as Aflasafe, by working closely with scaling partners, especially the private sector. Together, **WP3** and **WP4**, in collaboration with scaling partners and complementary One CGIAR Initiatives, will contribute to creating resilient and inclusive agrifood systems (**AA *OC2 and OC3***).

WP5, a cross-cutting Work Package, will conduct interdisciplinary research to provide tools, approaches, and methodologies to ensure inclusive and equitable impacts by considering specific needs of women, youth, and vulnerable groups, a functional interface between biophysical and social scientists, knowledge sharing among plant health researchers and downstream partners, and evidence-based policy briefs on plant health threats for decision-makers to create an enabling environment that promotes IPDM and IMM. These actions will strengthen the outcomes from **WP1** to **WP4** and ensures that the Initiative effectively contributes to the greater resilience of farming systems to biotic threats and changing climates (**AA OC4 and OC5**).

The EoI outcomes will contribute to **five AA Outcomes**, and thereby to the **CGIAR global collective targets by 2030**. Nutrition, health, and food security will be improved by reducing losses to crop yield and quality caused by P&D, and contamination by mycotoxins. New jobs will be created through stronger public-private partnerships, thereby alleviating poverty. Adoption of plant health innovations will give farmers enhanced capacity to adapt to the changing climates and the consequent effects on the P&D spectrum and intensity in Africa, Asia, and Latin America. This will also result in reduced use of toxic pesticides and preservation of the environment and biodiversity (including natural enemies of the pests/pathogens). Strong focus on gender and social inclusion will ensure that the PH innovations have equitable and inclusive benefits, especially for women, youth and vulnerable groups.

3.2 Work Package research plans and TOCs

Work Package title	**WP1: Bridging Knowledge Gaps and Networks: Plant Health Threat Identification and Characterization**
Work Package main focus and prioritization (max 100 words)	WP1 focuses on strengthening the diagnostic and surveillance capacity of NPPOs/NARES in targeted LMICs, facilitating exchange of knowledge from

	local-to-global/global-to-local, on research approaches, tools/technologies for detection/characterization and surveillance of prioritized P&D. WP1 priorities: 1. Establishing a global diagnostic and surveillance network, leveraging existing partnerships and networks across Africa/Asia/LAC. 2. Co-developing with innovation partners, tools/methods for lab/field detection, monitoring and mapping occurrence, quantifying crop damage, and analyzing population dynamics of targeted P&D. 3. Learning alliance for piloting surveillance tools of targeted P&D in target geographies. 4. Increasing capacity of local institutions on detection and surveillance for a broad range of P&D.
Work Package geographic scope (Global / Region / Country)	Selected countries in Africa, Asia, and LAC: See https://bit.ly/3lWXiv2

The science:

1. WP1 research questions, scientific methods and key outputs:

WP1 key research questions	**Scientific methods**	**Key outputs**
1. What are the main knowledge and capacity gaps on detection and characterization of emerging P&D faced by NPPOs, NARES and farming communities in LMICs?	Applying a stakeholder mapping and networks analysis to identify the relevant stakeholders at different levels including at community level to assess regional and national capacity gaps through stakeholder consultations, expert opinion, and farmer surveys. * *Assessment for extension workers and farmers supported by WP5.*	A map of relevant stakeholders and a report on key knowledge and capacity gaps on diagnostics, characterization, estimating damage levels, and surveillance of emerging P&D.
2. Which approaches can enhance cost-effective detection and surveillance of emerging P&D in targeted LMICs?	Reviewing of available ready-to-use tools/methods for deployment, co-developing cost-effective, gender responsive and climate smart digital and high-throughput diagnostics and surveillance tools and methods. Triangulating/comparing detection and surveillance tools/methods and applications for: lab/field detecting, monitoring, and mapping the occurrence of a series of P&D across different stakeholders.	A toolbox for molecular detection and image recognition, characterization, monitoring and surveillance of a broad range of P&D co-developed and deployed for use by NPPOs, NARES, extension staff and farmers in LMICs.
3. How can national phytosanitary systems in LMICs improve their capacity and knowledge on detection and surveillance of P&D?	Integrating existing diagnostic laboratories in LMICs, including CGIAR GHUs, Plantwise Plant Clinics, Farmers' Field School, and external partners (e.g., NPPOs). Developing a capacity strengthening plan based on regional and national consultations (outputs from Q1). Assessment of the benefits of participating in a global diagnostic and	A connected and functional diagnostic network of CGIAR and external partners (e.g., NPPOs, Universities) established in 10 countries, providing an advanced platform for plant P&D diagnostics and surveillance.

	surveillance network, sharing knowledge and innovations.	
4. What is the status of occurrence of selected P&D in targeted LMICs?	Together with NPPOs in the targeted countries (i) develop, test and validate tools for surveillance, (ii) strength surveillance capacity and (iii) support coordinated of prioritized P&Ds (e.g., CBSV, BBTV, MLN, FoC TR4, wheat blast and CMD) in targeted LMICs across Africa, Asia, and LAC.	Improved surveillance tools and human resource capacity to perform surveillance and monitoring of targeted P&D. Surveillance reports and data provided to decision makers within selected countries and, to WP2 for repositories and risk assessment analysis.
5. What are the critical gaps and cost-effective tools and protocols for mycotoxin detection and surveillance?	A review of existing data collected (metadata analysis), and protocols to quantify levels of mycotoxin contamination.	A report on harmonized tools and protocols for mycotoxin diagnostics and monitoring, to guide WP4 activities.

The theory of change:

2. WP1: Causal processes

- Based on regional and national capacity gap assessment through stakeholder consultation and support from RIIs, during Phase 1 (2022–2024), WP1 will identify knowledge and capacity gaps concerning lab diagnostics, field detection, loss assessment and characterization of P&D.
- Co-developing, implementing and scaling cost-effective innovations will help empower NPPOs, extension staff and farmers on field and lab detection, characterization, monitoring, mapping the occurrence, damage and population dynamics of P&D.
- Leveraging globally coordinated networks of CGIAR GHUs located across Africa, Asia, and LAC, and external partners (e.g., CABI Plantwise Clinics/FAO-IPPC/RPPOs/NPPOs/IARIs/NARES), WP1 will advocate for a global diagnostic laboratory network (Phase 1 (2022–2023)). Work Package will strengthen phytosanitary systems in LMICs by deploying and exchanging knowledge and innovations. This network will build the capacity of frontline agricultural workers to participate in detection of new invasions/outbreaks and will support national diagnostic labs in a region.
- Based on risk assessment analysis of WP2, together with demand and innovation partners, WP1 will perform sampling and surveillance for P&D of high priority in targeted LMICs.
- The regional diagnostic hub will support and facilitate the harmonization of tools and surveillance protocols for mycotoxin and toxigenic fungi for WP4.

3. WP1: Key demand, innovation and scaling partners

Demand partners help define national and regional priorities, and benefit from the innovations and networks developed and deployed. NARES, NPPOs, RPPOs, Ministries of Agriculture and farmers organizations in the target LMICs in Africa, Asia, and LAC; and One CGIAR RIIs.

Innovation partners co-create/complement innovations on tools and methods for detection and surveillance. IARCs (e.g., icipe, CABI, USAID CETC Innovation Lab, CIRAD, IRD, INRA, etc.), NARES (e.g., KALRO, NARO, ICAR, BARI, INIA, AGROSAVIA, etc.), Research Institutions/Universities (e.g., USDA-ARS, CSIRO-Australia, JIC, Rothamsted, etc.), Phytosanitary research/coordination networks (e.g., CGIAR GHUs, NPDN-USA, EUPHRESCO, etc.).

Scaling partners help deploy the plant health network, tools/methods to demand partners. UN/Conventions (e.g., FAO, IPPC), RPPOs and NPPOs.

4. WP1: Key TOC assumptions and risks

Key assumptions	Key risks
● NPPOs recognize the value to be connected to the regional and global diagnostic networks and are willing to dynamically exchange diagnostics, surveillance data and knowledge on a broad range of P&D. ● There is a need to identify specific knowledge and capacity gaps on detection, characterization, and surveillance of emerging P&D within targeted countries. If the information is made accessible to CGIAR and external partners, a context-based capacity-strengthening plan can be developed. ● The improved capacity and availability of reliable tools and methods for cost-effective large-scale detection and monitoring will support surveillance capacity of at national and regional level. ● The is a need for reliable tools and methods for cost-effective large-scale monitoring and surveillance. If these tools and methods is made accessible as a toolbox through a resource portal, stakeholders will use it. ● National partners need cost-effective harmonized tools and protocols for effective detection and monitoring of mycotoxins.	● Unwillingness to share P&D data with other partners/ countries. ● Countries fear economic consequences when sharing and reporting P&D occurrence data. ● Shortage of resources for the Initiative. ● Funders/Governments are not interested in investing on diagnostics and surveillance efforts. ● Difficult communications across regions due to language constraints and cultural differences. ● Limited access to internet and telecommunication network service.

5. WP1: Interdependencies and synergies with other Work Packages and other Initiatives

- Data generated by WP1 will be used by (i) WP2 to feed a global P&D repository, undertake risk assessment analysis and prediction models, including assessment of climate change impact on P&D; (ii) WP3 to develop and implement IPDM innovations for prioritized pests/diseases; and (iii) WP5 to apply novel gender-responsive and socially inclusive approaches for effectively scaling surveillance efforts.
- WP1 will have mutual dependence and synergies with various Global and Regional Initiatives under One CGIAR, especially:
  Genetic Innovations: Market Intelligence; Genebanks. **RAFS:** RIIs. **System Transformation**: Gender (HER+); Digital Tools, besides CABI's Plantwise.

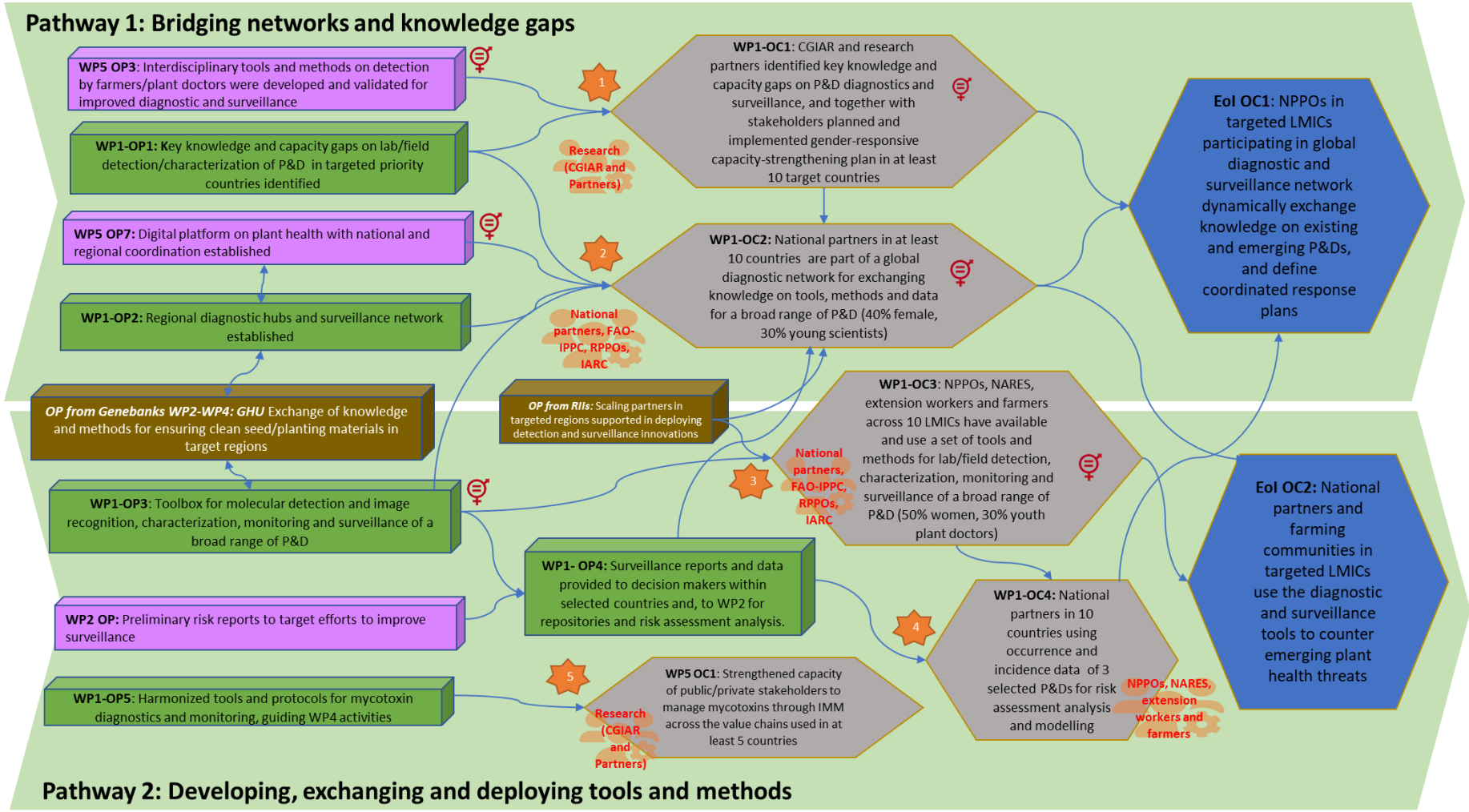
6. WP1: Links to Innovation Package and Scaling Readiness Plan

All the relevant plant health innovations will be rigorously evaluated following the scaling readiness approach. In Phase 1 (2022–2024), major focus will be on those diagnostics and surveillance innovations that are already in use or under piloting in the field to ensure development outcomes and impacts. The Plant Health Initiative will form partnerships with RPPOs through RAFS to ensure relevant issues are addressed and to stimulate uptake of innovations in target regions. At the same time, the Initiative will also devote attention to specific innovations that have the potential to address critical gaps in detection, characterizations, and surveillance of P&D for potential scaling in Phase 2 (2025–2030). This balance is critical for ensuring sustainability and a strong pipeline of plant health innovations for the years to come.

Measuring and managing performance and results

The details are captured in the Results Framework, with indicators, data sources, data collection methods, baseline and target values in Section 6.1, and Section 6.2 (Planned MELIA studies and activities).

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



Causal Link #	From result	To result	Geographical dimension	Actor type	Expected action	Assumption
1	**WP1 OP1:** Key knowledge and capacity gaps on lab/field detection/characterization of P&D in targeted priority countries identified **WP5 OP3**: Interdisciplinary tools and methods on detection by farmers/plant doctors were developed and validated for improved diagnostic and surveillance	**WP1-OC1:** CGIAR and research partners use identified key knowledge and capacity gaps and defined a context-based gender-responsive capacity-strengthening plan	CGIAR and research partners use identified key knowledge and capacity gaps and defined a context-based gender-responsive capacity-strengthening plan	Research (CGIAR and Partners)	Coordination with WP5 for consultation, expert opinion and farmers surveys.	There is a need to identify specific knowledge and capacity gaps on detection, characterization and surveillance of emerging P&D within targeted countries. If the information is made accessible to CGIAR and external partners, a context-based capacity-strengthening plan can be developed.
2	**WP1 OP1:** Key knowledge and capacity gaps on lab/field detection/characterization of P&D in targeted priority countries identified **WP1 OP2:** Regional diagnostic hubs and surveillance network established **WP1 OP3:** Toolbox for molecular detection and image recognition, characterization, monitoring and surveillance of a broad range of P&D **WP1 OP4:** Surveillance reports and data provided to decision makers within selected countries and, to WP2 for repositories and risk assessment analysis.	**WP1-OC2**: National partners in at least 10 countries are part of a global diagnostic and surveillance network for exchanging knowledge on tools, methods and data for a broad range of P&D (40% female, 30% young scientists)	Global, across 10 countries in Africa, Asia and LAC	National partners, FAO-IPPC, RPPOs, IARC	- Strengthening GHUs as reference laboratories at their hosting countries to support the region as diagnostic network hubs. - Strength and extend GHUs regional network - Developing a capacity strengthening plan based on regional and national consultations. - Reviewing available ready-to-use tools/methods for deployment, co-developing cost-effective, gender	NPPOs recognize the value to be connected to the regional and global diagnostic networks and are willing to dynamically exchange diagnostics, surveillance data and knowledge on a broad range of P&D.

	WP5 OP7: Digital platform on plant health with national and regional coordination established				responsive and climate smart digital and high-throughput diagnostics and surveillance tools/ methods.	
3	**WP1 OP3:** Toolbox for molecular detection and image recognition, characterization, monitoring and surveillance of a broad range of P&D **Genebank WP2-OP2.6 and 2.7:** Next generation phytosanitary protocols developed / Novel diagnostic tools for sensitive and broad-specified detection of pests and pathogens for germplasm health certification	**WP1-OC3**: NPPOs, NARES, extension workers and farmers across 10 LMICs have available and use a set of tools and methods for lab/field detection, characterization, monitoring and surveillance of a broad range of P&D (50% women, 30% youth plant doctors)	Global, across 10 countries in Africa, Asia and LAC	NPPOs, NARES, extension workers and farmers	Relevant innovations (tools/methods) validated by CGIAR and partners for fitness for use and scaling across regions using the global diagnostics and surveillance network as a vehicle.	There is a need for reliable tools and methods for cost-effective large-scale monitoring and surveillance. If these tools and methods are made accessible as a toolbox through a resource portal, stakeholders will use more effectively.
4	**WP1 OP4:** Surveillance reports and data provided to decision makers within selected countries and, to WP2 for repositories and risk assessment analysis.	**WP1-OC4:** National partners using occurrence and incidence data of selected P&D for risk assessment analysis and modelling	Global piloting on countries of selected P&Ds across LAC, Africa and Asia	National partners, FAO-IPPC, RPPOs, IARC	Together with NPPOs in the targeted countries (i) develop, test and validate tools for surveillance, (ii) strength surveillance capacity and (iii) support coordinated of prioritized P&Ds (e.g., CBSV, BBTV, MLN, FoC TR4, wheat blast and CMD) in targeted LMICs across Africa, Asia and LAC.	There is a need to improve capacity and access to reliable tools and methods for cost-effective large-scale detection and monitoring. These will support surveillance capacity at national and regional level increasing preparedness and response.

5	**WP1 OP5:** Harmonized tools and protocols for mycotoxin diagnostics and monitoring, guiding WP4 activities	**WP5 OC1:** Strengthened capacity of public/private stakeholders to manage mycotoxins through IMM across the value chains used in at least 5countries	Targeted countries	Research (CGIAR and Partners)	A review of existing data collected (metadata analysis), and protocols to quantify levels of mycotoxin contamination.	National partners need cost-effective harmonized tools and protocols for effective detection and monitoring of mycotoxins

Work Package title	**WP2: Risk Assessment, data management and guiding preparedness for rapid response**
Work Package main focus and prioritization (max 100 words)	WP2 focuses on controlling the introduction and spread of P&D by (i) developing/enhancing tools/standards for P&D data management, risk assessment and prediction, (ii) facilitating preparedness and response plans against emerging P&D, and (iii) guiding surveillance, IPDM, and mycotoxin interventions. Prioritization criteria include (i) increasing vulnerability of cropping systems to P&D evolution (emergence of severe strains), new introductions, and changes in P&D dynamics due to agricultural intensification, climate change, and anthropogenic behaviors (ii) increasing emphasis on preparedness, prevention, and efficient targeting to counter P&D outbreaks, and (iii) comparative advantages of One CGIAR and partners to develop and scale innovations.
Work Package geographic scope (global/region/country)	Global, with specific activities implemented in the Initiative targeted countries. See https://bit.ly/3lWXiv2

The science:

1. WP2 research questions, scientific methods and key outputs:

WP2 key research questions	**Scientific methods**	**Key outputs**
How to better integrate data sets and tools available within CGIAR and partners to develop a PH data management system for dynamic evaluation of PH risks?	Stakeholder consultation about available databases and their willingness to share; SWOT analysis of national and regional data management capacity; review data sharing policies; install tools for systematic PH data collection from trials; validation of PH data management system with partners.	• Baseline report on P&D datasets and tools • SWOT report on P&D data management with augmentation plans • Automation for harnessing surveillance data from One CGIAR trials (sentinel plots) • Improved PH data management system, with data harnessing tools • Integrated PH database • Standard Operating procedures for equitable access of PH data management system.
What are the best approaches to pest risk assessment (PRA) and preparedness to counter pests and diseases?	Adaption of IPPC ISPMs for science-based risk mapping; of modelling and prediction tools for probability and likelihood scenario analysis; establish preparedness response plans; benefit-cost analysis of interventions;	• Generic/specific risk assessment procedures • P&D risk maps • Knowledge/models on potential P&D invasion and spread pathways • Generic/specific guidelines for preparedness and response plans • Risk mitigation strategies for at least 10 high-risk P&D cases, with guidance for surveillance and IPDM
How to monitor changes in pathogen/pest virulence in natural populations and augment control measures?	Monitor host resistance in designated nurseries/ trials at hot spot sites of target P&D; assessment of pest/pathogen diversity and agricultural practices; trials under controlled conditions for scenario analysis; evaluation of	• Knowledge on virulence variation in the natural P&D populations • Models for predicting P&D shifts • Knowledge of factors contributing to virulence variation or P&D shifts

	existing/new IPDM and host resistance.	• Strategies for augmented IPDM and resistance breeding to counter virulent populations. • Reports on the effectiveness of existing IPDM/host resistance against virulent populations
How do climate change and anthropogenic activities exacerbate plant health risks in the targeted geographies?	Review existing epidemiological and environmental data (literature review, mining One CGIAR databases); climate risk modelling for selected crop P&D using PH data management system.	• Risk modelling protocols • Datasets for climate × pest risk analysis • Knowledge on key climate drivers of P&D emergence identified • Fit-for-purpose, social and gender inclusive risk mitigation strategies for at least 10 prioritized P&Ds.
What are the biosecurity risks to seed delivery pathways and how to prevent the transboundary spread of P&D with seed movement?	P&D seed transmission risk analysis by crop and geography; mining GHUs seed health data (jointly with Genebanks and SeEdQUAL)	• Knowledge on biosecurity risks to seed delivery pathways • Integrated seed health protection strategies (communicated to Genebanks and SeEdQUAL)
How to predict mycotoxin contamination risk to improve effectiveness of control interventions?	Analyses and modelling mycotoxin data together with crop and climate data for risk prediction	Strategies for sampling for mycotoxin testing and targeted control interventions
Howe to effectively persuade policymakers to invest in preparedness and P&D risks management?	Development of policy briefs based on WP2 results synthesis; communication tool kit	• Fit-for-purpose communication, advocacy, and capacity development strategies • Policy briefs with actionable recommendations

The theory of change:

2. WP2: Causal processes

- WP2 harnesses CGIAR and external partners' (e.g., FAO-IPPC, CABI, NPPOs, etc.) capacities, improve and integrate P&D databases and build robust information systems for inter-agency information sharing and communications, and prepare demand partners to minimize adverse impacts of P&D and mycotoxins on agriculture, trade, livelihoods, health, and the environment.
- With innovation and scaling partners, WP2 develops and uses modelling tools for dynamic assessment of plant health risks to predict P&D emergence, evaluates the likelihood of climate change impacts and anthropogenic activities on P&D and mycotoxin contamination dynamics, and guides appropriate preparation and response capabilities of local/regional institutions in the target countries.
- With demand partners, WP2 offers decision support to enhance the effectiveness of the Initiative interventions, including improvements to breeding strategies of ABI against important P&D; and examines P&D risks to seed delivery pathways of Genebanks and SeEdQUAL, and integrates strategies to prevent the transboundary spread of pests with seed movement.
- For scaling, WP2 interphase with WP5 and demand partners to organize multistakeholder consultations for evaluation of country capacities, institutional coordination mechanisms and develops strategies to improve preparedness responses against the P&D threats. Organizes communication and advocacy campaigns for policymakers to prioritize effective national and regional plant health management strategies.

