Role of International Plant Health Systems for Sustainable Agriculture in Developing Countries

PMFAI – International Crop Science Conference & Exhibition
Dubai
19 - 20 Jan 2026


by Shaza Omar
Senior Phytosanitary Specialist
PCE Facilitator

Why Plant Health Matters

Plant health is not merely a regulatory concern—it is **strategic infrastructure** that underpins the entire agricultural value chain. Effective plant health systems are essential for achieving global sustainability goals and ensuring agricultural resilience.

Plant Health Underpins:

- **Food security** for growing populations
- **Sustainable and regenerative agriculture** practices
- **Farmer livelihoods** and rural economic stability
- **Safe international trade** and market access

40%	$220B	$70B	$100B
Global Crop Production	Economic Losses	Invasive Insects	Environmental Losses
Lost annually to pests and diseases worldwide	Direct economic impact per year from crop losses	Annual cost of invasive insect damage alone	Annual cost of introduced pests in the U.S., U.K., Northern Ireland, Australia, India and Brazil

Invasive Align Species are one of the main drivers of Biodiversity Losses

Plant health and environment protection: https://www.fao.org/3/ca3279en/CA3279EN.pdf

The Cost of Unpreparedness

The economics of pest management reveal a critical truth: once pests establish in a region, eradication becomes extremely rare and management costs become permanent.

1

Prevention

Lowest cost, highest return. Surveillance systems and border controls prevent establishment.

2

Early Detection

Moderate cost if detected quickly. Rapid response can contain spread before establishment.

3

Eradication

High cost, rarely successful. Requires intensive intervention over large areas.

4

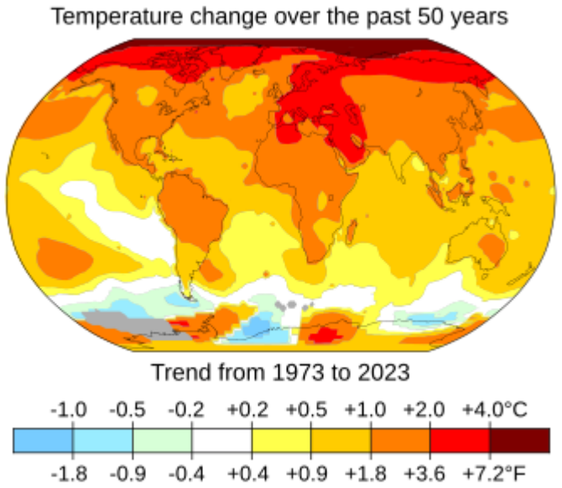
Management

Permanent high cost. Ongoing control measures required indefinitely once established.

> **Every dollar spent on prevention saves hundreds of dollars in response.** Investment in surveillance, diagnostics, and preparedness infrastructure delivers exceptional return on investment while protecting agricultural sustainability.

- **Global Context:** The economic cost of invasive alien species exceeds **USD 423 billion annually**, with agricultural pests representing a significant portion of this burden. These costs are largely preventable through robust plant health systems.

Climate Change: A Threat Multiplier for Plant Health



Climate change is not a future threat—it is **already reshaping pest risk profiles globally**. Rising temperatures, shifting precipitation patterns, and extreme weather events are fundamentally altering the geographic ranges, reproductive rates, and outbreak dynamics of agricultural pests.

Geographic Range Expansion

Warming temperatures enable pests to survive in previously unsuitable regions, expanding their distribution poleward and to higher elevations. Pests once limited by cold winters now establish year-round populations.

Increased Pest Generations

Higher temperatures accelerate pest development, allowing more reproductive cycles per season. This multiplication effect dramatically increases pest pressure and crop damage potential.

Altered Outbreak Dynamics

Climate variability disrupts natural pest-predator relationships and creates conditions favoring pest outbreaks. Traditional pest management calendars become unreliable.

Climate-Smart Plant Health: Surveillance systems must incorporate climate forecasting. Pest risk analysis must account for climate scenarios. Plant health systems must become adaptive and predictive, not just reactive.

Transboundary Pests: The Fall Armyworm Case Study

A Real-World Example

The spread of Fall Armyworm (Spod
demonstrates exactly what happens
pest, native to the Americas, has caus
warning systems or coordinated resp

Globalization and climate change hav
Armyworm can fly up to 100 km in a
making it nearly impossible to contro

all
ear,

Crop Losses

Potential maize losses in Africa alone: **8.3–20.6 million tonnes per year**

🌾 **Safeguarding Asia's Rice from Fall Armyworm** 🌿

A new study highlights Integrated Pest Management (IPM) as the best defence against fall armyworm. Experts suggest:

✅ Biological control – Natural predators & beneficial microbes
✅ Cultural practices – Crop rotation, staggered planting & sanitation
✅ Eco-friendly solutions – Cutting pesticide use to prevent resistance

Learn more: https://ow.ly/IOK950VloYM

Goss’s Wilt: A New Threat to African Maize

The recent emergence of Goss’s Wilt (***Clavibacter michiganensis subsp. nebraskensis***) in South Africa represents a significant new challenge for plant health systems in the region. Previously confined to North America, its confirmed presence in 2023/24 highlights the increasing vulnerability of agricultural systems to transboundary pests.

New Continental Introduction

First officially confirmed in South Africa (2023/24), detected across multiple provinces, posing a continental threat.

Severe Disease Impact

Causes leaf blight and systemic wilt, severely reducing photosynthesis and plant vigor in infected maize crops.