3. WP1: Key demand, innovation and scaling partners

Demand partners help define national and regional priorities, and benefit from the innovations and networks developed and deployed. NARES, NPPOs, RPPOs, Ministries of Agriculture and farmers organizations in the target LMICs in Africa, Asia, and LAC; and One CGIAR Global and Regional Initiatives.

Innovation partners co-create/complement innovations on tools and methods for risk assessment, prediction and preparedness. IARCs (e.g., CABI, icipe), NARES, Research Institutions/Universities (e.g., INRAE-France, USDA-ARS, CSIRO-Australia, Rothamsted, Wageningen UR, etc.), Phytosanitary research/coordination networks (e.g., CGIAR GHUs, EUPHRESCO, etc.).

Scaling partners help deploy the WP2 innovations, including tools/methods to demand partners. These include UN/Conventions (e.g., FAO, IPPC), RECs (ECOWAS, ASERECA, COMESA), RPPOs, NPPOs, NARES, NGOs, APAARI, etc.

4. WP2: Key TOC assumptions and risks

Key assumptions	Key risks
• Existing PH data management tools are fragmented and not easy to access or sufficient for P&D data mining and analyses • Partners are willing to share data/tools for P&D risk assessment • New/adapted tools are capable of accurately predicting P&D/mycotoxin risks • Policymakers willing to invest in response preparedness plans and capacity building	• Stakeholders' unwillingness to share P&D data. • P&D data is insufficient for risk assessment and prediction. • Insufficient resources allocation by policymakers to improve preparedness/response capacity. • Some P&D risks are difficult to predict/prevent (e.g., P&D spread through undefined routes). • Risk of unknown knowns, for which accurate prediction and preparedness are complicated.

5. WP2: Interdependencies and synergies with other Work Packages (and other Initiatives if relevant)

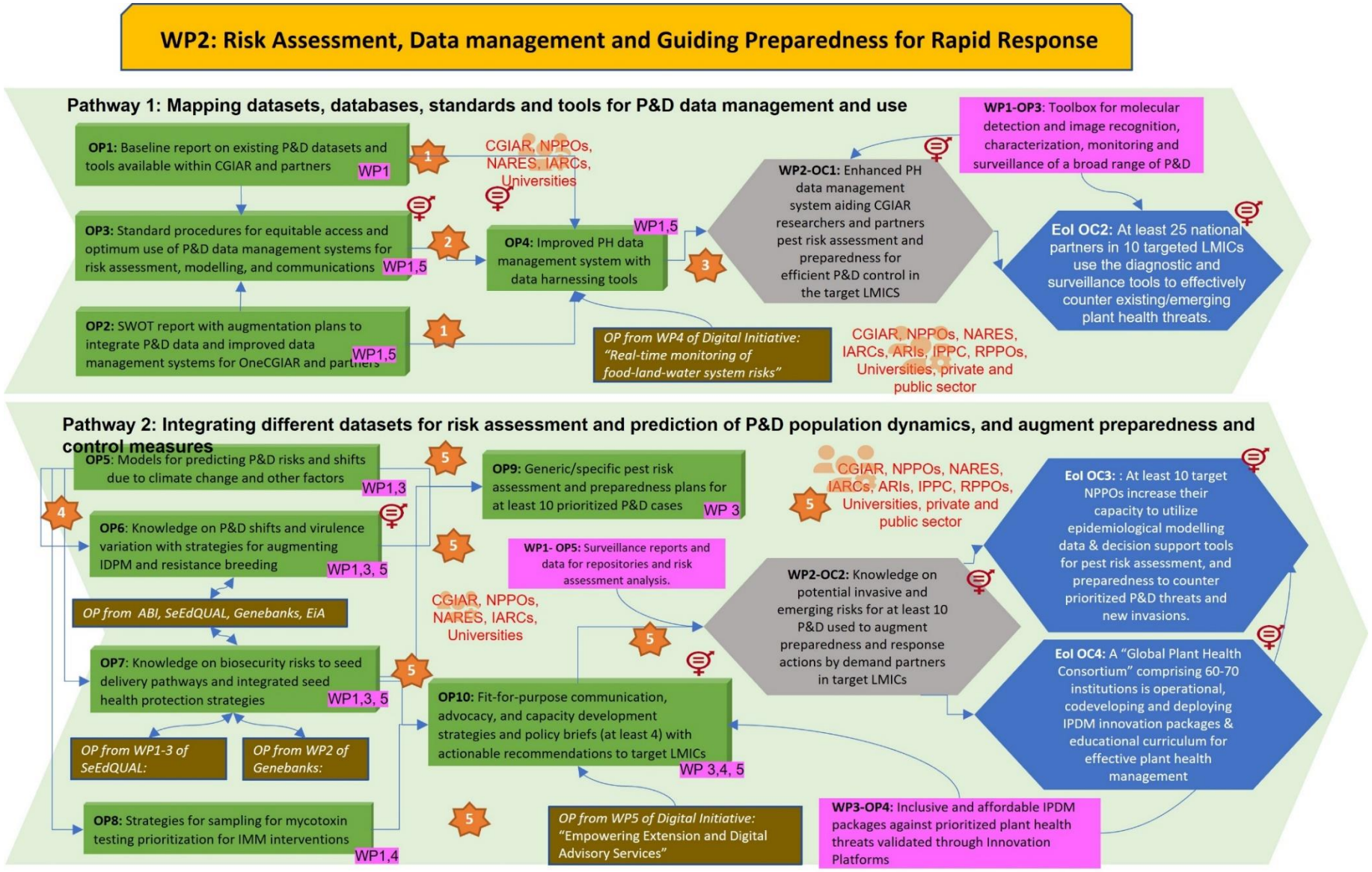
- Outputs from WP1 and WP3 will contribute to WP2 efforts to establish PH data management systems. The WP2 outputs will benefit WP1 to prioritize surveillance targets and offer decision support to WP3 (IPDM) and WP4 (mycotoxin control) to deploy appropriate mitigation interventions. WP2 interphase with WP5 to co-design fit-for-purpose advocacy with priority settings for achieving equitable impacts and capacity development strategies to improve country preparedness to counter P&D risks.
- WP2 will have synergies with various global and regional Initiatives, especially: Genetic Innovations (ABI; SeEdQUAL; Genebanks), RAFS (RIIs), and System Transformation (Digital Tools; HER+).

6. WP2: Links to Innovation Package and Scaling Readiness Plan

The WP2 innovations will be rigorously evaluated following the scaling readiness approach. In Phase 1 (2022–2024), WP2 will focus on harnessing tools that are already being scaled or piloted to ensure development outcomes and impacts. At the same time, WP2 will foster new innovations to address critical gaps in P&D data acquisition, risk assessment, forewarning, and decision support tools for piloting and scaling in Phase 2 (2025–2030). This approach ensures a strong pipeline of innovations to enhance strategic preparedness and response actions for the subsequent phases.

Measuring and managing performance and results

The details are captured in the Results Framework, with indicators, data sources, data collection methods, baseline and target values in Section 6.1, and Section 6.2 (Planned MELIA studies and activities).


WP2: Risk Assessment, Data management and Guiding Preparedness for Rapid Response
Pathway 1: Mapping datasets, databases, standards and tools for P&D data management and use
OP1: Baseline report on existing P&D datasets and tools available within CGIAR and partners WP1
OP3: Standard procedures for equitable access and optimum use of P&D data management systems for risk assessment, modelling, and communications WP1,5
OP2: SWOT report with augmentation plans to integrate P&D data and improved data management systems for OneCGIAR and partners WP1,5
CGIAR, NPPOs, NARES, IARCs, Universities
OP4: Improved PH data management system with data harnessing tools WP1,5
OP from WP4 of Digital Initiative: "Real-time monitoring of food-land-water system risks"
WP1-OP3: Toolbox for molecular detection and image recognition, characterization, monitoring and surveillance of a broad range of P&D
WP2-OC1: Enhanced PH data management system aiding CGIAR researchers and partners pest risk assessment and preparedness for efficient P&D control in the target LMICS
EoI OC2: At least 25 national partners in 10 targeted LMICs use the diagnostic and surveillance tools to effectively counter existing/emerging plant health threats.
CGIAR, NPPOs, NARES, IARCs, ARIs, IPPC, RPPOs, Universities, private and public sector
Pathway 2: Integrating different datasets for risk assessment and prediction of P&D population dynamics, and augment preparedness and control measures
OP5: Models for predicting P&D risks and shifts due to climate change and other factors WP1,3
OP6: Knowledge on P&D shifts and virulence variation with strategies for augmenting IDPM and resistance breeding WP1,3, 5
OP from ABI, SeEdQUAL, Genebanks, EiA
OP7: Knowledge on biosecurity risks to seed delivery pathways and integrated seed health protection strategies WP1,3, 5
OP from WP1-3 of SeEdQUAL:
OP from WP2 of Genebanks:
OP8: Strategies for sampling for mycotoxin testing prioritization for IMM interventions WP1,4
OP9: Generic/specific pest risk assessment and preparedness plans for at least 10 prioritized P&D cases WP 3
WP1- OP5: Surveillance reports and data for repositories and risk assessment analysis.
CGIAR, NPPOs, NARES, IARCs, Universities
OP10: Fit-for-purpose communication, advocacy, and capacity development strategies and policy briefs (at least 4) with actionable recommendations to target LMICs WP 3,4, 5
OP from WP5 of Digital Initiative: "Empowering Extension and Digital Advisory Services"
CGIAR, NPPOs, NARES, IARCs, ARIs, IPPC, RPPOs, Universities, private and public sector
WP2-OC2: Knowledge on potential invasive and emerging risks for at least 10 P&D used to augment preparedness and response actions by demand partners in target LMICs
EoI OC3: : At least 10 target NPPOs increase their capacity to utilize epidemiological modelling data & decision support tools for pest risk assessment, and preparedness to counter prioritized P&D threats and new invasions.
EoI OC4: A "Global Plant Health Consortium" comprising 60-70 institutions is operational, codeveloping and deploying IPDM innovation packages & educational curriculum for effective plant health management
WP3-OP4: Inclusive and affordable IPDM packages against prioritized plant health threats validated through Innovation Platforms

Causal linkage #	From result	To result	Geographical dimension	Actor type	Expected actions	Assumptions
1	**WP2-OP1:** Baseline report on existing P&D datasets and tools available within CGIAR and partners (WP1) **WP2-OP2**: SWOT report with augmentation plans to integrate P&D data and improved data management systems for One CGIAR and partners	**WP2-OP3, OP4 and WP2-OC1**	Global, with particular focus on the 20 target LMICs in Africa, Asia and Latin America	CGIAR, NPPOs, RPPOs, FAO-IPPC, IARCs, NARES, ARIs, Ministries	Coordinate with WP1, 3, 4 and the Digital Initiative (WP4) for feedback on PH data/tools for development of blueprint for PH data management system Guidance for establishment of a robust PH data management and a sustainable operation plan.	• Partners and stakeholders willing to share P&D data for an interoperable open access system. • Partners are willing to share data/tools for P&D risk assessment.
2	**WP2-OP3:** Standard procedures for equitable access and optimum use of P&D data management systems for risk assessment, modelling, and communications OP3 (WP1 and WP5)	**WP2-OP4 and WP2-OC1**	Global, with particular focus on the 20 target LMICs in Africa, Asia and Latin America	CGIAR, NPPOs, RPPOs, FAO-IPPC, IARCs, NARES, ARIs, Ministries	Data architecture for integrated, open access PH database with standards for data sharing and use. PH database validation by innovation, scaling and demand partners.	Capacity exists among innovation and demand partners to use PH data management systems for accurately predicting P&D/mycotoxin risks.
3	**WP2-OP4:** Improved PH data management system with data harnessing tools (validated by WP1, 3, 4, 5 and demand partners)	**WP2-OC1**	Global, with particular focus on the 20 target LMICs in Africa, Asia and Latin America	CGIAR, NPPOs, RPPOs, FAO-IPPC, IARCs, NARES, ARIs, Ministries, NGOs, public and private sector	Promotion of PH data management system by innovation-, scaling- and demand partners	Stakeholders at global to national level mine PH database and prepare action-oriented recommendations for the control of emerging and established P&D.
4	**WP2-OP5:** Models for predicting P&D risks and shifts due to climate change and other factors	**WP2-OP5, OP6-10 and WP2-OC2**	Global, with particular focus on the 20 target LMICs in Africa, Asia and Latin America	CGIAR, NPPOs, RPPOs, FAO-IPPC, IARCs, NARES, ARIs, Ministries	Development of prediction models based on epidemiology information and multitrophic analysis (incorporating weather information, cropland use, farming practices) of existing and new data P&D data (collected during the implementation of the Initiative (WP1, 2 and 3), EiA, ABI, Genebanks, SeEdQUAL) and epidemiological information. Digital Initiative and partners contributions to epidemiological models and computation capacity. Development of appropriate mitigation actions to	• Existing P&D data is easily accessible; external partners and stakeholders share P&D data for modelling and prediction studies. • New/adapted PH data management systems offer data and computing capacity for risk modelling and future scenario predictions.
	WP2-OP6: Knowledge on P&D shifts and virulence variation with strategies for augmenting IPDM and resistance breeding	**WP2-OP7, OP9, OP10 and WP2-OC2**	Global, with particular focus on the 20 target LMICs in Africa, Asia and Latin America, priority countries, of EiA, trial sites of ABI and Traits and Services	CGIAR, NPPOs, RPPOs, FAO-IPPC, IARCs, NARES, ARIs, Ministries		

					counter emerging threats through surveillance (WP1), IPDM (WP3), capacity development (WP5), and strategies for improving host resistance (GII).	
	WP2-OP7: Knowledge on biosecurity risks to seed delivery pathways and integrated seed health protection strategies	**WP2-OP10 and WP2-OC2**	Global, with particular focus on the target LMICs in Africa, Asia and Latin America of Genebanks, ABI and SeEdQUAL	CGIAR, NPPOs, RPPOs, FAO-IPPC, IARCs, NARES, ARIs, Public and Private sector	Analyze seed-borne pest risk using ISPM PRA frameworks jointly with WP1 and WP3, GII (Genebanks, ABI, and SeEdQUAL), and NPPOs to develop risk mitigation strategies and disseminate to demand partners, jointly with WP5.	Information on seed-borne P&D generated by GHUs accessible for PRA analysis.
	WP2-OP8: Strategies for sampling for mycotoxin testing prioritization for IMM interventions	**WP2-OP10 and WP2-OC2**	Global, with particular focus on the 2 target LMICs of WP4 in Africa	CGIAR, IARCs, NARES, ARIs, Ministries, Public and Private sector	Analyze mycotoxin incidence and prevalence data of past and newly generated data sets, together with WP4, to identify conducive factors and geographies prone to mycotoxin susceptibility for directing WP4 intervention actions.	Mycotoxin incidence and prevalence data available for risk prediction analysis.
5	**WP2-OP9:** Generic/specific pest risk assessment and preparedness plans for at least 10 prioritized P&D cases	**WP2-OP10 and WP2-OC2**	Global, with particular focus on the 20 target LMICs in Africa, Asia and Latin America	CGIAR, NPPOs, RPPOs, FAO-IPPC, IARCs, NARES, ARIs, Ministries, Public and Private sector	Together with NPPOs, use ISPM PRA frameworks to analyze and establish P&D risk mitigation plans. Together with WP3 and WP5, Digital Initiative (Extension), scaling and demand partners identify the needs and establish strategies for strengthening preparedness and rapid response capacity of target countries against prioritized P&Ds, develop communication plans and at least four policy briefs with actional recommendations.	Policymakers invest in capacity building and incentivize demand partners to adopt preparedness and response action to counter emerging P&Ds.
	WP2-OP10: Fit-for-purpose communication, advocacy, and capacity development strategies and policy briefs (at least 4) with actionable recommendations to target LMICs	**WP2-OC2**	20 target LMICs in Africa, Asia and Latin America			

Work Package title	**WP3: Integrated pest and disease management**
Work Package main focus and prioritization (max 100 words)	WP3 focuses on designing and deploying IPDM approaches against prioritized plant health threats in targeted crops/cropping systems to protect smallholders' food and feed security and livelihoods. The key criteria used for prioritization under WP3 are: 1. Plant health threats with high economic / environmental / biodiversity impacts in Africa, Asia and Latin America, and need integrated approaches for sustainable management, including synergies with other One CGIAR Initiatives (e.g., ABI, EiA); 2. Particular emphasis on emerging/invasive transboundary pests/diseases; 3. Comparative advantage of One CGIAR and its partners in effectively addressing the threat; 4. Proven or potential economic and environmental impacts of the innovations.
Work Package geographic scope (global/region/country)	Global, with particular focus on selected LMICs in Africa, Asia and Latin America; see https://bit.ly/3lWXiv2

The science:

1. WP3 research questions, scientific methods and key outputs:

Arthropod pests and diseases are key production constraints of food crops in LMICs where farming communities and often resource-constrained and suffer from chronic and acute food shortages. Scaling and adoption of IPDM innovations on prioritized P&D are known to narrow the yield gaps and provide food security to people. To achieve this, IPDM innovations, knowledge and skills to manage plant threats should be validated and scaled through partnership with key stakeholders in LMICs. Development, validation and scaling of IPDM innovations were done by CGIAR with innovation partners and NAREs, but without much coordination to create synergy and with limited impacts. Bringing plant health innovation partners, including CGIAR, IARCs, NARES, ARIs and other innovation partners, under one platform (the Initiative) will enable more effective validation and scaling of innovations that can bring desired outcomes in accelerated manner. The Initiative can help partners to co-design and implement IPDM innovations and create synergy for larger impact. To achieve the three outcomes in WP3, multilocation validation and scaling as well as training will be done in targeted LMICs. IPDM innovations will also benefit from other Work Packages in the Initiative, besides outputs from relevant global and regional Initiatives.

WP3 key research questions	**Scientific methods**	**Key outputs**
What are the economic impacts of key P&D on food security and livelihoods of farming communities in target LMICs?	Stakeholder and expert consultations and interviews; literature reviews; field experiments; and modelling Critical R4D gaps in developing effective, equitable and scalable IPDM packages identified through participatory approach	Knowledge on the economic impacts of P&D in the targeted LMICs for effective targeting of plant health innovations, and for providing evidence-based information to policy makers and funders
Which IPDM innovations and their components can deliver game-changing improvements to plant health management?	1) Participatory evaluation of IPDM innovations (e.g., innovation platforms; on-farm trials) in selected countries, and understanding of critical gaps, if any.	Eco-friendly, cost-effective and scalable IPDM developed/validated innovations against targeted plant health threats.

	2) Meta-analysis of data from on-farm trials and innovation platforms and fine-tuning of IPDM innovations. 3) Integration of cost-effective and synergistic IPDM components (e.g., host plant resistance, biological control, biopesticides, agro-ecological approaches) to create eco-friendly IPDM Innovation Packages against 27 prioritized P&D across major food crops.	
Will the changing climate and cropping system impact the efficacy of IPDM innovations?	Outputs from WP1 and WP2 will guide risk assessment and forecasting of plant health threats; Integration of climate-resilient and pest-/disease-resistant varieties along with climate-smart agronomic practices to minimize the impact of changing climates on IPDM innovations.	• IPDM innovations adopted to the needs of changing climates and cropping systems in targeted LMICs.
Are the identified IPDM innovations scale-neutral, gender-responsive and inclusive?	Socioeconomic evaluation, including gender analysis, of IPDM innovations for understanding the smallholder farmers' responses to IPDM innovations; Literature review.	Key drivers and bottlenecks, especially from gender and social inclusion perspective, for IPDM adoption identified and factored into scaling strategies
How can digital tools be deployed most effectively for plant health management?	Systematic integration of digital toolboxes on major pests and diseases across CGIAR; Models for integration and deploying digital tools for scaling IPDM packages.	A "Plant Health Web Portal" developed, integrating surveillance, diagnostics and IPDM innovations against targeted pests and diseases across CGIAR mandate crops.
How best to engage with policy/decision makers to ensure support for IPDM innovations?	The ROMA — the RAPID Outcome Mapping Approach — a guide to understanding, engaging with and influencing policy (https://odi.org/en/about/features/roma-a-guide-to-policy-engagement-and-policy-influence/) will be used.	Effectiveness of ROMA for understanding, engaging with, and influencing enabling policies on plant health management ascertained.
How to achieve synergies with complementary global/regional Initiatives for tackling crop pests and diseases?	Stakeholder consultations and working groups to identify complementarities and synergies and implement these meticulously based on agreed frameworks.	A "Global Plant Health Consortium" established to promote synergies at the regional and global levels, including linkages with complementary Initiatives (e.g., Global Burden of Crop Loss; FAO's Action Plans on plant health threats)

The theory of change:

2. WP3: Causal processes

- Demand partners have helped define the national and regional needs and will benefit from the IPDM innovations developed and deployed through the Plant Health Initiative. Innovation partners will help co-develop and validate IPDM innovations in innovation platforms. Scaling partners will help in organizing on-farm trials, stimulate demand, and deploy plant health solutions in the target countries.
- Innovation platforms (IPs) in target geographies will help in addressing key research questions, fine-tuning the IPDM innovations based on stakeholders' inputs, identifying cost-effective and scalable innovations, and for transfer of innovations to the local communities, including improvement of the skills and knowledge of farmers and extension staff.
- Eco-friendly and cost-effective IPDM innovations will be codeveloped and scaled in partnership with active engagement of researchers, farmers, input suppliers, policy makers, regulators, and development partners. For available innovations, we will use the scaling readiness approach to deploy in target countries, in partnership with RIIs, with gender and social inclusion firmly in view.
- For scaling, we will actively partner with public and private organizations, including policy/decision makers, to ensure wider adoption and adequate investment. During the process, we will learn and exchange knowledge following principles of Community of Practice.

3. WP3: Key demand, innovation and scaling partners

Key demand partners include NARES and the Ministries of Agriculture in the target LMICs in Africa, Asia, and Latin America; NGOs; Farmers' Groups; and One CGIAR Global and RIIs.

Key innovation partners include: IARCs (e.g., icipe, CABI, WorldVeg), NARES (e.g., EIAR, KALRO, NARO, ICAR, BARI, BARC, PhilRice, IAARD, etc.), ARIs (e.g., USDA-ARS, CSIRO-Australia, Rothamsted Research, Wageningen UR, etc.), private sector institutions (e.g., Bayer, Corteva, Syngenta, etc.), Phytosanitary networks (e.g., FAW R4D International Consortium, BBTD Alliance, etc.).

Key scaling partners include FAO, IPPC, regional organizations, NPPOs, NARES, 'Green' agrochemical/seed companies, and International Alliances (e.g., PABRA, TAAT, etc.)

4. WP3: Key TOC assumptions and risks

Key assumptions	Key risks
• IPDM innovations against the prioritized pests and diseases of food crops are eco-friendly, effective, affordable and scalable. • Innovation partners are interested in co-designing, integrating and validating IPDM innovations • Development partners, including farmers, are interested in hosting IPDM on-farm trials and participate actively in the scaling process. • Policy/decision makers in target LMICs are keen to promote eco-friendly IPDM innovations in place of low-cost but toxic conventional pesticides. • Farmers are willing to pay for IPDM innovations, and markets/consumers are willing to pay for "clean" food produced using IPDM innovations.	• Rapid emergence of new pest and pathogen strains and extreme weather events (climate variability) may offset some of the IPDM gains. • Absence of cost-effective IPM components (e.g., biopesticides, biocontrol agents, etc.) • Unfavorable policies, regulatory frameworks, and low-cost conventional pesticides may affect adoption and scaling of IPDM innovations. • Low interest of policy/decision makers in promoting IPDM innovations. • Shortage of R4D funds for the Plant Health Initiative to address critical gaps and make desired impacts. • The COVID-19 pandemic may affect some activities (field days, travel, face-to-face meetings etc.).

5. WP3: Interdependencies and synergies with other Work Packages (and other Initiatives if relevant)

- Outputs from WP1 and WP2 shall be used for targeting IPDM innovations under WP3. WP3 will also work in active interface with WP5 on gender and social inclusion, communications, MELIA, and impact assessment.
- WP3 will have mutual dependence and synergies with various Global and Regional Initiatives under One CGIAR, especially:
    - **Genetic Innovations**: Accelerated Breeding; SeEdQUAL; MIPPI; Genebanks
    - **RAFS**: Excellence-in-Agronomy; RIIs
    - **System Transformation**: HER+; Digital Tools

  Detailed documents are developed to identify synergies with different One CGIAR Initiatives (e.g., ABI, EiA, SeEdQUAL) and to guide harmonized implementation of critical functions.

6. WP3: Links to Innovation Package and Scaling Readiness Plan

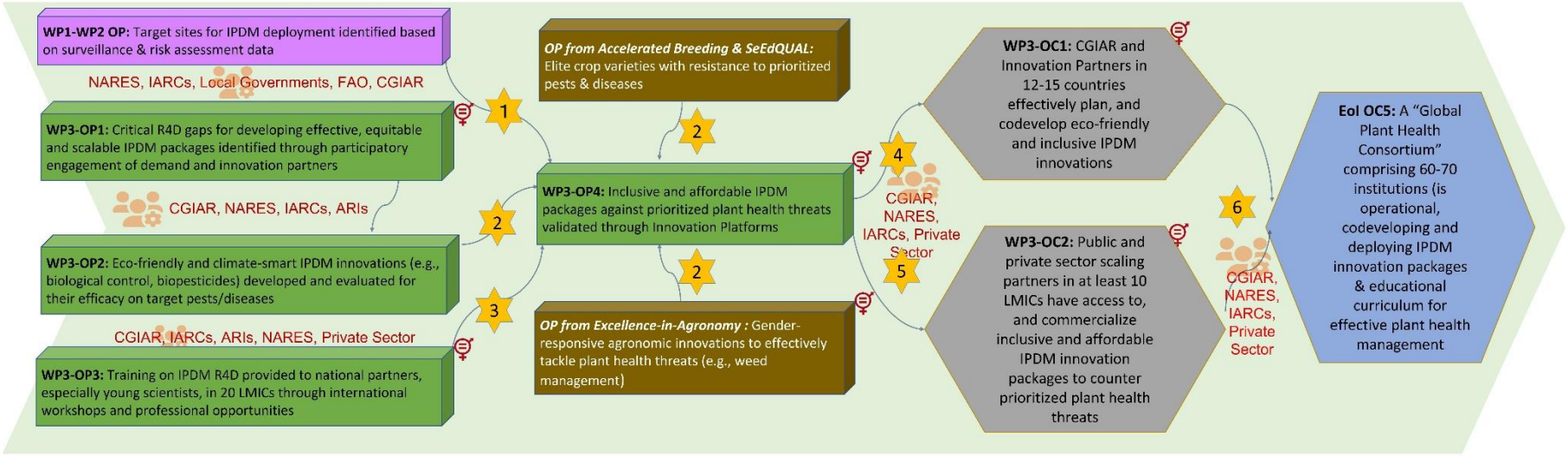
All the WP3 relevant innovations have been rigorously evaluated following the scaling readiness approach and potential impacts. In Phase 1 (2022–2024), major focus will be on those innovations that are either already in use or under piloting in the target geographies to ensure development outcomes and impacts. At the same time, WP3 will devote attention to specific IPDM innovations that have the potential to address critical gaps and can be scaled in Phase 2 (2025–2030). This balance is critical for ensuring sustainability and a strong pipeline of plant health innovations for the years to come.

Measuring and managing performance and results

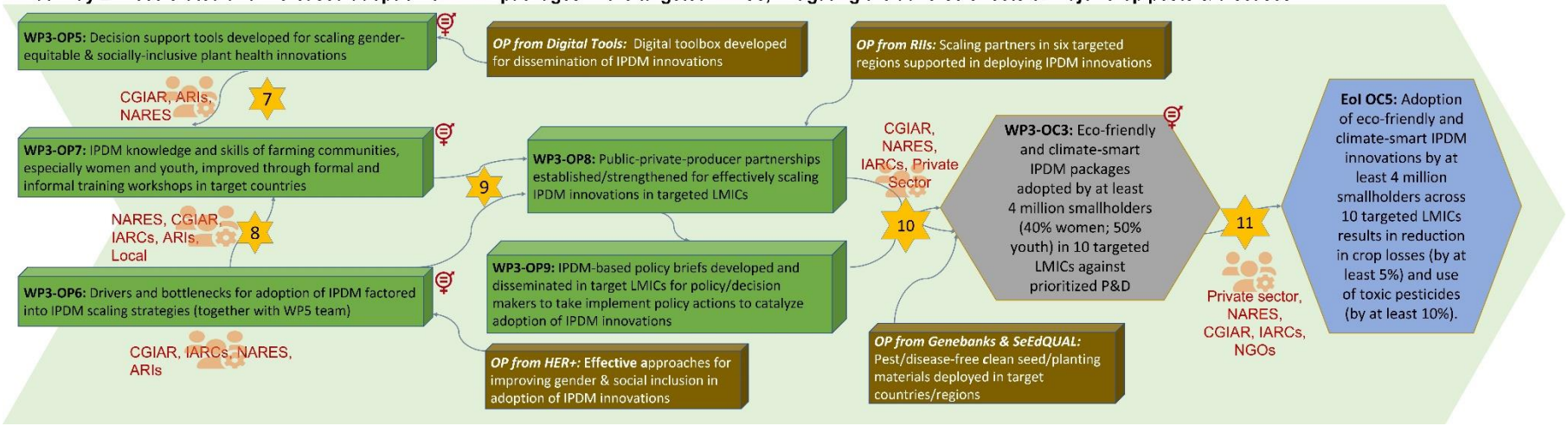
The details are captured in the Results Framework, with indicators, data sources, data collection methods, baseline and target values in Section 6.1, Section 6.2 (Planned MELIA studies and activities), and Section 5.1 (Projected Benefits by 2030).

WP3: Integrated Pest and Disease Management for Threat Mitigation

Pathway 1: Effective, scalable and inclusive integrated pest and disease management (IPDM) packages developed/validated against prioritized plant health threats



Pathway 2: Accelerated and increased adoption of IPDM packages in the targeted LMICs, mitigating the adverse effects of major crop pests & diseases



Causal linkage #	From result	To result	Geographical dimension	Actor type	Expected actions	Assumptions
1	Target sites (”hot spots”) for IPDM innovations identified (**WP3-OP1**), based on global surveillance (**WP1**), coupled with risk assessment and forecasting results (**WP2**)	IPDM Innovation Platforms set up in target regions for validation of IPDM innovations against targeted plant health threats (**WP3-OP5**)	Global (with 20 target countries across ESA, WCA, CWANA, SA, SEA and LAC)	Innovation Partners (CGIAR, NARES, IARCs, ARIs), together with Demand Partners	Coordination with WP1 and WP2 in accessing relevant surveillance, modelling, and forecasting data and in jointly deciding on target sites for establishing IPDM Innovation Platforms in relevant countries/regions.	Partners provide necessary surveillance data in taking informed decisions on IPDM target sites, and in setting up Innovation Platforms.
2	Synergistic R4D on essential components of IPDM leading to formulation of IPDM packages against targeted plant health threats and their population changes (**WP3-OP3**), together with pest- and disease-resistant varieties (OP from **ABI and SeEdQUAL**) and agronomic innovations (OP from **EiA**) and informed by analysis of critical gaps (**WP3-OP2**).	Inclusive IPDM packages developed and validated against targeted pests/diseases through participatory engagement of innovation partners, including farming communities (**WP3-OP5**)	Global (with 20 target countries across ESA, WCA, CWANA, SA, SEA and LAC)	Innovation Partners (CGIAR, IARCs, ARIs, NARES, NGOs, Farming communities)	1) Validated IPDM components (e.g., host plant resistance, biological control, biopesticides, agro-ecological approaches) integrated to create synergistic IPDM innovations. 2) Coordination with WP5 on critical analysis of IPDM adoption gaps, especially from the perspective of women, youth and marginalized communities in LMICs. 3) Coordination with GII-ABI, GII-SeEdQUAL and RAFS-EiA for sourcing relevant innovations to formulate and validate IPDM innovations, together with Initiative outputs (WP3-OP3) against targeted plant health threats.	1) Elite varieties with at least partial resistance/tolerance to targeted P&D are developed through One CGIAR breeding pipelines. 2) Complementary IPDM components are available from One CGIAR and Innovation Partners. 3) National guidelines are available for registration and use of biological agents against targeted P&D.
3	Strengthening the IPDM R4D capacity of national partners in the LMICs, especially young scientists, through international training workshops, academic training and professional opportunities (**WP3-OP4**)	Innovation partners (including NARES) work effectively in formulating and validating inclusive and impactful IPDM packages (**WP3-OP5**)	Global (especially ESA, WCA, CWANA, Asia, LAC)	Demand and Innovation Partners (National Governments, CGIAR, NARES, IARCs, NGOs, Private sector)	1) Analysis of critical knowledge and skill gaps in IPDM R4D capacity of national partners in the target LMICs, and focused formal and informal training workshops to address those gaps. 2) Strengthening institutional linkages and partnerships for leveraging complementary strengths in IPDM.	The training opportunities will provide unique value to the national partners and will motivate them to actively contribute to the Plant Health Initiative.

4	Inclusive IPDM packages formulated and/or validated in Innovation Platforms against prioritized plant health threats in target regions (**WP3-OP5**)	Pipelines of validated and scalable IPDM innovations available for scaling across 20 targeted LMICs against prioritized plant health threats in major cereals, grain legumes, roots, tubers, banana, and vegetable crops (**WP3-OC1**)	Global (especially ESA, WCA, CWANA, Asia, LAC)	Innovation Partners (CGIAR, IARCs, ARIs, NARES, Private sector)	1) Coordination among innovation partners, including CGIAR, IARCs, ARIs, NARES and private sector in bringing together relevant innovations. 2) Validation of IPDM packages in six "Plant Health Innovation Platforms" to be established in the target regions (one each in ESA, WCA, CWANA, SA, SEA, LAC).	1) Timely contribution of technologies/innovations by innovation partners for validation. 2) Components of IPDM innovations are compatible with no significant negative trade-offs.
5	Capacity strengthening of national partners **(WP3-OP4)** and availability of inclusive, equitable and scalable IPDM Innovation Packages (**WP3-OP5**)	Partners in at least 12 LMICs (across Africa, Asia and LAC) develop improved capacity to effectively respond to dynamic needs of plant health management (**WP3-OC2**)	At least two targeted LMICs each in ESA, WCA, CWANA, SA, SEA and LAC	Innovation and Scaling Partners (NARES, CGIAR, IARCs, Private sector; Farming communities)	1) IPDM Training Modules developed and implemented for targeted crops, for capacity strengthening of national partners (both public and private). 2) IPDM Field Days and demos in target countries.	1) R4D partners in target LMICs are interested in learning about IPDM innovations. 2) Knowledge/skills related to IPDM are effectively put into practice by the institutions and individual users.
6	Institutional arrangement and synergistic R4D partnerships among CGIAR and partners in co-creating and validating IPDM Innovation Packages (**WP3-OC1**), together with stronger national capacity in effectively managing plant health threats of targeted crops (**WP3-OC2**)	A "Global Plant Health Consortium" operational and effective for co-creation and deployment of IPDM Innovation Packages against any existing / emerging plant health threat (**EOI-OC1 i.e., by 2030**)	20 targeted LMICs across ESA, WCA, CWANA, SA, SEA and LAC	Demand, Innovation and Scaling Partners for WP3	1) IPDM innovations are co-created, fine-tuned, validated and deployed through institutional synergies. 2) A "Plant Health Consortium" is established, for leveraging and synergizing global R4D efforts to effectively and timely tackle plant health threats in Africa, Asia and LAC.	1) Adequate funding is available to scale-up IPDM Innovation Packages in the 20 targeted LMICs. 2) Demand, Innovation and Scaling Partners continue with strong commitment for achieving the Initiative goals in both Phase-1 (2022–2024) and Phase-2 (2025–2030).

7	Decision support tools co-developed with **WP5** for deploying gender-equitable and socially inclusive plant health innovations (**WP3-OP6**), with complementary outputs from the **Digital Tools Initiative.**	IPDM capacity of extension staff and farming communities, especially women and youth, strengthened through digital tools, and formal and informal training workshops (**WP3-OP8**)	Global (especially ESA, WCA, CWANA, Asia, LAC)	Innovation and Scaling Partners (CGIAR, NARES, ARIs, IARCs, Farming Communities)	1) Systematic integration of digital toolboxes on major pests and diseases across CGIAR. 2) A "Plant Health Web Portal" developed, integrating P&D surveillance, diagnostics, risk assessment, and IPDM innovations. 3) Use of digital tools and Farmers' Field Schools for improving understanding of farming communities on IPDM.	Digital tools, together with a one-stop window ("Plant Health Web Portal"), will effectively enable stakeholders, including policy makers, for taking informed decisions, and will accelerate adoption and inclusive scaling-up of IPDM innovations in the target countries/regions.
8	Drivers and bottlenecks for scaling IPDM innovations identified **(WP3-OP7)**, guided by gender analysis **(WP5-OP2** and **OP from HER+)**.	IPDM capacity of farming communities, especially women and youth, strengthened through formal and informal training workshops **(WP3-OP8)**	Global (especially in ESA, WCA, CWANA, SA, SEA, and LAC)	Innovation and Scaling Partners (CGIAR, NARES, IARCs, Farming Communities)	Critical assessment of existing IPDM innovations using gender and social inclusion lens	Outputs from WP5, together with HER+, enable understanding of critical drivers and bottlenecks for IPDM adoption, and to devise appropriate scaling strategies.
9	IPDM capacity of farming communities, especially women and youth, strengthened through formal and informal training workshops **(WP3-OP8)**, together with **WP3-OP7**.	Public-private-producer partnerships established / strengthened for effectively scaling IPDM innovations in at least 12 targeted LMICs (**WP3-OP9**)	At least two targeted LMICs each in ESA, WCA, CWANA, SA, SEA and LAC	Scaling Partners (especially NARES, Private Sector, NGOs, Community-based Organizations)	1) Evidence-based and context-specific scaling approaches codeveloped with partners (under WP5) for inclusive scaling of targeted IPMD innovations. 2) Field-level gender-responsive participatory demonstration and interventions undertaken by local partners with youth and women farmers' leadership.	Strong demand exists or can be created in development partners for scaling IPDM innovations in targeted LMICs, and to reach out especially to women, young farmers, and marginalized communities.
10	IPDM-based conducive policy actions implemented in at least 10 targeted LMICs based on communications to decision/policy makers **(WP3-OP10)**, together with **WP3-OP9** and **complementary OPs from Genebanks, SeEdQUAL and RIIs**.	Eco-friendly and climate-smart IPDM packages adopted by at least 5 million farm households across 12 targeted LMICs against prioritized crop pests and diseases **(WP3-OC3)**	At least two targeted LMICs each in ESA, WCA, CWANA, SA, SEA and LAC	Scaling Partners (especially NARES, Private Sector, NGOs, Community-based Organizations)	1) Engagement with policy/decision makers in targeted LMICs for bringing conducive policy actions that promote IPDM innovations. 2) Aggressive extension activities (both public and private) to ensure rapid scaling of IPDM packages 3) Impact evaluation of IPDM innovations (together with WP5) to demonstrate the benefits to policy makers and funders.	1) Policy makers are interesting in considering science-based evidence to introduce, incentivize and promote relevant IPDM innovations in plant health management. 2) Adequate funding for WP3 for scaling IPDM packages. 3) Development partners are interested in scaling IPDM innovations, and farming communities find the IPDM innovations beneficial for their food and nutritional security.

11	Eco-friendly and climate-smart IPDM packages adopted by at least 4 million farm households across 12 targeted LMICs against prioritized crop pests and diseases **(WP3-OC3)**	Crop losses (in terms of both yield and quality) due to pests and diseases decreased by at least 15% across 20 targeted LMICs, concomitant with reduction in use of toxic pesticides by at least 20% **(EOI OC2 i.e., by 2030)**	Global (especially 20 targeted LMICs across ESA, WCA, CWANA, SA, SEA, and LAC)	Demand, Innovation and Scaling Partners across the Initiative	1) Continue monitoring emergence of new plant health threats, and leverage the partnership network to quickly develop, validate and deploy appropriate IPDM innovations. 2) Scale up IPDM innovations from the initial 12 focus countries to 20 LMICs in partnership with relevant institutions. 3) Undertake impact evaluation (WP5 and SPIA) of identified IPDM innovations across multiple target crops to empirically assess the benefits to crop production, poverty alleviation, and food security in the target countries.	1) Farmers are willing to pay for IPDM innovations, and consumers are interested in buying and promoting “clean food” produced using IPDM innovations. 2) Funders invest adequately in WP3. 3) Governments in target LMICs remain stable, and are committed to support implementation of IPDM work.

Work Package title	**WP4: Tools and processes for protecting food chains from mycotoxin contamination**
Work Package main focus and prioritization (max 100 words)	WP4 will design and deploy two innovations for reducing mycotoxin contamination to protect health, increase food/feed safety, enhance trade, diversify end-use, and boost income: (i) IMM with pre- and post-harvest innovations and a traceability system from field-to-fork; and (ii) Aflasafe, a bioprotectant against aflatoxin. Key criteria used to prioritize the designing and deploying the innovations are: 1. Importance and enhanced vulnerability to mycotoxins due to changes in climate and agricultural practices; 2. Scaling readiness and demand for the innovations; 3. Comparative advantage of One CGIAR and its partners; and 4. Proven/potential adoption, PPP partnerships, impacts of innovations.
Work Package geographic scope (global/region/country)	Selected LMICs in Africa (and Latin America, to a minor extent); see https://bit.ly/3lWXiv2

The science:

1. WP4 research questions, scientific methods and key outputs:

WP4 key research questions	**Scientific methods**	**Key outputs**
Which are the priority mycotoxins, crops, countries for targeting innovations to create large-scale impact?	Literature review; database analysis consultations with experts/stakeholders	Report on mycotoxin-crop-countries where interventions would have most impact and mitigation strategy
Which among multiple components of IMM are necessary for cost-effective mycotoxin reduction from field to fork, what are the bottlenecks for their adoption and ways to overcome them?	Comparative assessment of cost, effectiveness, ease of use, scalability and adoptability of IMM practices; field surveys; participatory research including gender analyses; stakeholder consultations; monitoring and evaluation of adoption of IMM technologies	• Report to assist evidence-based selection of IMM components • Women and youth's specific needs are incorporated in IMM design • Gender-responsive effective mycotoxin management innovations identified and scaling-ready • Decision tool to guide implementation of IMM

How best to integrate and cost-effectively scale up biocontrol, crop management, post-harvest, genetics, institutional and policy innovations and other strategies for sustainable IMM?	Stakeholder mapping and consultations; convergence innovation analysis; public-private partnerships; traceability system with digital backbones; communication tools; evaluation of adoption of current mycotoxin management tools; mycotoxin sampling and analytical tools, designing effective programs; experiments on formulations/methods of application (rate), manufacturing process validation, field effectiveness validation	• 20 national extension and private agencies in crop value chains use IMM to reach 350,000 farmers • Effective IMM technologies identified and bundled to reduce contamination by 80% • Report/manual for best approaches to converge innovations; linkages and synergies established with complementary Initiatives • Improved formulations; recommendations for improved biocontrol usage/dosage
What is the best approach to develop atoxigenic strain-based bioprotectants in key African and Latin American countries?	Microbiological, chemical, and molecular tools to select superior atoxigenic strains; effectiveness trials, stakeholder consultations to fast-track registration of bioprotectants; registration dossier preparations; PPP	Six bioprotectants registered with regulators for further scaling
i) What is required to identify private sector partners for bioprotectant manufacturing and distribution (M&D) and ii) what are the best approaches to technically backstop them?	Guides for 5-step Aflasafe commercialization tool Factory design; process analysis; quality analysis; capacity development; demonstrations	• Four M&D of aflatoxin bioprotectants licensed • 400,000 ha treated with bioprotectants
What are the optimal processing technologies to reduce mycotoxin content in foods, and what are the best alternative uses for unsafe foods/feeds?	Nixtamalization and fermentation treatments; sensory evaluation; nutrient analysis; mycotoxin quantification; resource use; Contaminated grains evaluated as substrate in insect farm, mushroom cultivation; alcohol production; analysis of mycotoxin breakdown metabolites	• Knowledge and recommendations on optimal processing practices to reduce mycotoxin in foods • Value created (instead of destruction or illegal use), for contaminated crops
Which are the priority mycotoxins, crops, countries for targeting innovations to create large-scale impact?	Literature review; database analysis consultations with experts/stakeholders	Report on mycotoxin-crop-countries where interventions would have most impact and mitigation strategy

The theory of change:

2. WP4: Causal processes

- Demand partners will help to develop, test, and register mycotoxin management innovations and will benefit from developed and deployed IMM innovations and networks. Innovation partners will co-create and complement WP4 innovations. Scaling partners will stimulate demand and deploy the IMM solutions to demand partners and farming communities.
- Women play significant roles in post-harvest and processing. Their needs are incorporated in IMM design to ensure equitable and inclusive innovations and scaling.
- Key research questions addressed, and cost-effective innovations co-developed with active engagement of researchers, farmers, input suppliers, policymakers, regulators, private sector, and development partners. For available innovations, we will use the scaling readiness approach for deployment, in partnership with RIIs, with gender and social inclusion firmly in view. For Aflasafe, the 5-phase approach for commercialization will be used.
- Innovation platforms (IPs) in target geographies will empower local communities, including skill improvement and knowledge of farmers and extension staff, and for further fine-tuning the IMM innovations.
- For scaling, we will partner with public and private organizations, including policymakers, to promote wider adoption and adequate investment, and correct use of the innovations. During the process, we will learn and exchange knowledge following principles of Community of Practice.

3. WP4: Key demand, innovation and scaling partners

Key demand partners include NARES and Ministries of Agriculture/Health; NGOs; farmers' groups; commodity associations, private sector (e.g., processors), and One CGIAR RIIs.

Key innovation partners include NARES, ARIs/Universities (e.g., USDA-ARS, McGill University), private sector (e.g., MARS, GRUMA).

Key scaling partners include UN (e.g., WFP, FAO), regional organizations (e.g., AU-PACA, CCARDESA, COMESA, EAC, ECOWAS); NARES; private sector (e.g., HarvestField Industries, UPL, AtoZ Textiles, Samil Industrial, Provivi).

4. WP4: Key TOC assumptions and risks

Key assumptions	Key risks
• Mycotoxin management tools are available, cost-effective, scalable. • Demand for mycotoxin-safe foods/feeds exists. • Farmers, private sector, and development partners are interested to co-develop mycotoxin management tools. • Bioprotectants become registered. • Food processing methods reduce mycotoxin and are accepted. • Markets and consumers are willing to pay for mycotoxin-safe food and feed.	• Unfavorable policies, regulatory frameworks, lack of market incentives may affect development, adoption, and scaling of IMM innovations. • Low awareness of mycotoxins. • Decision makers unwilling to invest in and promote IMM innovations. • Inadequate funds to address critical gaps for desired impacts.

5. WP4: Interdependencies and synergies with other Work Packages (and other Initiatives if relevant)

- Outputs from WP1 and WP2 (e.g., mycotoxin risk models, novel ICT tools for traceability systems; surveillance system), and WP3 (IPDM recommendations) will be used in decision making in WP4. WP4 will interface with WP5 on gender and social inclusion, communications, MEL and impact assessment for effective scaling, adoption, and correct use of IMM innovations.
- WP4 will have mutual dependence and synergies with various Global and Regional Initiatives:

  Genetic Innovations: Accelerated Breeding; SeEdQUAL
  RAFS: RIIs
  System Transformation: HER+; Markets; Digital Tools

6. WP4: Links to Innovation Package and Scaling Readiness Plan

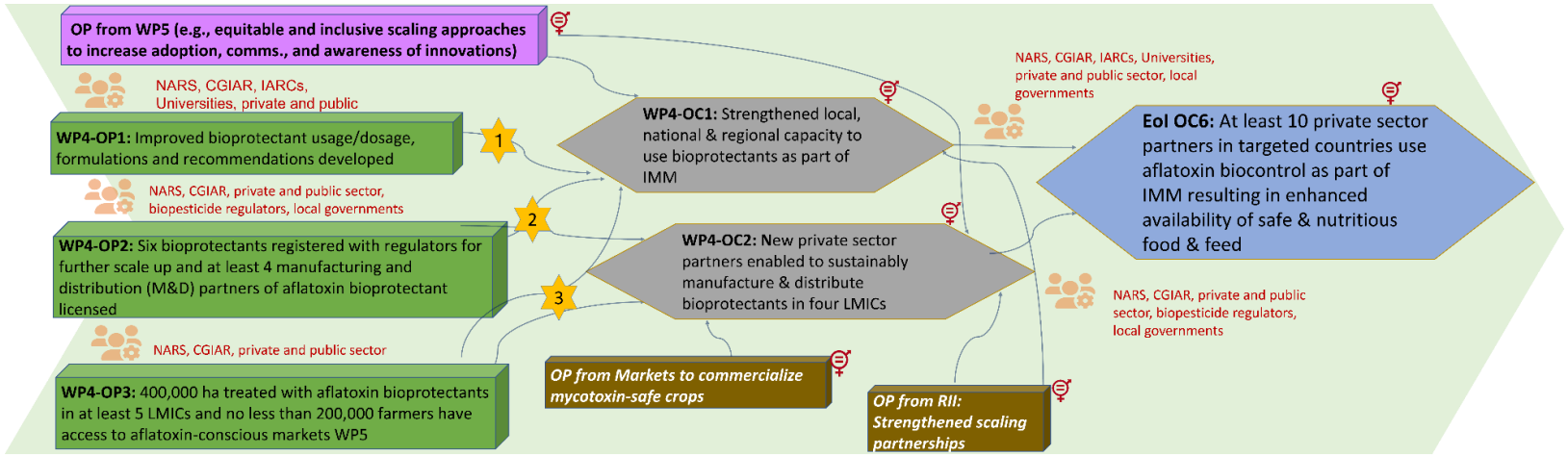
Mycotoxin management innovations will be rigorously evaluated following the One CGIAR scaling readiness approach. For Aflasafe, the 5-phase approach will be used. In Phase 1 (2022–2024), major focus will be on innovations currently in-use at scale to foster outcomes and impacts. Innovations being piloted or under development with potential to contribute to successful IMM can be scaled in subsequent phases. This balance is critical for ensuring impact during Phase 1 (2022–2024), sustainability and a strong pipeline of mycotoxin management innovations for subsequent phases.

Measuring and managing performance and results

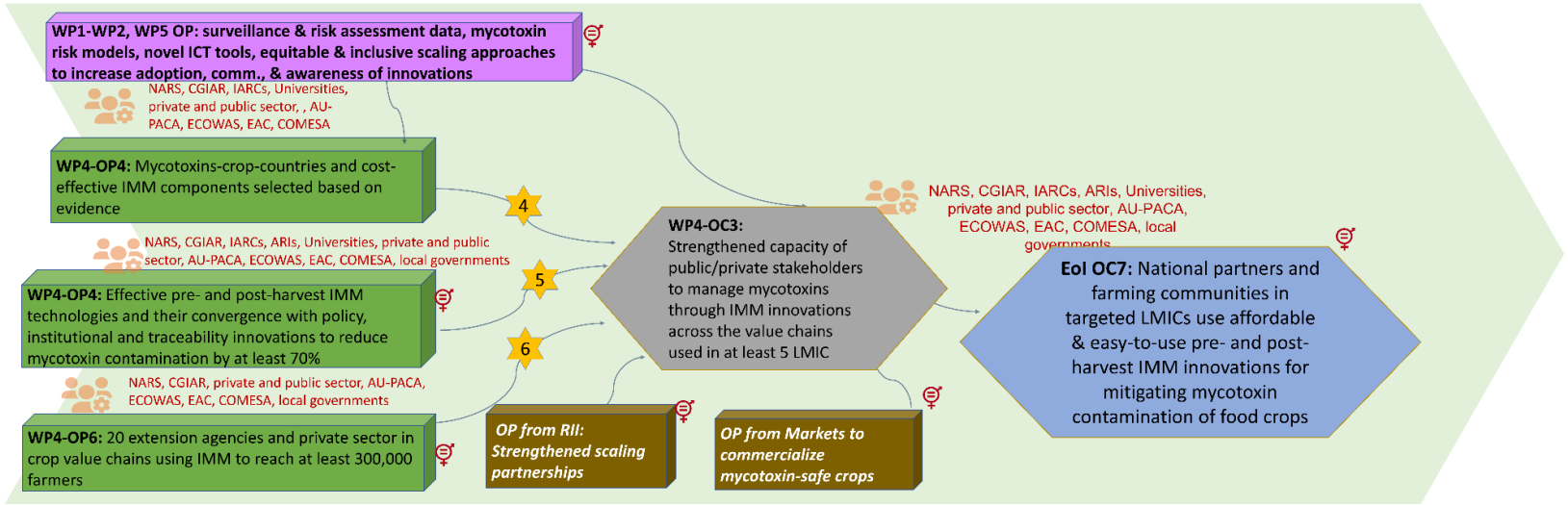
The details are captured in the Results Framework, with indicators, data sources, data collection methods, baseline and target values in Section 6.1, Section 6.2 (Planned MELIA studies and activities), and Section 5.1 (Projected Benefits by 2030).

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

Pathway 1: Aflasafe, a bioprotectant against aflatoxin contamination



Pathway 2: An integrated mycotoxin management (IMM) and traceability system from field-to-fork



Causal linkage #	From result (name)	To result (name)	Geographical dimension	Actor type	Expected action	Assumption
1	**WP4-OP1:** Improved bioprotectant usage/dosage, formulations and recommendations developed	**WP4-OC1:** Local, national and regional partners in at least 8 LMICs use bioprotectants as a part of IMM.	Selected LMICs in Africa (Nigeria, Kenya, Senegal, Mali, Burkina Faso, Tanzania, Mozambique) and LAC (Mexico)	Scaling partners, private sector NARES, CGIAR, IARCs, ARIs, Universities, UN, RPPOs, NPPOs	Coordination with Work Packages 1,2,5, private sector, Markets, scaling partners	Mycotoxin management tools are available, cost-effective, and scalable. Demand for mycotoxin-safe foods/feeds exists. Farmers, private sector, and development partners are interested to co-develop mycotoxin management tools. Bioprotectants become registered. Willingness to pay for mycotoxin-safe food and feed.
2	**WP4-OP2**: Six bioprotectants registered with regulators for further scale up and at least 4 manufacturing and distribution (M&D) partners of aflatoxin bioprotectant licensed	**WP4-OC1**: Local, national and regional partners in at least 8 LMICs use bioprotectants as a part of IMM. **WP4-OC2**: New private sector partners enabled to sustainably manufacture and distribute bioprotectants in four LMICs	Four selected LMICs in Africa (Uganda, Sudan, Mali, Malawi)	Scaling partners, private sector NARES, CGIAR, IARCs, ARIs, Universities, UN, RPPOs, NPPOs	Coordination with Work Packages 1,2,5, private sector, Markets, scaling partners	Mycotoxin management tools are available, cost-effective, and scalable. Demand for mycotoxin-safe foods/feeds exists. Farmers, private sector, and development partners are interested to co-develop mycotoxin management tools. Bioprotectants become registered. Willingness to pay for mycotoxin-safe food and feed.
3	**WP4-OP3**: ~400,000 ha of maize area treated with aflatoxin bioprotectants in at least 5 LMICs, and no less than 200,000 farmers have access to aflatoxin-conscious markets.	**WP4-OC1**: Local, national and regional partners in at least 8 LMICs use bioprotectants as part of IMM. **WP4-OC2**: New private sector partners enabled to sustainably manufacture and commercialize bioprotectants in four LMICs	Selected LMICs in Africa and LAC	Scaling partners, private sector NARES, CGIAR, IARCs, ARIs, Universities, UN, RPPOs, NPPOs	Coordination with Work Packages 1,2,5, private sector, Markets, scaling partners	Mycotoxin management tools are available, cost-effective, and scalable. Demand for mycotoxin-safe foods/feeds exists. Farmers, private sector, and development partners are interested to co-develop mycotoxin management tools. Bioprotectants become registered. Willingness to pay for mycotoxin-safe food and feed.

4	**WP4-OP4**: Mycotoxins-crop-countries and cost-effective IMM components selected based on evidence	**WP4-OC3**: Public/private stakeholders in at least 5 LMICs effectively manage mycotoxins through IMM innovations across the value chains	Global, with particular focus on LMICs in Africa (major: Nigeria, Kenya, Ghana, Burkina Faso), Asia and Latin America (minor: Mexico)	Scaling partners, private sector NARES, CGIAR, IARCs, ARIs, Universities, UN, RPPOs, NPPOs	Coordination with Work Packages 1,2,3, 5, private sector, Markets, RII, scaling partners	Mycotoxin management tools are available, cost-effective, and scalable. Demand for mycotoxin-safe foods/feeds exists. Farmers, private sector, and development partners are interested to co-develop mycotoxin management tools. Food processing methods, like maize alkaline cooking, reduce mycotoxin. Markets and consumers are willing to pay for mycotoxin-safe food and feed.
5	**WP4-OP4**: Effective pre- and post-harvest IMM technologies and their convergence with policy, institutional and traceability innovations to reduce mycotoxin contamination by at least 70%	**WP4-OC3**: Public/private stakeholders in at least 5 LMICs effectively manage mycotoxins through IMM innovations across the value chains	Global, with particular focus on LMICs in Africa (major), Asia and Latin America (minor)	Scaling partners, private sector NARES, CGIAR, IARCs, ARIs, Universities, UN, RPPOs, NPPOs	Coordination with Work Packages 1,2,3, 5, private sector, Markets, RII, scaling partners	Mycotoxin management tools are available, cost-effective, and scalable. Demand for mycotoxin-safe foods/feeds exists. Farmers, private sector, and development partners are interested to co-develop mycotoxin management tools. Food processing methods reduce mycotoxin. Key IMM technologies are cost-effective and acceptable to farmers Consumers will accept processed (e.g., alkaline-cooked products) foods. Markets and consumers are willing to pay for mycotoxin-safe food and feed.
6	**WP4-OP6**: At least 20 extension agencies and private sector in crop value chains using IMM to reach at least 300,000 smallholders.	**WP4-OC3:** Public/private stakeholders in at least 5 LMICs effectively manage mycotoxins through IMM innovations across the value chains	Global, with particular focus on LMICs in Africa (major), Asia and Latin America (minor)	Scaling partners, private sector NARES, CGIAR, IARCs, ARIs, Universities, UN, RPPOs, NPPOs	Coordination with Work Packages 1,2,3, 5, private sector, Markets, RII, scaling partners	Mycotoxin management tools are available, cost-effective, and scalable. Demand for mycotoxin-safe foods/feeds exists. Farmers, private sector, and development partners are interested to co-develop mycotoxin management tools. Food processing methods reduce mycotoxin. Markets and consumers are willing to pay for mycotoxin-safe food and feed.

Work Package title	**WP5: Equitable and inclusive scaling of plant health innovations to achieve impacts**
Work Package main focus and prioritization (max 100 words)	WP5's main focus is to develop approaches for gender-equitable and socially inclusive design and scaling of plant health innovations through multi-stakeholder partnerships, inter-disciplinary research and effective communications. WP5 has four priority areas: 1. Modulating innovations in coordination with other Work Packages to respond to varied demand towards equitable impacts; 2. Combining novel data collection with rigorous and gender-responsive impact evaluation methods; 3. Interdisciplinary approaches for bringing innovations to market through value chain analyses and interventions; and 4. Generating relevant science-based evidence to catalyze plant health-related policy changes through effective communications and outreach.
Work Package geographic scope (global/region/country)	Global, with activities implemented in specific LMICs in Africa, Asia, and Latin America; see https://bit.ly/3lWXiv2

The science:

1. WP5 research questions, scientific methods and key outputs:

WP5 key research questions	Scientific methods	Key outputs
Pathway 1: Gender-responsive and socially inclusive needs assessment, context analysis to inform technology/tool development and adjustment		
• How do socio-economic conditions, enabling environments, and gender relations shape the practices, constraints, and needs of resource-constrained women, men, and youth in crop protection? • What are the barriers for adoption of plant health innovations by different social groups of women, men and youth?	• Qualitative diagnostic research to understand local knowledge, gender divisions of labor, migration and decision making, and practices • Gender-responsive participatory research on understanding the barriers for adoption of plant health innovations • Gender-disaggregated and context tailored baseline survey	• OP1: Valid tools and analytic methods on field-level needs assessment • OP2: Gender- and generation-specific constraints and aspirations, and farmers and societal orientated needs identified based on participatory approach • OP3: Valid interdisciplinary tools and methods on detection by farmers/plant doctors for improved diagnostic and surveillance • OP4: Decision support tools for deploying gender-equitable and socially inclusive plant health innovations
Pathway 2: Equitable and inclusive approaches to implementing and evaluating plant health innovations		

How effectively can different methods deliver plant health innovations to targeted smallholder farmer groups, including women and youth in marginalized communities?	• Mixed methods, randomized controlled trials (RCTs), behavioral nudges, gender-disaggregated household surveys • Analyses of social networks and information flow • Critical analyses of digitalization for marginalized communities with low digital literacy and infrastructure • Analyses of decision-making process at the household and community levels • Participatory videos	OP5: Equitable, inclusive, and cost-effective methods to promote adoption of plant health innovations
What are the dynamic and heterogeneous impacts of plant health innovations on environmental safety, land productivity, food quality, food and nutrition security, employment, and livelihoods of the poor?	Mixed methods, RCTs, quasi-experimental methods (DID, RDD, etc.), gender-disaggregated household surveys, big data from remote sensing, crowdsourcing, etc.	OP6: Policy-relevant evidence generated based on causal impact evaluation that considers equity, cost effectiveness and ecological aspects
Pathway 3: Communications for policy change and facilitating scaling		
What are the bottlenecks for institutional coordination and communications at local and national levels?	A policy analysis (by interviewing decision-makers and practitioners to understand their perceptions) Stakeholder workshops	OP7: A digital platform on plant health with national and regional coordination established

The theory of change:

2. WP5: Causal processes

WP5 will develop approaches for scaling of plant health innovations in target LMICs (in close coordination with other Work Packages) by providing insights from social and economic contexts and ensuring equitable access to and impacts of technologies. To achieve this, WP5 will adopt the following strategy in Phase 1 (2022–2024):

1) gender-awareness training to farming communities, extension workers, and NARES partners in selected countries, and to global interdisciplinary teams; 2) socio-economic data collection and analysis together with NARES partners. These two activities will empower women and young scientists and stakeholders to increase knowledge and skills on interdisciplinary approaches to crop protection. 3) WP5 will organize multi-stakeholder engagement, including: a) a robust framework for stakeholder identification and engagement; b) policy analysis to understand institutional coordination, current priorities and perceptions of decision-makers, both public and private; c) establishment of a research-learning and communication platform to consolidate knowledge and provide evidence-based recommendations to decision-makers and stakeholders at various levels; d) Workshops/ webinars for targeted audience such as decision-makers, public and private sector partners, donors, etc. to ensure that the lessons learned from Work Packages 1-5 guide decision-makers and stakeholders on plant health management and are reflected in relevant policies and planning.

3. WP5: Key demand, innovation and scaling partners

Key demand partners include NARES and the Ministries of Agriculture in the target LMICs in Africa, Asia, and Latin America; and One CGIAR RIIs.

Key innovation partners shall include: icipe Social Science and Impact Assessment Unit, CABI Development Communication and social science teams, IPM Innovation Lab, FAW R4D International Consortium (Women as IPM leaders Program), CGIAR GENDER Platform, etc.

Key scaling partners:
Global: FAO FFS Global Platform, CABI Development Communication and Social Science teams
Regional organizations: CGIAR Regional Initiatives
Country-level: NARES institutions, NGOs, Private sector partners

4. WP5: Key TOC assumptions and risks

Key assumptions	**Key risks**
Close collaboration between R4D teams and development partners allows for a rigorous impact evaluation.	• Fieldwork may be interrupted by unexpected scenarios (such as pandemics and conflicts). • Insufficient funding to support multiple-round gender-disaggregated household surveys that are required to generate relevant data. • Some of the impacts of plant health innovations may materialize over a long period (i.e., beyond Phase 1).
Gender-responsive and socially inclusive approaches to plant health management are adopted by national and regional partners. The ability of women and youth in IPDM decision-making and adoption is increased as a result of addressing major barriers to adoption of relevant plant health innovations.	• Male dominance in decision makers and practitioners • Low interest of policy/decision makers in promoting gender-responsive approaches • Shortage of R4D funds for the Plant Health Initiative to address critical gaps and make desired impacts or to support envisaged activities of WP5.
Consumers have accurate information on food quality and trust the accuracy of information generated by plant health teams. Consumers are willing to pay higher prices for plant health innovations, leading to pesticide-free and mycotoxin-safe food.	• Consumers may not trust the information on food quality (e.g., food label of “pesticide-free” and “mycotoxin-safe”). • Although sufficient price premium to producers provides a sustainable incentive of adoption of IPDM and/or mycotoxin reduction measures, the effects may materialize beyond Phase 1. • Consumers choose to avoid produce that they learn could be risky — rather than pay more to access safer sources.
Efficient communication and coordination models will help deliver social behavioral changes at field level and policy change at national/regional level.	• Low interest of policy/decision makers in promoting gender-responsive approaches • Shortage of R4D funds for the Plant Health Initiative to address critical gaps and to make desired impacts.

5. WP5: Interdependencies and synergies with other Work Packages (and other Initiatives if relevant)

Research questions addressed in WP5 are closely linked to WP1 to WP4. Outputs from the other Work Packages will be channelized through WP5 to inform decision makers at the national, regional and global levels. WP5 will have mutual dependence and synergies with various Global and Regional Initiatives under One CGIAR, especially:

- HER+: Harnessing equality for resilience in the agrifood system (in terms of research methods on gender norms and relations, and gender transformative approaches);
- One Health (in terms of approaches to disease prevention and management at a field level and impact assessment methods);
- Rethinking Food Markets and Value Chains for Inclusion and Sustainability (in terms of market incentives to promote the diffusion of investments/innovations along value chains).

6. WP5: Links to Innovation Package and Scaling Readiness Plan

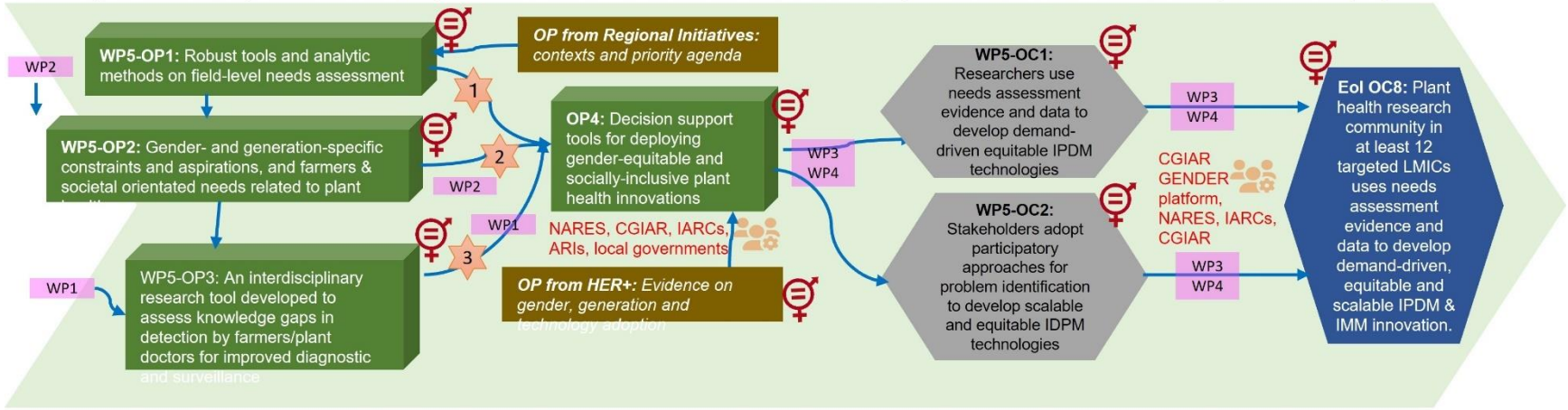
All the WP5 related innovations will be rigorously evaluated following the scaling readiness approach. In Phase 1 (2022–2024), a major focus will be on those plant health innovations that are already in use or under piloting in the target geographies to ensure development outcomes and impacts. At the same time, the Initiative will also devote attention to specific innovations that have the potential to address critical gender and disciplinary gaps in integrated disease/pest management and can be scaled in Phase 2 (2025–2030).

Measuring and managing performance and results

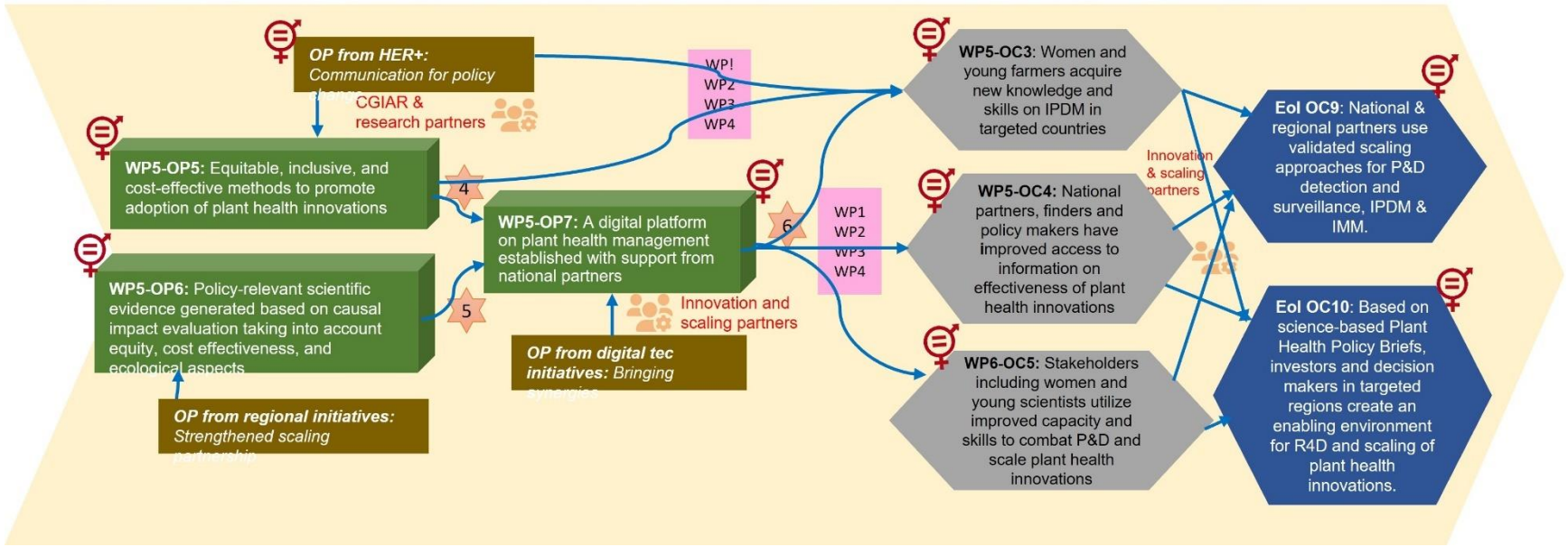
The details are captured in the Results Framework, with indicators, data sources, data collection methods, baseline and target values in Section 6.1, and Section 6.2 (Planned MELIA studies and activities).

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

Pathway 1: Gender-responsive and socially-inclusive needs assessment, and context analysis to inform innovation development and deployment



Pathway2: Facilitating scaling of plant health innovations using evidence-based communications for enabling policy environment



Causal linkage #	From result	To result	Geographical dimension	Actor type	Expected actions	Assumptions
1	Robust tools and analytical methods on field-level needs assessment **(WP5-OP1)** enable researchers to identify gender- and generation-specific constraints, aspirations, and farmers and societal orientated needs related to plant health innovations **(WP5-OP2)**	Researchers use needs assessment evidence and data to develop demand- driven and equitable IPDM innovations **(WP5-OC1 and WP3&4 OC)**	Global with specific case studies from Asia and SSA	Research (CGIAR and Partners)	• Qualitative needs assessment is conducted in three crops/innovations which are highly relevant to women for gender transformation • Needs assessment data and evidence are shared with CGIAR and innovation partners	• NARES and CGIAR researchers need better understanding of context-specific farmers' needs, current practices and constraints related to crop protection. • Needs assessment data will enable NARES and CGIAR researchers to address gender, socio-economic, and environmental barriers to adoption of plant health innovations.
2	Decision support tools developed for deploying gender-equitable and socially inclusive plant health innovations **(WP5-OP2&4)**	Stakeholders use decision support tools and participatory approaches for scale IPDM and IMM innovations **(WP5-OC2 and WP3&4 OC)**	Targeted LMICs in SSA, Asia and LAC	Research (CGIAR and innovation partners) and scaling partners	• Collaboration between Initiative team and Digital Tools Initiative to develop digital decision support tools. • Feedback from WP3&4 incorporated in the decision support tools before scaling.	
3	An interdisciplinary research tool developed to assess knowledge gaps in detection by farmers/plant doctors for improved diagnostic and surveillance **(WP5-OP1&3)**	Initiative researchers use robust and validated tools to assess farmers' and Plant Doctors' P&D knowledge and skills, and implement appropriate capacity strengthening plans **(WP1-OC)**	Targeted LMICs in SSA, Asia and LAC	Research (CGIAR and partners) and innovation partners, with farming communities	• Critical gender- and generation-based gaps in knowledge and technical skills identified • WP1 conducts training on P&D diagnostics and surveillance to improve the knowledge and skills for farmers/plant doctors	Significant knowledge gaps exist in farming communities and Plant Doctors regarding P&D diagnostics. Such gaps could be effectively filled by capacity building.

4	Equitable, inclusive, and cost-effective methods to promote adoption of plant health innovations **(WP5-OP5)**	Women and young farmers acquire new knowledge and skills on IPDM in targeted countries **(WP5-OC3)**	Targeted LMICs	Research (CGIAR and partners) Scaling partners	• Existing approaches to introducing innovations are crucially examined to, and better approaches to reaching women and youth are identified by using both primary and secondary data. • Training is conducted to extension workers and stakeholders on gender-responsive approaches. • Stakeholder workshops to present methods and results	Women and youth face specific constraints in access to new innovations, while limited attention is paid to social barriers in traditional extension work. Gender-responsive approaches and extension workers' gender-awareness can help deliver innovations to more women and youth from which they benefit.
5	Policy-relevant scientific evidence generated based on causal impact evaluation, taking into account equity, cost effectiveness, and ecological aspects **(WP5-OP6)**	National partners, finders and policy makers have **i**mproved access to information on effectiveness of plant health innovations **(WP5-OC4)**	Targeted LMICs	Research (CGIAR and innovation partners) Scaling partners	• Causal impact evaluation is conducted in selected cases. • Feedback from WP1-4 teams used to improve impact evaluation methods • Science-based evidence on IPDM and IMM innovations communicated to policy makers and relevant to stakeholders • Specific impact assessment model cases documented for communication and knowledge-sharing; feedback from stakeholders received. • Specific success stories on plant health management identified, documented and shared with policy makers and other relevant stakeholders.	Science-based evidence on the impacts of plant health innovations needed by funders and policy makers for creating an enabling environment for strengthening investment on plant health research and development.
6	A digital platform on plant health management established with support from national partners **(WP5-OP7)**	Stakeholders including women and young scientists utilize improved capacity and skills to combat P&D and scale plant health innovations **(WP5-OC5, and WP1-4 OCs)**		Scaling partners: NARES, CGIAR, IARCs, ARIs, Universities, UN, RPPOs, NPPOs	• Organize a stakeholder workshop with relevant organizations for coordination and planning • Design and deploy a digital toolbox for sharing plant health data and knowledge • Establish a Plant Health Community of Practice for dynamic exchange of relevant information and knowledge.	Currently, various organizations have their own digital platforms with a focus on specific discipline, crop(s) and regions. A consolidated digital platform will enable effective exchange of plant health knowledge among researchers, scaling partners, decision-makers and funders.

4. Innovation Packages and Scaling Readiness Plan

Plant health threat management, including establishment of a global diagnostic and surveillance system, and developing/validating and scaling IPDM and IMM innovations, are knowledge- and resource-intensive. These require extensive partnerships both internally and externally. To co-develop/validate impactful Innovation Packages around the core innovations, the Initiative will partner with an array of institutions globally, including IARCs, NARES, ARIs in Global North/South, and private sector.

The Initiative will have strong complementarities/synergies with several One CGIAR Initiatives, including (a) Accelerated Breeding, SeEdQUAL, MIPP and EiA on IPDM/IMM Innovation Packages (WP3/WP4); (b) Digital Transformation Initiative for creating "Global Plant Health Portal" and digital support tools (WP1-WP5) etc. In addition, two toolkits will be prepared for scaling beyond 2024: (a) Context-specific Behavioral Change Communications Toolkit to improve plant health knowledge and influence adoption and scaling of innovations by smallholders; and (b) Impact Toolkit (partnership with SPIA and HER+). Synergies built with complementary One CGIAR Initiatives (e.g., ABI; SeEdEQUAL; EiA) will enable concurrent delivery of IPDM/IMM innovations along with healthy and improved seed and agronomic advisory services. This will minimize scaling costs while maximizing the benefits to smallholders who depend on multiple innovations for building resilient, productive, safe, and profitable AFS.

The Initiative has allocated US$200K per year for hiring a dedicated staff member who will aid in designing and implementing Innovation Packages and Scaling Readiness Plan, including: (1) identification of bottlenecks for adoption and scaling of core innovations, especially by women and marginalized communities; (2) designing a scaling strategy, including PPPs for improving access to proven, affordable and profitable IPDM and IMM innovations; (3) institutional arrangements and capacity strengthening of stakeholders in partnership with RIIs; and (4) monitoring changes in adoption and scaling readiness of Innovation Packages. Decision support tools, including artificial intelligence-based apps and remote sensing, will be integrated to improve data collection, monitor effectiveness of interventions, and address MELIA needs. Lessons from scaling will aid in refining and improving delivery methods, overcoming bottlenecks, and identifying opportunities, especially for women and youth in rural communities in PH management.

5. Impact statements

5.1 Nutrition, health and food security

- ***Challenges and prioritization***
  The Initiative works on prioritized biotic threats to major food crops (cereals, food legumes, roots, tubers, bananas, and vegetables) important for the food and nutritional security of millions of farm families and consumers in the LMICs. The Initiative will have a huge contribution to food security and safety and improved nutrition by:
  (i) Decreasing losses in yield and quality of major food crops due to P&D through IPDM innovations.
  (ii) Increasing the resilience of crops and cropping systems through better preparedness to counter biotic threats, exacerbated by climate variability and changing farming practices, thereby increasing food security and farm profitability, and reducing food prices.
  (iii) Making food and feed safer for consumption by reducing pesticide and mycotoxin contamination in targeted crops, thereby improving human and animal health.
  (iv) Promoting inclusive and equitable scaling of IPDM innovations for self-sufficiency of food-insecure farm families who often experience significant production shortfalls due to P&D outbreaks.

- ***Research questions***
  - **WP1 and WP2**: What major P&D epidemics are affecting the agrifood systems in target regions?
  - **WP3**: Which IPDM innovations and their components can deliver game-changing improvements to PH management?
  - **WP4**: What specific components of IMM can cost-effectively reduce mycotoxin contamination from field to fork?
  - **WP4:** What are the optimal cultural/post-harvest processing methods to reduce mycotoxin contamination of foods?
  - **WP5**: What are the dynamic and heterogeneous impacts of plant health innovations on food quality and nutrition security?

- ***Components of Work Packages***
  - **WP1 and WP2:** Improved PH data management systems including data harnessing tools to predict current and emerging threats and their potential impact on food security
  - **WP3**: Eco-friendly, cost-effective, and scalable IPDM developed/validated innovations against targeted plant health threats.
  - **WP4**: Gender-responsive effective mycotoxin management innovations identified and used; knowledge and recommendations on optimal processing practices to reduce mycotoxin in foods.
  - **WP5**: Equitable, inclusive and cost-effective methods/tools to promote adoption of PH innovations; Policy-relevant evidence generated based on causal impact evaluation, considering equity, cost effectiveness and ecological aspects.

- ***Measuring performance and results***
  - National partners in at least 10 countries are part of a global diagnostic and surveillance network for exchanging knowledge on tools, methods and data on P&D to assess risks to food security
  - Eco-friendly and climate smart IPDM packages adopted by at least 5 million farm households across 12 targeted LMICs against prioritized crop pests and diseases.
  - IMM practices scaled out and effectively used by at least 300,000 farmers in five targeted LMICs, achieving 70% lower mycotoxin contamination.

- ***Partners:*** Partners under different Work Packages, including Governments, NARES, ARIs, IARCs, and private-sector institutions for monitoring and risk assessment of P&D threats, and

co-developing, validating and deploying cost-effective, environmentally safe IPDM and IMM innovations in the targeted LMICs.

- ***Human resources and capacity development of Initiative team:*** The team has well-experienced nutritional quality specialists.

5.2 Poverty reduction, livelihoods and jobs

- ***Challenges and prioritization***
  Protecting crop production and yields is as important as measures to increase productivity, as both contribute to reducing poverty, improving livelihoods, and creating opportunities for income generation. The Initiative focuses on developing and delivering eco-friendly innovations to detect and control P&D that are known to reduce annual crop production by 30 to 40%. This will be achieved by:
  (i) Implementing detection tools and eco-friendly IPDM to protect crop yields from P&D threats under smallholder farming conditions, thereby improving incomes and livelihoods, and reducing poverty.
  (ii) Anticipating shifts in P&D prevalence under present and changing climate scenarios and improving preparedness and respond to minimize the negative impacts of biotic risks to agriculture productivity.
  (iii) Effectively controlling sanitary and phytosanitary risks and improve access to regional and international markets for high-value plant/food/feed products produced in LMICs.
  (iv) Creating opportunities for private sector for manufacturing and supplying IPDM-based innovations and mycotoxin mitigation products, thereby raising employment among the poor, including women and youth.

- ***Research questions***
  Considering the range of P&D in targeted individual crops and their influence on crop yields and farmers' livelihoods, the following questions are critical:
  - **WP1 and WP3**: What are the economic impacts of key P&D on food security and livelihoods of farming communities in target LMICs, and how to effectively control them?
  - **WP4**: How best to integrate and cost-effectively scale up biocontrol, crop management, post-harvest, genetics, institutional and policy innovations, and other strategies for sustainable IMM?
  - **WP5**: How effectively can different methods deliver plant health innovations to targeted smallholder farmer groups, including women and youth in marginalized communities? What are the dynamic and heterogeneous impacts of plant health innovations on employment and livelihoods of the poor and environment?

- ***Components of Work Packages***
  - **WP1 and WP3**: Knowledge on the economic impacts of P&D in the targeted LMICs for effective targeting of plant health innovations, and for providing evidence-based information to policy makers and funders.
  - **WP4**: At least 20 national extension and private agencies in crop value chains use IMM to reach 300,000 farmers by 2024.
  - **WP5:** Equitable, inclusive, and cost-effective methods to promote adoption of plant health innovations. Policy-relevant evidence generated based on causal impact evaluation, considering equity, cost effectiveness and ecological aspects.

- ***Measuring performance and results***
  - Eco-friendly and climate smart IPDM packages adopted by at least 5 million farm households across 12 targeted LMICs against prioritized crop pests and diseases.
  - Private sector partners have strengthened their capacity to sustainably manufacture, distribute, and commercialize Aflasafe to nearly 200,000 farmers (~400,000 ha) in four targeted LMICs.

- ***Partners:*** Governments, NARES, ARIs, IARCs, and private-sector institutions deploying cost-effective, environmentally safe IPDM and IMM innovations in the targeted LMICs.

- ***Human resources and capacity development of Initiative team:*** The required human resources and technical skills are available in the Initiative team. Any critical gaps will be identified and addressed during the inception phase of the Initiative.

5.3 Gender equality, youth and social inclusion

- ***Challenges and prioritization***
  Women and youth have often been marginalized in P&D prevention and mitigation strategies resulting in a missed opportunity for efficient crop protection. In close collaboration with HER+, the Initiative will prioritize and implement approaches for gender-equitable and socially inclusive design and scaling of plant health innovations through multi-stakeholder partnerships and developing new opportunities for women and youth. This will be achieved by:
  (i) Reducing gender gap by creating enabling environment for women to participate in plant health management decisions, including on-field diagnostic and surveillance, IPDM and IMM.
  (ii) Incorporating women and youth's specific needs in developing and scaling IPDM and IMM solutions and identifying labor-saving IPDM and IMM innovations that are largely managed by women and youth, thereby improving their income opportunities.
  (iii) Engaging with private sector partners for women and youth entrepreneurs in commercial production and distribution of plant health innovations (e.g., Aflasafe) for IPDM and mycotoxin management in the targeted LMICs.
  (iv) Building capacities of female and young scientists in plant health R4D, thereby facilitating inclusive and equitable approaches to surveillance, risk mitigation, IPDM and IMM.

- ***Research questions***
  - **WP1 and WP2**: How to attract, mentor and career-advance women and young researchers to reduce the gender gap in PH research, management and decision making?
  - **WP3**: Are the identified IPDM innovations scale-neutral, gender-responsive and inclusive?
  - **WP4**: What is required to identify gender-inclusive i) private sector partners for bioprotectant manufacturing and distribution, producers of mycotoxin-safe foods?
  - **WP5**: How do socio-economic conditions, enabling environments, and gender relations shape the practices, constraints, and needs of resource-constrained women, men and youth in crop protection? How effectively can different methods deliver plant health innovations to targeted smallholder farmer groups, including women and youth in marginalized communities? What are the heterogeneous impacts of plant health innovations by gender and by socio-economic status?

- ***Components of Work Packages***
  - **WP1, WP2 and WP5**: Valid interdisciplinary tools and methods on detection by farmers/plant doctors for improved diagnostic and surveillance.
  - **WP3 and WP4**: Gender-responsive effective IPDM and mycotoxin management innovations identified and scaling-ready.
  - **WP3 and WP5:** Gender- and generation-specific constraints and aspirations, and farmers and societal orientated needs identified based on participatory approach.
  - **WP1–WP5:** Decision support tools for deploying gender-equitable and socially inclusive plant health innovations.

- ***Measuring performance and results***
  Strengthened capacity of partners to achieve equitable impacts: 40% women and 30% youth involved in field detection and surveillance, and 50% women direct beneficiaries of IPDM and IMM interventions.

- ***Partners:*** Partnerships as specified in all Work Packages apply, especially forging partnerships with HER+, African Women in Agricultural Research and Development (AWARD), gender team in IPM Innovation Lab, FAW R4D Int. Consortium ("Women as IPM leaders"), CGIAR GENDER Platform etc.

- ***Human resources and capacity development of Initiative team:*** Work with Gender Platform and AWARD (African Women in Agricultural Research and Development) to develop a gender and socially inclusive capacity development and mentoring strategies relevant for the Initiative; this will be implemented during the inception phase (first six months), as mentioned in the Section 9.3: Capacity development.

5.4 Climate adaptation and mitigation

- ***Challenges and prioritization***
  Climate/environment is an important component of plant health triangle. Any changes in climatic elements (e.g., temperature, humidity, wind, precipitation, etc.) make environments conducive for pests/diseases, cause changes in vector development, long-distance movement, areas of outbreak, and conversion minor P&D into major threats. The Initiative, therefore, focuses on:
  (i) Forecasting plant health threats based on the past/ongoing studies on epidemiological modelling, risk assessment, and preparedness.
  (ii) Assessing the impact of climatic variables on established/emerging P&D dynamics on crop production and food security in the targeted regions.
  (iii) Establishing plant health data management systems for modelling and forecasting, including future scenario analysis for predicting P&D and mycotoxins burdens on targeted cropping systems and preparedness to counter the emerging threats.
  (iv) Determining the effectiveness of IPDM, including pest/disease-resistant varieties, and mycotoxin mitigation solutions that are in use in the target LMICs.
  (v) Fine-tuning/adapting plant health innovations under the changing climate scenarios.

- ***Research questions***
  - **WP2**: How do climate change and anthropogenic activities exacerbate P&D and mycotoxin incidence in the targeted geographies? How to better integrate datasets and tools available within CGIAR and partners to develop a PH data management system for dynamic evaluation of PH risks?
  - **WP3 and WP4**: Will the changing climate and cropping system impact the efficacy of IPDM and IMM innovations?

- ***Components of Work Packages***
  - **WP1 and WP2**: Improved diagnostics, surveillance and monitoring of targeted P&D. Surveillance reports and data provided to decision makers within selected countries. Data repositories and risk assessment analysis, using One CGIAR trials (sentinel plots) for assessing pest/pathogen dynamics.
  - **WP2, WP3 and WP4**: Knowledge on key climate drivers of P&D and mycotoxin contamination. IPDM and IMM innovations adopted to the needs of changing climates and target cropping systems.
  - **WP2 and WP5:** Policy-relevant evidence generated based on causal impact evaluation, considering equity, cost effectiveness and ecological aspects.

- ***Measuring performance and results***
  - Plant health data management systems and NPPO capacity for P&D risk assessment and early warning to counter new threats improved in at least 10 target LMICs.
  - Knowledge on 10 prioritized invasive/emerging P&D risks used for preparedness and response actions by demand partners in the targeted LMICs.

- Improved knowledge of policy/decision makers of the benefits of plant health innovations lead to enabling policies in terms of scaling surveillance, IPDM and IMM.

- ***Partners:*** One CGIAR Digital Initiative for establishing state-of-the-art platform for P&D risk modelling. Validating the effectiveness of available IPDM innovations against prioritized P&D threats and scaling promising approaches.

- ***Human resources and capacity development of Initiative team:*** The Initiative team has significant experience of working on various projects related to climate adaptation. The Initiative will build on that knowledge and institutional capacity, in developing and deploying new innovations, data management and analysis. Strategic partnerships with advanced research institutions will enable addressing critical gaps in specific areas (e.g., epidemiological modelling in relation to changing climates).

5.5 Environmental health and biodiversity

- ***Challenges and prioritization***
  Historically, CGIAR has consciously avoided P&D management practices that involve the use of toxic pesticides and approaches harmful to the environment and biodiversity. The Initiative will continue this approach and will further improve the use of eco-friendly solutions (e.g., IPDM) to sustain and promote environmental health and biodiversity. The Initiative focuses on:
  (i) Establishing and scaling IPDM solutions that conform with the existing international conventions and reduce the use of harmful pesticides.
  (ii) Prioritizing development of nature-based solutions (e.g., biopesticides, biocontrol agents, bioprotectants, etc.) and other novel eco-friendly methods to counter P&D and mycotoxin threats.
  (iii) Develop strategies to prevent transboundary spread of invasive P&Ds, especially species listed in the IUCN Red List, the introduction of which could harm native biodiversity.
  (iv) Organize awareness and advocacy campaigns to promote eco-friendly IPDM and IMM methods and abolish harmful pesticides that are still in use in the target LMICs.

- ***Research questions***
  - **WP1**: How can national phytosanitary systems in LMICs improve their capacity and knowledge on detection and surveillance of P&D, reduce use of toxic pesticides, and prevent biodiversity erosion?
  - **WP2**: What are the environment and biodiversity risks of emerging P&D?
  - **WP3**: Which IPDM innovations and their components can deliver game-changing improvements to reduce harmful impacts of agriculture on environment and biodiversity?
  - **WP4**: What is the best approach to develop effective atoxigenic strain-based bioprotectants?
  - **WP5**: What are the dynamic and heterogeneous impacts of plant health innovations on environmental safety? What are the most effective and efficient business and partnership models to deliver IPDM and IMM innovations?

- ***Components of Work Packages***
  - Establishing a well-connected and functional P&D diagnostics and surveillance network.
  - Knowledge on biosecurity risks to major food crops and environment, and integrated seed health protection strategies to prevent transboundary spread of P&D.
  - Eco-friendly and scalable IPDM innovations against targeted plant health threats.
  - Improved formulations and recommendations for biocontrol of mycotoxin-producing fungi.
  - Policy-relevant evidence generated based on causal impact evaluation that considers equity, cost effectiveness and ecological aspects.

- ***Measuring performance and results***
  - Knowledge on 10 prioritized invasive and emerging P&D risks used for preparedness and response actions by demand partners in the targeted LMICs.
  - Eco-friendly and climate-smart IPDM and IMM packages adopted across targeted LMICs against prioritized crop P&D and mycotoxin-producing fungi.

- ***Partners:*** Partnerships as specified in different Work Packages apply, including strong interface with Genebanks, ABI, SeEdQUAL, Sustainable Intensification, etc. for validating and deploying eco-friendly solutions in plant health management. Work closely with demand, innovation and scaling partners to enable policies to promote the registration and commercialization of eco-friendly solutions.

- ***Human resources and capacity development of Initiative team:*** In general, IPDM shows its major positive effects on environmental health and biodiversity over a longer period of time and is augmented when practiced by communities. Plant health research community needs to be trained on effective communications related to these aspects. In addition, causal impact evaluations of plant health innovations often lacked a clear lens of beneficial effects on environmental health and biodiversity protection. This critical gap needs to be addressed by strengthening capacity of plant health research community, including biophysical and socioeconomics teams.

6. Monitoring, evaluation, learning and impact assessment (MELIA)

6.1 Result framework

CGIAR Impact Areas				
Nutrition, health and food security	**Poverty reduction, livelihoods and jobs**	**Gender equality, youth and social inclusion**	**Climate adaptation and mitigation**	**Environmental health and biodiversity**
Collective global 2030 targets				
The collective global 2030 targets are available centrally here to save space.				
Common impact indicators that your Initiative will contribute to and will be able to provide data towards (refer to page 5 of Guidance for MELIA for selection of appropriate indicators)				
# of people benefiting from relevant CGIAR innovations	# of poor people benefiting from relevant CGIAR innovations	# of women and youth benefiting from relevant CGIAR innovations	# of tonnes $C0_2$ averted; #people benefiting from climate-adapted innovations	ha under improved management
SDG Targets				
2.1. By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round. 3.d. Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.	1.5. By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters. 17.6. Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms.	5.a. Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws. 13.3. Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.	2.4. By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help and maintain ecosystems, that strengthen capacity for adaptation to climate change and other disasters, and that progressively improve land and soil quality. 12.a. Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production.	15.8. By 2030, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species.

Action Area title (Resilient Agrifood Systems)	
Action Area Outcomes	**Action Area Outcome Indicators**
AA OC1: Research and scaling organizations enhance their capabilities to develop and disseminate RAFS-related innovations	RAFSi 2.1 Number of organizations
• **AA OC2**: Smallholder farmers use resource-efficient and climate-smart technologies and practices to enhance their livelihoods, environmental health and biodiversity	RAFSi 1.1 Number of resource-efficient and climate-smart technologies at stage IV (uptake by next user), disaggregated by type
• **AA OC3:** Smallholder farmers implement new practices that mitigate risks associated with extreme climate change and environmental conditions and achieve more resilient livelihoods	STRAFSi 1.1 Number of smallholder farmers who have implemented new practices that mitigate climate change risks, disaggregated by gender and type of practice.
• **AA OC4**: National and local governments utilize enhanced capacity (skills, systems and culture) to assess and apply research evidence and data in policy making process	STRAFSi 2.1 Number of policies/ strategies/ laws/ regulations/ budgets/ investments/ curricula (and similar) at different scales that were modified in design or implementation, with evidence that the change was informed by CGIAR research

• **AA OC5:** Women and youth are empowered to be more active in decision making in food, land and water systems	STRAFSGIi 1.2 Number of women, youth and people from marginalized groups who report input into productive decisions, ownership of assets, access to and decisions on credit, control over use of income, work balance, and visiting important locations

Result type	***Result***	***Indicator***	***Measurement Unit***	***Geographic scope***	***Data source***	***Data collection method***	***Freq. of data collection***	***Baseline value***	***Baseline year***	***Target value***	***Target year***
Outcome (EoI OC1)	NPPOs in at least 10 targeted LMICs participate in the "Global Plant Diagnostic and Surveillance Network" dynamically exchanging data and knowledge on existing/emerging P&D.	Number of national staff (gender-disaggregated) at different countries improving knowledge and skills as part of a global diagnostic network	Number	10 LMICs (4 in SSA, 3 in Asia and 3 in LAC) [Peru, Colombia, Mexico, Nigeria, Ethiopia, Ivory Coast, Kenya, Philippines, India, Lebanon]	Information from NPPOs	Online surveys	Semi-annual	50 staff	2021	250 staff	2024
Outcome (EoI OC2)	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.	- Number of novel tools/ methods available for P&D detection (lab/field), characterization and surveillance - Number of P&D surveillance data points collected by the network of partners	Number	10 LMICs ((4 in Africa (Uganda, Nigeria Kenya, Morocco, Lebanon, Rwanda, Zimbabwe, Malawi, Zambia, Egypt, Cote d'Ivoire Senegal, Ghana, Ethiopia), 3 each in Asia (India, Bangladesh, Vietnam, Nepal, Philippines) and LAC (Bolivia, Colombia, Ecuador, Peru) Name of countries for surveillance	- GHU reports, centers' report on diagnostic tools - Reports from partners on P&D occurrence and level of incidence	Field surveillance of P&D; Reports from partners; Publications on diagnostics and surveillance	Semi-annual	- 10 existing diagnostic tools / assays - 10,000 surveillance data points	2021	- 30 existing/ novel diagnostic tools / assays - 30,000 data points	2024
Outcome (EoI OC3)	At least 10 target NPPOs increase their capacity to utilize epidemiological modelling data and decision support tools for pest risk assessment, and preparedness to counter prioritized P&D threats and new invasions.	- Number of staff (gender-disaggregated) of NPPOs using the Plant Health data management system - Number of NPPOs adopting pest risk assessment and preparedness reports	Number	10 targeted LMICs (7 in Africa (Nigeria, Tanzania, Ghana, Kenya, Uganda, Rwanda, Malawi) 2 in LAC (Peru, Ecuador), 1 in Asia (Philippines)	Registered users of PH data system; Reports from NPPO partners	Criteria-based assessment	Semi-annual	0	2021	- 200 staff - 10 NPPOs	2024

Outcome (EoI OC4)	A “Global Plant Health Consortium” comprising 60-70 institutions is operational, codeveloping and deploying IPDM Innovation Packages and educational curriculum for effective plant health management	- Number of Institutions from Global North and Global South participating in the Consortium - Number of Innovation Packages codeveloped - Number of MSc/PhD students (50% female) from LMICs receiving degrees based on work done under Plant Health Initiative at partner centers	Number	Global partnership, focused on improving plant health management in the LMICs	- GPHC meeting reports - Initiative Annual Reports	Criteria-based assessment	Semi-annual	- 2 Consortia (e.g., FAW, BBTV) but on specific threats	2021	- 60-70 Institutions - 10 Innovation packages - 60-70 MSc/PHD students	2024
Outcome (EoI OC5)	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%).	- Number of smallholder HHs and total number of beneficiaries (gender-disaggregated) of IPDM innovations - Area (in ha) of targeted crops in the LMICs estimated to adopt IPDM innovations	- Number - Crop area (in ha)	10 LMICs in Africa (5), Asia (3) and LAC (2)	- Technical Reports from partner institutions - Initiative Annual Reports - Publications	Review of project reports; Targeted surveys; Secondary data collection; Digital tools; Meetings with partners; Causal impact evaluation of selected Innovation Packages	Annual (data collection)	As reported in AFS CRPs	2021	- 4,000,000 smallholder HHs; ~20 M beneficiaries - ~2 million ha area (across target crops)	2024
Outcome (EoI OC6)	At least 15 private sector partners in four focal countries in Africa commercialize Aflasafe to ~200,000 smallholders (~400,000 ha of maize), resulting in enhanced availability of safe and nutritious food and feed.	- Number of private companies commercializing Aflasafe - Number of smallholders (gender-disaggregated) using Aflasafe - Estimated area (in ha) with Aflasafe application - % mitigation of mycotoxin contamination	- Number - Crop area (in ha) - % mitigation of mycotoxin contamination	**ESA:** Kenya, Uganda, Tanzania, Mozambique, Malawi **WCA**: Nigeria, Senegal, Mali, Burkina Faso **CWANA**: Sudan **LAC**: Mexico	- Technical Reports from partner institutions - Initiative Annual Reports - Publications	Review of project reports; Targeted surveys; Secondary data collection; Digital tools; Meetings with partners; CIE of Aflasafe	Annual (data collection)	- 8 scaling companies - 35,000 smallholder HHs - 70,000 ha (of maize)	2021	- 15 scaling companies - 200,000 smallholder HHs - 400,000 ha (of maize)	2024
Outcome (EoI OC7)	At least 300,000 smallholder households across at least five LMICs use affordable and easy-to-use pre- and	- Number of smallholders and total beneficiaries ((gender-disaggregated) adopting IMM innovations	- Number - % mitigation of	**ESA**: Uganda, Tanzania, Mozambique, Malawi	- Technical Reports from partner institutions	- Qualitative and quantitative data from	Annual (data collection)	135,000 HHs	2021	300,000 HHs	2024

	post-harvest IMM innovations for mitigating mycotoxin contamination of food chain.	- % mitigation of mycotoxin contamination	mycotoxin contamination	**WCA**: Nigeria, Senegal, Mali, Burkina Faso **CWANA**: Sudan **LAC**: Mexico	- Initiative Annual Reports - Publications	scaling partners - Surveys in selected countries					
Outcome (EoI OC8)	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.	Number of researchers (gender-disaggregated) using needs assessment data/evidence for developing IPDM/IMM Innovations	Number	Global, with particular focus on SSA, SA, SEA, LAC	- Technical Reports from partner institutions - Initiative Annual Reports	- Data from Innovation Partners in targeted LMICs - Online surveys	Annual	5 P&D cases	2021	20 P&D cases	2024
Outcome (EoI OC9)	National and regional partners utilize validated scaling approaches for P&D detection and surveillance, IPDM and IMM.	Number of Innovation Packages and scaling readiness plans developed for targeted plant health innovations	Number	Global, with particular focus on SSA, SA, SEA, LAC	- Technical Reports from partner institutions - Initiative Annual Reports	- Data from demand and Innovation Partners in targeted LMICs - Online surveys	Annual	2-3 plant health innovations	2021	20 plant health innovations	2024
Outcome (EoI OC10)	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.	- Number of Plant Health Policy Briefs developed and disseminated - Number of investors and policy/decision makers reached	Number	Global, with particular focus on SSA, SA, SEA, LAC	- Plant Health Policy Briefs - Reports from Demand Partners - Initiative Annual Reports	- Reports from demand, innovation and scaling partners in targeted LMICs - Online surveys	Annual	0	2021	6 Plant Health Policy Briefs	2024

Results framework for Initiative WP-level outputs and outcomes

Result type	*Result*	*Indicators*	*Unit of measurement*	*Geographic scope*	*Data sources*	*Data collection methods*	*Frequency of data collection*	*Baseline value*	*Baseline year*	*Target value*	*Target year*
Output WP1-OP1	Key knowledge and capacity gaps on lab/field detection/characterization of P&D in targeted priority countries identified	Number of reports summarizing the major knowledge and capacity gaps at country level	Number	Peru, Colombia, Mexico, Nigeria, Ethiopia, Ivory Coast, Kenya, Philippines, India, Lebanon	Information from NPPOs and extension workers	Online surveys	Annual	0	2021	10	2024
Output WP1-OP2	Regional diagnostic hubs and surveillance network established	Number of regional diagnostic hubs exchanging knowledge and capacity on detection and surveillance	Number	Peru, Colombia, Mexico, Nigeria, Ethiopia, Ivory Coast, Philippines, Lebanon	GHU reports	Reports from partners	End of Initiative	0	2021	8	2024
Output WP1-OP3	Toolbox of validated/novel molecular and image-based (AI) detection tools for characterization, monitoring, and surveillance of targeted P&Ds.	Number of validated/novel tools/ methods available for P&D detection (lab/field), characterization and surveillance.	Number	GHU reports, centers' report on detection tools	GHU reports, centers' report on detection tools	Reports from partners; Publications on diagnostics and surveillance	Annual	50 novel diagnostic tools / assays	2021	350 validated and/or novel diagnostic tools / assays	2024
Output WP1-OP4	Surveillance reports and data provided to decision makers within selected countries and, to WP2 for repositories and risk assessment analysis.	Number of P&D surveillance data points collected by the network of partners	Number	Across targeted countries in Africa, Asia and Latin America depending on the P&D to be surveyed	Reports from partners on P&D occurrence and level of incidence	Field surveillance of P&D; Publications on diagnostics and surveillance	Annual	10,000 surveillance data points	2021	30,000 surveillance data points	2024
Output WP1-OP5	Harmonized tools and protocols for mycotoxin diagnostics and monitoring, guiding WP4 activities	Number of reports summarizing available tools and protocols	Number	Global, with particular focus on Africa and LAC	Publications on mycotoxin diagnostics and monitoring, Reports from partners, industries,	Literature review; reports from stakeholders; online surveys,	End of Initiative	0	2021	1	2024

					and governments on tools and protocols used for mycotoxin quantification						
Outcome WP2-OC1	Enhanced PH data management system aiding CGIAR researchers and partners pest risk assessment and preparedness for efficient P&D control in the target LMICS	-Number of users of PH data management system -Number of pest risk analysis reports on targeted P&D and recommendations for prioritization	Number	Global, with particular focus on SSA, SA, SEA, and LAC	- Initiative Annual Reports	-Reports of innovation, scaling and demand partners -Publications and reports mention of PH database use -Partners feedback survey reports	Annual	1 or 2 PRA reports per year	2021	1 PH data management system. At least 10 pest risk analysis reports and recommendations	2024
Output WP2-OP1	**B**aseline report on existing P&D datasets and tools available within CGIAR and partners	Baseline report on existing P&D databases	Number	Global with particular focus on prioritized countries	-Initiative Annual Reports -Online survey feedback records	-Online feedback survey -Focus group discussion and expert interviews	Quarterly	0	2021	1	2022
Output WP2-OP2	SWOT report with augmentation plans to integrate P&D data and improved data management systems for One CGIAR and partners	One SWOT report and a data management improvement plan	Number	Global with particular focus on prioritized countries	-Initiative Annual Reports -Online survey feedback records	-Online feedback survey -Focus group discussion and expert interviews	Quarterly in year 1	0	2021	2 reports (1 SWOT report and 1 data management improvement plant)	2022
Output WP2-OP3	Standard procedures for equitable access and optimum use of P&D data management systems for risk assessment, modelling, and communications	Number of SOP	Number	Global with particular focus on prioritized countries	-Initiative Annual Reports -Online protocols -Initiative and partner Communication materials	-Reports of innovation, scaling and demand partners -PH Database access reports -PRA reports	Annual	Center/CRP/ Platform protocols	2021	3 SOPs on One CGIAR PH Data management, access, and data sharing procedures	2024
Output WP2-OP4	Improved PH data management system with data harnessing tools	-Functional PH data management system -PH Database	Number	Global with particular focus on prioritized countries	-Initiative Annual Reports -Online P&D datasets	P&D data submissions -PH Database access reports	Annual	Center/CRP/ Platform databases	2021	1 integrated PH data management system	2024

Outcome WP2-OC2	Knowledge on potential invasive and emerging risks for at least 10 P&D used to establish preparedness and response actions by demand partners in target LMICs	-Number of technical briefs on P&D risk assessment and mitigation -Number of communication and policy briefs developed -Number of policy/decision makers reached	Number	Global, with particular focus on priority countries in SSA, SA, SEA and LAC	- Initiative Annual Reports -Plant health technical, communication and policy briefs	-Reports from innovation, scaling and demand partners -Initiative and One CGIAR Reports	Annual	1-2 reports per year	2021	10 plant health technical, communication and policy briefs	2024
Output WP2-OP5	Models for predicting P&D risks and shifts due to climate change and other factors	Number of in silico risk assessment models	Number	Global, with particular focus on priority countries in SSA, SA, SEA and LAC	- Initiative Annual Reports -Plant health technical, communication and policy briefs	-Reports from innovation, scaling and demand partners	Annual	Models reported in AFS-CRP reports	2021	4 models for predicting P&D shifts	2024
Output WP2-OP6	Knowledge on P&D shifts and virulence variation with strategies for augmenting IPDM and resistance breeding	Number of sentinel survey reports and P&D characterization n data	Number	Global, with particular focus on priority countries in SSA, SA, SEA and LAC	- Initiative Annual Reports -Sentinel survey records	-Sentinel plots assessment data -Reports from innovation, scaling and demand partners	Annual	P&D data from breeding nurseries reported in AFS-CRP reports	2021	Annual updates on P&D status to GI Initiatives and WP3	2024
Output WP2-OP7	Knowledge on biosecurity risks to seed delivery pathways and integrated seed health protection strategies	P&D risk analysis of seed distribution pathway	Number	Global, with particular focus on priority countries in SSA, SA, SEA and LAC	- Initiative Annual Reports -PRA reports	-GII Initiative reports -Reports from innovation, scaling and demand partners -CGIAR GHU germplasm health testing reports	Annual	Annual GHU germplasm health testing data	2021	2 PRA reports (one each for seed and clonally propagated crops)	2024
Output WP2-OP8	Strategies for sampling for mycotoxin testing prioritization for IMM interventions	Mycotoxin (aflatoxin) data modelling reports	Number	Global, with particular focus on priority countries in SSA, SA, SEA and LAC	- Initiative Annual Reports -IMM Prioritization report -Initiative WP4 reports	-Reports from innovation, scaling and demand partners -Annual mycotoxin monitoring reports	Annual	Mycotoxin contamination data in Aflasafe database and A4NH reports	2021	At least one model and decision support framework for IMM	2024
Output WP2-OP9	Generic/specific pest risk assessment and preparedness plans for at least 10 prioritized P&D cases	PRA reports and P&D incursion scenario analysis (e.g., Monte Carlo analysis)	Number	Global, with particular focus on priority countries in	- Initiative Annual Reports -Stakeholder consultation	-Reports from innovation, scaling and demand partners	Annual	P&D scenarios reported in AFS-CRP reports	2021	10 PRA reports on prioritized P&D	2024

				SSA, SA, SEA and LAC	and workshop reports						
Output WP2-OP10	Fit-for-purpose communication, advocacy, and capacity development strategies and policy briefs (at least 4) with actionable recommendations to target LMICs	Number of advocacy/policy briefs	Number	Global, with particular focus on priority countries in SSA, SA, SEA and LAC	- Initiative Annual Reports -Stakeholder consultation and workshop reports	-Reports from innovation, scaling and demand partners	Annual	P&D scenarios mitigation plans reported in AFS-CRP reports	2021	At least 4 communication /policy briefs to augment national P&D control measures	2024
Outcome WP3-OC1	CGIAR and Innovation Partners in targeted countries effectively plan, and codevelop eco-friendly and inclusive IPDM innovations	- Number of "Plant Health Tech Hubs" established for integration, validation and demonstration by innovation partners - Number of IPDM Innovation Packages codeveloped and validated by innovation partners - Number of national partners (gender-disaggregated) trained on IPDM (40% women; 50% youth)	Number	At least 12 countries in LMICs of Africa, Asia and LAC	- Primary data - Plant Health Web Portal - Partners' reports - Annual reports from the Initiative	- User interviews - Online surveys - Workshops	Semi-annual	- 0 Plant Health Tech Hubs / Innovation packages - 300 IPDM trainees across crops	2021	- 6 Plant Health Tech Hubs established - 10 Innovation Packages - 1000 researchers	2024
Outcome WP3-OC2	Public and private sector scaling partners in at least 10 LMICs have access to, and commercialize inclusive and affordable IPDM Innovation Packages to counter prioritized plant health threats	- Number of public sector institutions promoting IPDM innovations - Number of private sector actors commercializing IPDM innovations in target LMICs - Number of institutions using decision support tools for scaling IPDM innovations	Number	At least 10 countries in LMICs of Africa, Asia and LAC	- Primary data - Plant Health Web Portal - Partners' reports - Annual reports from the Initiative	- User interviews - Online surveys - Workshops	Semi-annual	Comprehensive data not available	2021	- 50 NARES partners - 150 private sector actors - 30-40 institutions	2024
Outcome WP3-OC3	Eco-friendly and climate-smart IPDM packages adopted by at least 4 million smallholders (40% women; 50% youth) in 10 targeted LMICs against prioritized P&D	- Number of smallholders (gender-disaggregated) and beneficiaries per IPDM Innovation Package and per target country - Number of IPDM-based policy briefs developed and disseminated for catalyzing scaling in target countries - Number of stakeholders (gender-disaggregated)	Number	At least 10 countries in LMICs of Africa, Asia and LAC	- Technical Reports from partner institutions - Initiative Annual Reports - Publications	- Targeted surveys - Secondary data collection - Digital tools - Meetings with partners	Semi-annual		2021		2024

		trained on IPDM in target LMICs									
Output WP4-OP1	Improved bioprotectant usage/dosage, formulations and recommendations developed	Number of reports summarizing improved formulations and recommendations for bioprotectant usage/dosage	Number	**ESA:** Kenya, Uganda, Tanzania, Mozambique, Malawi **WCA**: Nigeria, Senegal, Mali, Burkina Faso **CWANA**: Sudan **LAC**: Mexico	PH Initiative reports; reports from partners on improved dosage and formulation	Reports from partners, online surveys,	End of Initiative (3-year)	0	2021	1	2024
Output WP4-OP2	Six bioprotectants registered with regulators for further scale up and at least 4 manufacturing and distribution (M&D) partners of aflatoxin bioprotectant licensed	Number of: (i) Aflasafe products registered; (ii) commercialization strategies; (iii) Technology Transfer and Licensing Agreements signed; and (iv) public and private sector partners up- scaling Aflasafe;	Number	Uganda, Sudan, Mali, Burundi	Certification from registration authorities; commercialization strategies; TTLAs	PH Initiative reports	Annual	14	2020	18	2024
Output WP4-OP3	400,000 ha treated with aflatoxin bioprotectants in at least 5 LMICs and no less than 200,000 farmers have access to aflatoxin-conscious markets	Number of hectares treated, and beneficiaries using the innovation; Number (tons) of crops with at least 70% less mycotoxin contamination; number of farmers that have access to aflatoxin-conscious markets	Number	**ESA:** Kenya, Uganda, Tanzania, Mozambique, Malawi **WCA**: Nigeria, Senegal, Mali, Burkina Faso **CWANA**: Sudan **LAC**: Mexico	Information from partners and key stakeholders	PH Initiative reports; reports from partners	Annual	50,000 beneficiaries ; 70,000 ha	2020	200,000 beneficiaries; 400,000 ha	2021
Output WP4-OP4	Mycotoxins-crop-countries and cost-effective IMM components selected based on evidence	Number of reports describing the selection of mycotoxins-crop-countries and cost-effective IMM components	Number	**ESA:** Kenya, Uganda, Tanzania, Mozambique, Malawi **WCA**: Nigeria, Senegal, Mali, Burkina Faso **CWANA**: Sudan **LAC**: Mexico	PH Initiative reports; reports from partners on i) mycotoxin occurrence and incidence; ii) effective IMM	Literature reviews, PH Initiative reports; reports from partners	Annual	0	2021	1	2021

Output WP4-OP5	Effective pre- and post-harvest IMM technologies and their convergence with policy, institutional and traceability innovations to reduce mycotoxin contamination by at least 70%	Number of innovations integrated in IMM	Number	**ESA:** Kenya, Uganda, Tanzania, Mozambique, Malawi **WCA**: Nigeria, Senegal, Mali, Burkina Faso, Ivory Coast **CWANA**: Sudan **LAC**: Mexico	PH Initiative reports; reports from partners	Databases, reports from partners	Annual	2	2022	At least 6	2024
Output WP4-OP6	20 extension agencies and private sector in crop value chains using IMM to reach at least 300,000 farmers	Number of extension agencies and private sector in crop value chains using IMM	Number	**ESA:** Kenya, Uganda, Tanzania, Mozambique, Malawi **WCA**: Nigeria, Senegal, Mali, Burkina Faso **CWANA**: Sudan **LAC**: Mexico	PH Initiative reports; reports from partners	Databases, reports from partners	Annual	4 extension agencies and private sector currently enabled to have 140,000 farmers using IMM	2021	20 extension agencies and private sector enabled to have 300,000 farmers using IMM	2024
Output WP5-OP1	Robust tools and analytical methods on field-level needs assessment	Number of communication products delivered	Number	5 selected countries across three regions	Online platform	Publication lists	End of Initiative	0	2022	2	2024
Output WP5-OP2	Gender- and generation-specific constraints and aspirations, and farmers and societal orientated needs related to plant health are identified	% of surveyed stakeholders who changed attitudes towards gender-responsive approaches to plant health innovations (disaggregated by gender and age)	Percentage	Kenya Ethiopia Cambodia Vietnam Nigeria	Online survey; Stakeholder workshops	Gender and social inclusion efficiency and satisfaction survey	Yearly	0	2022	65% of men, and 65% of senior positions	2024
Output WP5-OP3	An interdisciplinary research tool developed to assess knowledge gaps in detection by farmers/plant doctors for improved diagnostic and surveillance	Number of communication products delivered	Number	Targeted countries in LMICs	Online platform	Publication lists	End of Initiative	0	2022	2	2024
Output WP5-OP4	Decision support tools for deploying gender-equitable and socially inclusive plant health innovations	% of satisfaction with the quality and usefulness of tools (disaggregated by gender and age)	Percentage	5 selected countries across three regions	Online survey	Gender and social inclusion efficiency and satisfaction survey	End of Initiative	0	2022	70	2024

Outcome WP5-OC1	Researchers use needs assessment evidence and data to develop demand-driven equitable IPDM technologies	Number of stakeholders adopted	Number	Kenya Ethiopia Cambodia Vietnam Nigeria	Primary data; Online platform	User interviews	End of Initiative	0	2022	15	2024
Outcome WP5-OC2	Stakeholders adopt participatory approaches for problem identification to develop scalable and equitable IPDM technologies	Number of stakeholders adopted	Number	10 targeted countries in LMICs	Primary data; Online platform	Information from stakeholder workshops	End of Initiative	0	2022	20	2024
Output WP5-OP5	Equitable, inclusive, and cost-effective value-added methods to promote adoption of plant health innovations	- Number of research papers completed - Number of methods co-designed with stakeholders (50% women) - Number of graduate students and national researchers from LMICs engaged	Number	Cambodia Vietnam Kenya Ethiopia Nigeria	Online platform; Initiative reports; Stakeholder workshops; Primary data; Research reports	Online platform. Information from stakeholders. Information from partners and reports.	Yearly	0	2022	2 research papers; 5 methods; 5 students (at least 3 women)	2024
Output WP5-OP6	Policy-relevant evidence based on casual impact evaluation that considers equity, cost effectiveness, and ecological aspects	- Number of research papers completed - Number of graduate students and national researchers from LMICs engaged	Number	Targeted countries in LMICs	Online platform	Online platform	Yearly	0	2022	2 research papers; 5 students (at least 3 women)	2024
Outcome WP5-OC3	Increased capacity of women and youth farmers in IPDM adoption in targeted countries	- % increase in adoption rate among women and youth farmers using proposed encouragement/delivery methods targeting women's interests - Number of innovations with women's and/or youth's inputs to adjust technologies or improve approaches for scaling	- Percentage - Number	Kenya Ethiopia Cambodia Nigeria Tanzania TBC Vietnam Cambodia	Household survey data, admin data (gender-disaggregated, self-reporting)	Primary household surveys and qualitative case study	End of Initiative	NA	2022	>20	2024
Outcome WP5-OC4	improved access to information of stakeholders on effectiveness of plant health innovations	- % of open access products - Number of people who accessed the platform (% of which are women) - % of surveyed stakeholders who accessed	- Percentage - Number	Targeted 10 countries in LMICs	Online platform	Online platform	Yearly	0	2022/23	80% open-access products; 5000 users (50% women;) 80% stakeholders (50% women)	2024

		products (% of which are women)									
Outcome WP5-OC5	Strengthened capacity and skills of stakeholders including women and young scientists to combat pests and diseases and scale plant health innovations	- Number of people trained, long-term (including MSc and PhDs) and short-term, disaggregated by gender and age - % of satisfaction with the effectiveness of the partnerships under this Initiative expressed by surveyed partners and stakeholders (disaggregated by gender and age)	Number	Targeted 10 countries in LMICs	Online platform; Online survey	Online platform; Partnership/ Social inclusion efficiency and satisfaction survey	Yearly	0	2022 /23	10 students (50% women, 50% youth); 70% (women's satisfaction not lower than men's)	2024

6.2 MELIA plan

a. Narrative for MEL plans

We will incorporate MEL plan at the Initiative, the Work Package and the innovation level. The MEL plan includes TOC, learning questions based on TOC, Stakeholder feedback plan, M&E plan, and Data management plan. Activity leads are responsible for developing TOC, learning questions, stakeholder feedback plan, and monitoring plan, and will be reviewed by WP5 for consistency and incorporated into the Initiative plan. Data management plan will be developed at the Work Package level. WP5 leads are responsible for the evaluation plan with consultation and support by Initiative management team and corresponding activity leads. Progress reports on MEL will be produced regularly with support of an M&E expert, using a bottom-up approach, to monitor progress and support effective management and learning.

b. Narrative for impact assessment research plans

In Phase 1 (2022–2024), we plan to conduct one qualitative impact assessment and one causal impact evaluation (CIE) for three selected plant health innovations.

1. Qualitative IA: WP1 and WP2 provide preventive measures of P&D. We plan to: 1) use process tracing to assess the causal links described in the TOC; 2) document the rollout of diagnostic network and surveillance activities so that we can merge with secondary data to estimate the effects on P&D occurrence, crop area affected, productivity loss and loss abatement, food security, and poverty measures.

2. WP3 and WP4 incorporate several IPDM and IMM innovations, which we have categorized based on the scaling readiness. From these, we plan to select three selected cases for CIE, as described below.

   (1) New innovations at the proof-of-concept stage will be assessed by RCTs to answer the key evaluation question: how large is the benefit of adoption of this innovation? We will estimate both private and social benefits using randomized saturation design (RSD), providing important policy implications, especially where social benefits are high but private benefits low, justifying subsidies to promote the adoption.

   (2) Innovations ready to be scaled: Mixed-methods and randomized encouragement design will be used to answer the key evaluation question: what are the cost-effective promotion/delivery methods that can increase gender-responsive and socially inclusive adoption of the innovation? The randomly introduced encouragements can serve as IVs to evaluate the impacts of innovation adoption. We can also estimate the intent-to-treat effects.

   (3) Innovations under scaling for several years: We plan to use the staggered deployment and secondary data to estimate causal effects. While realizing the uncertainty of identifying a good match between innovations and datasets, such impact assessment study is cost-effective and allows us to estimate longer-term and dynamic effects.

P&D can spread easily and quickly within and across farming communities, countries and regions, resulting in large externalities of PH innovations. For example, IPDM packages can mitigate and contain the spread of devastating P&D (e.g., Maize Lethal Necrosis, Wheat blast, Fusarium TR4, etc.) to other vulnerable regions. Such externalities are often insufficiently captured using regular impact assessment methods; RSD can only account for the externalities within communities. How to capture such externalities imposes a key challenge but also

provides a good opportunity to conduct novel impact assessment that integrates epidemiological modelling. Furthermore, to facilitate impact assessment research on PH innovations using secondary data, we plan to design a short household survey module tailored to PH management for inclusion in LSMS-ISA and other large-scale household surveys.

6.3 Planned MELIA studies and activities

Type of MELIA study or activity	Result or indicator title that the MELIA study or activity will contribute to.	Anticipated year of completion (based on 2022-24 Initiative timeline)	Co-delivery of planned MELIA study with other Initiatives	How the MELIA study or activity will inform management decisions and contribute to internal learning
Qualitative impact assessment study on Plant Health Diagnostic and Surveillance Network	NPPOs in at least 10 targeted LMICs participate in the "Global Plant Diagnostic and Surveillance Network" dynamically exchanging data and knowledge on existing/emerging P&D.	2023/2024		We plan to use process tracing to assess the causal links described in the TOC of WP1 and WP2. This study can inform management decisions and contribute to learning by evaluating prior explanatory hypotheses, discovering new hypotheses, and assessing these new causal claims.
Causal Impact Evaluation (CIE) and learning studies on: 1) Integrated management of MLN in Eastern Africa 2) IPM of FAW 3) Aflasafe for mycotoxin mitigation	Equitable, inclusive, and cost-effective methods to promote adoption of plant health innovations; Policy-relevant evidence based on casual impact evaluation that considers equity, cost effectiveness, and contribution to CGIAR Impact Areas.	2024 and beyond	GI: ABI and SeEdQUAL	Causal impact assessment studies will help answer a number of policy-relevant research questions including: 1) How large is the benefit of adoption of a PH innovation? 2) What are the cost-effective promotion/delivery methods that can increase gender-responsive and socially inclusive adoption of the innovation? 3) What is the longer-term and dynamic effects of the innovation? Answers to these questions will inform management decision and contribute to internal learning.
MEL reports	Key outputs from WP1-5	Yearly		MEL reports will show monitoring of the progress toward achievement of deliverables and will support effective management and learning.

7. Management plan and risk assessment

7.1 Management plan

The Initiative strategic plan will operate through five different but complementary and interconnected Work Packages. The Initiative and its Work Packages will be led by One CGIAR staff. The Initiative implementation team comprises the researchers from One CGIAR and non-CGIAR innovation, demand, and scaling partners, including public, private, and non-governmental organizations, including farmer/private sector associations and entities. The Initiative has defined outputs, outcomes, and key deliverables under different Work Packages. The team developed a detailed Results Framework with baseline and indicators (Section 6.1), formulated Innovation Packages Scaling Readiness Plan, and MELIA plan (Section 7.2). During the inception phase, the management team, comprising the Initiative Leader/Deputy Lead and the Work Package leaders, will organize a series of (virtual and face-to-face) project meetings/workshops (Virtual, considering Covid19) at different regions, as well as globally to: (i) discuss the Theories of Change (TOCs), projection of benefits, and specific work plans with the partners; (ii) identify critical knowledge/technical gaps that need to be addressed in Year 1, and (ii) ensure strong alignment in the vision and understanding of key research questions, outputs, and specific roles of each partner institution for accountability and impact.

The Initiative team will hold annual project review and planning meetings, including a wide array of demand, innovation, and scaling partners; this will form the foundation for submitting high-quality technical and financial reports. During these meetings, the team will: a) review the status of the key deliverables in each Work Package (Section 6.1); b) update the TOC and scaling strategies; c) analyze progress toward realization of Initiative benefits; d) assess the bottlenecks/risks (Section 7.3) and refine/fine-tune approaches; and e) identify lessons learnt from the MEL and impact assessment plan (Section 6.2). The MEL plan will be jointly reviewed and elaborated to indicate responsibility of various team members, validated with innovation and scaling partners, and updated regularly. An external panel of plant health experts will provide strategic guidance on each of the Work Packages to the Initiative Management Team.

The Initiative will have the following two committees to effectively manage, steer and oversee the Initiative:

Initiative Management Committee (IMC): This will ensure regular monitoring of the progress on annual work plans and achievement of outputs, and will develop work plans with partners, engage and update key stakeholders, share information, and ensure that learnings are used across Work Packages.

Technical Advisory Committee (TAC): This committee will provide strategic guidance to IMC and will meet (virtual/F2F) at least twice annually. TAC will consist of the IMC Chair and Co-Chair (2), major subgrantees (3), donor representative (3), and independent external experts (3). Among other responsibilities, they will critically review the use by CGIAR and partner institutions' technical progress, and the optimization opportunities for greater impact of the Initiative.

7.2 Summary management plan Gantt table

Plant Health Initiative		Timelines												Description of key deliverables (maximum 3 per row, maximum 20 words per deliverable)
		2022				2023				2024				
Work Packages	**Lead organization**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	
Work Package 1: Bridging knowledge gaps and networks: Plant health threat identification and characterization	CGIAR				**1**					**2**		**3**		***1.*** *Report on identified capacity gaps of NPPOs in targeted LMICs on P&D lab/field detection and surveillance (WP1-OP1).* ***2.*** *Surveillance datasets available for targeted P&D cases (WP1-OP5).* ***3.*** *Report on the functioning of Regional Plant Health Diagnostic Hubs and Surveillance Network (WP1-OP2).*
Work Package 2: Guiding preparedness and rapid response: Data management and risk assessment	CGIAR				**1**				**2**			**3**		***1.*** *Baseline report on existing P&D datasets and tools available within CGIAR and partners (WP2-OP1).* ***2.*** *Improved PH data management system with data harnessing tools (WP2-OP4).* ***3.*** *Generic/specific pest risk assessment and preparedness plans for at least 10 prioritized P&D cases (WP2-OP9).*
Work Package 3: Integrated pest and disease management for threat mitigation	CGIAR		**1**			**2**				3				***1.*** *Report: A "Global Plant Health Consortium" established for co-developing and deploying IPDM Innovation Packages and educational curriculum for effective plant health management.* ***2.*** *Report: IPDM Innovation Packages formulated and/or validated in "Plant Health Tech Hubs" established at selected locations in target regions in partnership with innovation partners.* ***3.*** *A "Plant Health Web Portal" developed, integrating P&D surveillance, diagnostics, risk assessment, and IPDM and IMM innovations.*
Work Package 4: Tools and processes for protecting food chains from mycotoxin contamination	CGIAR							**1**			**2**		**3**	***1.*** *Report to demonstrate that 50% of targeted extension agencies, private sector and farmers are using IMM (WP4-OP6).* ***2.*** *Registration approval document and licensing agreements of aflatoxin bioprotectant products (WP4-OP2).* ***3.*** *Report demonstrating that at least 400,000 ha of maize area are treated and at least 200,000 smallholder farmers reached with aflatoxin bioprotectants (WP4-OP3).*
Work Package 5: Methods for inclusive and equitable scaling for achieving impacts	CGIAR				**1**				**2**				**3**	***1.*** *Training materials on participatory needs assessment; stakeholder workshop report; baseline report on knowledge gaps in surveillance (WP5-OP3-4): Working Paper: Gender and Social Inclusion Toolkit for Plant Health Management (WP5-OP5).* ***2.*** *Working Paper: CIE of MLN and FAW IPM (WP-OP5).* ***3.*** *Working Papers: CIE of Aflasafe, and IPM in Rice (WP5-OP5); Digital Platform (WP5-OP7). Qualitative impact assessment of WP1/WP2 (WP5-OP5).*
Innovation Packages and Scaling Readiness	CGIAR			**1**				**2, 3**				**3**		***1.*** *Report: Based on consultations with innovation and scaling partners, and Initiative teams (WP1-WP5), formulation of Initiative Innovation Packages/Knowledge Products and Scaling Readiness Plans for 5 selected cases (1 each for WP1 and WP4, and 3 for WP3).* ***2.*** *Report: Progress and bottlenecks in scaling Innovation Packages in target geographies.*

														3. *Report: Stage-gate decisions on Innovation Packages and target countries for further scaling; Scaling Readiness Report.*
MEL (Impact Assessment is part of WP5)	CGIAR	**1**			**2**				**2**				**2, 3**	***1****. MEL plan formulated at the Initiative level and WP-level* ***2****. MEL Annual Reports available for review and further steps.* ***3.*** *End of Initiative MEL Report highlighting the lessons learned, and example of good practices.*
Project management	CGIAR	**1**			**2**				**2**				**2, 3**	***1.*** *Project Inception Meetings in different regions, and globally (virtual) and reports.* ***2.*** *Annual Project Review and Planning Meetings with CGIAR, Demand, Innovation and Scaling Partners; Submission of Technical and Financial Reports.* ***3.*** *Planning for the next phase of the Initiative, and formulation of proposal.*

7.3 Risk assessment

Top 5 risks to achieving impact (note relevant Work Package numbers in brackets)	**Description of risk (50 words max each)**	**Likelihood** Rate from 1-5	**Impact** Rate from 1-5	**Risk score Likelihood x Impact**	**Opportunities**
#1. Countries unwilling to share/report P&D and mycotoxin occurrence data **(WP1/WP2)**	Economic implications of recognizing the presence of P&D/mycotoxin contamination, general culture of data secrecy, academic reasons etc. could result in this risk. This may lead to delays in issuing regional-wide P&D alerts, allowing P&D to spread into neighboring regions/countries, and inadequate achievement of desired outcomes.	4	4	16 (High)	Establishing the global plant diagnostic and surveillance system, strengthening capacity of national partners, and science-based evidence to policy makers will significantly alleviate this risk and will increase the level of preparedness and confidence of LMICs.
#2. Unfavorable policy environment hinders uptake of IPDM and IMM innovations **(WP3/WP4)**	Multiple national policies explicitly or implicitly encourage pesticide use, including direct and indirect input subsidies for dealers and farmers; un-costed pesticide externalities; agricultural education and extension policies; national research funding processes; product registration regulations. Eco-friendly innovations that compete with pesticides are thus disadvantaged.	3	4	12 (Medium)	Policy influence (e.g., in Ghana, the government has promoted biorationals rather than toxic synthetics). Work with regulators on product registration processes (some regionally harmonized guidelines already in place, e.g., EAC), especially biopesticides and pest/disease-resistant varieties.
#3. Scaling of the uptake of IPDM/IMM innovations and Innovation Packages could be limited by inadequate /unsustainable financial support **(WP3/WP4)**	Plant health innovations are typically either commercial products or public goods. Catalyzing adoption of these innovations often requires initial “push” (stimulation of demand; awareness creation) before a strong “pull” could be generated. Inadequate funding support for knowledge/resource-intensive innovations may negatively impact the scaling process.	4	4	16 (High)	The Initiative will implement a balanced strategy in terms of scaling: a) innovations with proven track record and strong private sector interest; and b) innovations that are under piloting or development, with strong demand from stakeholders in targeted countries/regions. Emphasis laid on public-private partnerships to ensure sustainability of scaling IPDM/IMM innovations.
#4. Failing to provide rigorous impact assessment to plant health innovations with potentially large benefits due to insufficient resources **(WP5)**	Because of budget constraints, we can only provide rigorous impact assessment to 3-4 innovations. Lack of solid empirical evidence on large social benefits of some innovations may deter scaling of such innovations.	4	3	12 (Medium)	Leverage bilateral funding or funding from other sources to support more rigorous impact assessment studies.
#5. Lack of continuity of experienced/talented staff due to financial uncertainties associated with One CGIAR transition **(WP1-WP5)**	One CGIAR transition processes may create significant financial uncertainties, leading to difficulties in retaining talented staff with strong experience in crop protection, and hiring new staff in their place. This may delay or affect the proposed outputs and outcomes, and consequently the five Impact Areas.	3	4	12 (Medium)	Access to complementary bilateral funding and strategic partnerships due to strong value proposition of the Initiative will aid in retaining and attracting talented staff to support the implementation of the Initiative.

8. Policy compliance, and oversight

8.1 Research governance

Researchers involved in the implementation of this Initiative will comply with the procedures and policies determined by the System Board to be applicable to the delivery of research undertaken in furtherance of CGIAR's 2030 Research and Innovation Strategy, thereby ensuring that all research meets applicable legal, regulatory and institutional requirements; appropriate ethical and scientific standards; and standards of quality, safety, privacy, risk management and financial management. This includes CGIAR's CGIAR Research Ethics Code and to the values, norms and behaviors in CGIAR's Ethics Framework and in the Framework for Gender, Diversity and Inclusion in CGIAR's workplaces.

8.2 Open and FAIR Data Assets

Researchers involved in the implementation of this Initiative shall adhere to the terms of the Open and FAIR Data Assets Policy. The Plant Health Initiative will align with the OFDA Policy's Open and FAIR requirements, ensuring:

- Rich metadata conforming to the CGIAR Core Schema to maximize Findability, including geolocation information where relevant.
- Accessibility by utilizing unrestrictive, standard licenses (e.g. Creative Commons for non-software assets; General Public License (GPL))/Massachusetts Institute of Technology (MIT) for software), and depositing assets in open repositories.
- Wider access through deposition in open repositories of translations and requiring minimal data download to assist with limited internet connectivity.
- Interoperability by annotating dataset variables with ontologies where possible (controlled vocabularies where not possible).
- Adherence to Research Ethics Code (Section 4) relating to responsible data (through human subject consent, avoiding personally identifiable information in data assets and other data-related risks to communities).

9. Human resources

9.1 Initiative team

Category	*Initiative team members*	*Area of expertise*	*Short description of key accountabilities*
Research	Prasanna Boddupalli (CGIAR)	Maize Pest and Disease Management; Host Plant Resistance	Initiative Design Team Lead and WP3 Lead; Strategy, partnership management and quality control across the Initiative, together with Work Package Leads; WP3 implementation, data management; communications and outreach.
Research	Monica Carvajal (CGIAR)	Virology, Molecular biologist	Initiative Design Team Deputy Lead and WP1 Lead; WP1 implementation; Global diagnostic network and surveillance; data management; partnership management; delivery; communications and outreach.
Research	Lava Kumar (CGIAR)	Germplasm Health; Virology	WP2 Lead; Data management; implementation; partnership management; delivery mainly for WP2, and partly for WP1 and WP3.
Research	Alejandro Ortega-Beltran (CGIAR)	Mycotoxin Management	WP4 Lead; Data management; implementation; partnership management; delivery.

Research	Nozomi Kawarazuka (CGIAR)	Gender Research; MEL	WP5 Co-Lead; Gender and social inclusion strategy, implementation and delivery across the Initiative; partnership management.
Research	Yanyan Liu (CGIAR)	Impact Assessment; MEL	WP5 Co-Lead; MEL and Impact Assessment strategy, implementation and delivery across the Initiative; partnership management.
Research	Jan Kreuze (CGIAR)	Germplasm Health; Virology	WP3-Potato and Sweet Potato IPDM Innovations implementation; delivery; partnership management; partially supports WP3 implementation and delivery.
Research	Guy Blomme (CGIAR)	Banana Pest and Disease Management	WP3-Banana IPDM Innovations implementation; delivery; partnership management
Research	Jorge Andrade (CGIAR)	Plant Pathology; Epidemiology	WP3-Potato and Sweet Potato IPDM Innovations implementation; delivery
Research	Seid-Ahmed Kemal (CGIAR)	Legume Pathology; Host Plant Resistance	WP3-Legumes and Vegetables IPDM Innovations implementation; delivery; partnership management
Research	George Mahuku (CGIAR)	Plant Disease Management; Pathology	WP3 IPDM Innovations implementation; delivery; partnership management
Research	Ricardo Oliva (CGIAR)	Rice Pathology; Host Plant Resistance	WP3-Rice IPDM Innovations implementation; delivery; partnership management
Research Support	Ranajit Bandyopadhyay (WP4 Consultant)	Mycotoxin Management	WP4 strategy design and implementation; scaling of key innovations under WP4; MEL; partnership management
Research	Pawan Singh (CGIAR)	Wheat disease management; Pathology; Host Plant Resistance	WP5 design; WP4-Mycotoxin mitigation in wheat; WP3-Wheat IPDM innovations implementation and delivery; partnership management.
Research	Natalia Palacios (CGIAR)	Post-harvest Processing and Nutritional Quality	WP5 design and implementation; nixtamalization and post-harvest approaches for mycotoxin mitigation; partnership management.
Research	Hugo de Groote (CGIAR)	Socio-economics, MEL and Impact Assessment	WP5 design and implementation; MEL; impact assessment.
Research	Srinivasan Ramasamy (WorldVeg)	Vegetable IPM	Key innovation and scaling partner for the Initiative; Co-design and implementation of specific innovations under WP3.
Research	Roger Day, Wade Jenner, Dannie Romney (CABI)	Plant Health Management; Development Communication	Key innovation and scaling partner for the Initiative; Co-design and scaling of specific innovations under WP1, WP3 and WP5.
Research	Subramanian Sevgan, Menale Kassie, Henri Tonnang (icipe)	IPM; Entomology; Impact Assessment; Science Modelling; Data Management	Key innovation and scaling partner for the Initiative; Co-design and scaling of specific innovations under WP1, WP3 and WP5.
Research	Sarah Schmidt (GIZ)	Host Plant Resistance; Plant-Microbe Interactions	Co-design of Initiative strategy; scaling of PH innovations.
Research	Angela Records (USAID)	Plant Pathology; Plant-Microbe Interactions	Co-design of Initiative strategy; scaling of PH innovations.
Research	Buyung Hadi (FAO)	IPM; Entomology	Key innovation and scaling partner for the Initiative; Co-design and scaling of PH innovations.
Research Support	Nick Rose and Rose Mburu (CGIAR)	Administration	Support for administration of Initiative activities, including partnership management, capacity building, communications and outreach.
Research Support	Remy Labuguen (CGIAR)	Financial management	Support for financial management of the Initiative, including subgrant management.

9.2 Gender, diversity and inclusion in the workplace

Overall, the Plant Health Implementation across One CGIAR (nine centers) is expected to have a total of 120 staff (including 56 IRS, 62 LRS, and two Consultants); of these, women comprise 35%. The Initiative design team comprises 26 scientists from 20 different nationalities; 80% are from Asia, Africa, and Latin America. This highly diverse and multicultural Initiative implementation team has significant strengths in terms of disciplinary

backgrounds, including pathology, virology, entomology, molecular biology, genetics and plant breeding, agronomy, agri-business, engineering, technology transfer, agricultural economics, and social anthropology. Cultural and disciplinary diversities will enable the team to design and implement strategies and innovations from wider perspectives and with greater creativity. The hugely experienced team with global recognition in crop protection is suitably placed to leverage diverse professional networks across the world for the success of the Initiative.

Women represent 35% of the Initiative implementation team under One CGIAR, which falls slightly short of the CGIAR target of 40% women in professional roles. To address this, the Initiative provides a gender-equal opportunity in terms of leadership of Initiative Work Packages and overall management; three women and three men will assume Work Package leadership roles. In addition, the team will ensure gender inclusion of national scientists and local innovation and scaling partners, with a target of 40% women and at least 30-40% youth (below 35 years old) participation. The Initiative will also create learning/mentoring opportunities for women and young scientists and partners by providing female-female mentorship and organizing female and youth group annual discussions, and will mindfully include their voices in all the Work Package activities, following the guidance outlined in *CGIAR's GDI Inclusive Recruitment Toolkit*.

9.3 Capacity development

The Plant Health Initiative deeply recognizes the importance of continuous learning for developing and strengthening the capacity and professional skills of team members and external partners to accomplish the Initiative goals. A series of training activities, supported by One CGIAR, will be planned and implemented, including: 1) training on inclusive leadership to the Initiative team leadership and managers within three months of launch; 2) training of all Initiative team members within 6 months of launch on gender, diversity, and inclusion, including whistleblowing and 'how to report' concerns; and 3) an awareness session on CGIAR's values, code of conduct and range of learning opportunities available within CGIAR during the Initiative launch; 4) training/internship opportunities to MSc/PhD students from LMICs in Africa, Asia and Latin America to work on various aspects of plant health management at relevant CGIAR centers and innovation partners.

In the inception phase (first six months), the Initiative team will rigorously assess the capacity and knowledge gaps of the national/regional partners in the targeted LMICs regarding P&D detection/diagnostics, characterization, surveillance, risk assessment, IPDM and mycotoxin management. Once capacity development needs are identified, a calendar of events, including lab, in-field and virtual trainings based on the specific national and regional needs, will be formulated. Preference will be given to women and young scientists in training and internship opportunities (at least 50% women, 60% young scientists). The Initiative will provide internship opportunities to young students, especially from under-represented countries/groups (at least 50% women). Funding support will be given to deserving national partners for presentation of their work on plant health R4D in relevant scientific events.

10. Financial resources

10.1 Budget

10.1.1: Activity breakdown

Budget (in US$)

USD	2022	2023	2024	Total
Cross-cutting (across Work Packages)	375,934	444,285	546,813	1,367,032
WP1: Bridging Knowledge Gaps and Networks: Plant Health Threat Identification & Characterization	2,020,769	2,388,181	2,939,300	7,348,250
WP2: Guiding Preparedness and Rapid Response: Data Management and Risk Assessment	1,588,623	1,877,464	2,310,725	5,776,812
WP3: Integrated Pest and Disease Management for Threat Mitigation	3,848,485	4,548,210	5,597,797	13,994,492
WP4: Tools and Processes for Protecting Food Chains from Mycotoxin Contamination	1,314,319	1,553,286	1,911,736	4,779,341
WP5: Methods for Inclusive and Equitable Scaling for Achieving Impacts	1,571,270	1,856,956	2,285,484	5,713,710
				0
Innovation Packages and Scaling Readiness	280,600	331,618	408,145	1,020,363
TOTAL	**11,000,000**	**13,000,000**	**16,000,000**	**40,000,000**

10.1.2: Geographic breakdown

Budget (in US$)

USD	2022	2023	2024	Total
Global (not specific country)	3,816,428	4,510,323	5,551,167	13,877,918
ESA (not specific country)	2,203,048	2,603,602	3,204,434	8,011,084
WCA (not specific country)	1,643,178	1,941,937	2,390,076	5,975,191
LAC (not specific country)	1,087,336	1,285,033	1,581,581	3,953,950
South Asia (not specific country)	875,085	1,034,194	1,272,851	3,182,130
SE Asia (not specific country)	794,267	938,679	1,155,298	2,888,244
CWANA (not specific country)	580,658	686,232	844,593	2,111,483
TOTAL	**11,000,000**	**13,000,000**	**16,000,000**	**40,000,000**

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2.1 Challenge statement

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