Multiple Spread Pathways

Transmitted through infected crop residue, wind-driven rain, irrigation, machinery, and plant wounds, making containment difficult.

Significant Yield Losses

Up to 50% yield reduction reported in severe outbreaks, jeopardizing food security.

Complex Management Challenge

No effective chemical control; management relies on rigorous residue practices, crop rotation, and resistant hybrids.

This case underscores why robust international and national plant health systems are crucial for preventing devastating agricultural and economic losses.

What Are International Plant Health Systems?

International plant health systems represent a **global, science-based framework** designed to prevent pest spread, protect agricultural systems and biodiversity, and enable safe international trade. These systems are built on the principle that plant health threats transcend borders and require coordinated, harmonized responses.

At the heart of this framework is the International Plant Protection Convention (IPPC), a multilateral treaty with **184 contracting parties**. The IPPC provides the governance structure, sets international standards, and coordinates national plant protection organizations worldwide.

This is **global governance applied locally**—where international standards are implemented through national systems, creating a network of plant protection that benefits all countries regardless of size or resources.

IPPC mission, vision and objectives

- **IPPC Mission:** Protect global plant resources and facilitate safe trade.
- **IPPC Vision:** The spread of plant pests is minimized and their impacts within countries are effectively managed.
- **IPPC objective:** All countries have the capacity to implement harmonized measures to reduce pest spread and minimize the impact of pests on food security, trade, economic growth, and the environment.

Strategic Objectives:

In practice, what does the IPPC do?

The IPPC **develops International Standards for Phytosanitary Measures (ISPMs)** and **facilitates their implementation** to ensure food security and reduce the risks to agriculture and biodiversity.

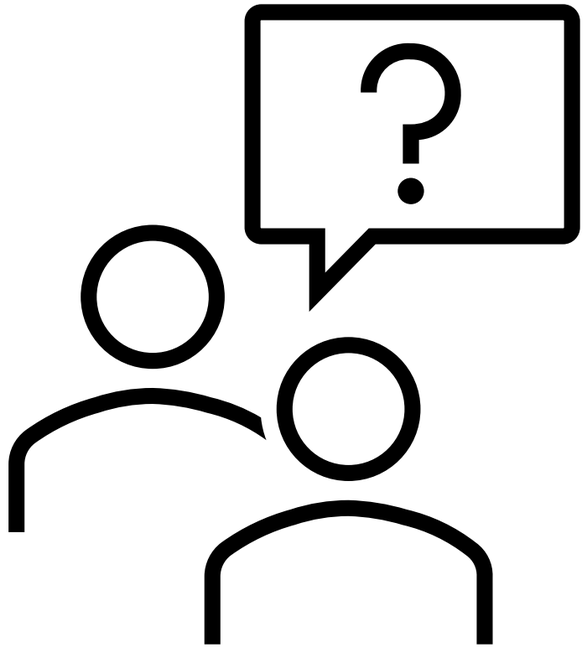
ISPMs: the framework for phytosanitary systems and operations

(as of October 2025)

- 47 ISPMs
- 33 diagnostic protocols
- 46 phytosanitary treatments
- 10 CPM Recommendations
- 25 Guides
- 11 e-learning and training materials

https://www.ippc.int/en/

Why set international standards?



Why set international standards?

Contracting parties have **access to a same level of playing field** upon which **all** can safely trade plants and plant products.

The aim of **international standards is to harmonize phytosanitary measures**.

Facilitate **safe international trade**, protect the **environment** and ensure **food security**.

Phytosanitary measures: basic principles

- Only when necessary
- No more restrictive than necessary
- Technical justification
- Minimal impact
- Non-discrimination (→Equivalence of phytosanitary measures)
- Transparency

ISPM1 - ***Phytosanitary principles for the protection of plants and the application of phytosanitary measures in international trade*** **(adopted in 1993, revised in 2006)**

For more information:

IPPC adopted ISPMs

https://youtu.be/W8zciLFG--8

Video on IPPC Standard Setting Process

CPM Recomendations

The Role of National Plant Protection Organizations

National Plant Protection Organizations (NPPOs) are the operational heart of international plant health systems. Strong NPPOs create strong markets; weak systems invite pest entry and trade rejection. The effectiveness of global plant health depends entirely on the capacity of these national authorities.

Core NPPO Functions

Pest Surveillance & Diagnostics

Systematic monitoring to detect new pests early, coupled with laboratory capacity to accurately identify threats. Early detection enables rapid response before pests establish.

Pest Risk Analysis

Science-based assessment of pest threats to inform policy decisions. PRA evaluates likelihood of entry, establishment, spread, and potential economic impact.

Inspection & Certification

Border inspection of imports and pre-export certification of exports. These activities protect domestic agriculture while enabling trade access.

Emergency Preparedness & Response

Contingency planning and rapid response protocols for pest incursions. Preparedness determines whether detection leads to containment or establishment.

Capacity Building Priority: Many developing countries have NPPOs that exist on paper but lack resources for effective operation. Investment in NPPO capacity—diagnostics, training, equipment, and systems—is investment in agricultural sustainability and trade competitiveness.

What does the IPPC offer to strengthen the capacities of the NPPOs?

E-learning Opportunity – Plant Health Campus

11 E-learning Courses

And more being published…

Visit: IPPC Plant Health Campus

Phytosanitary Capacity Evaluation (PCE)

PCE validation mission in Djibouti, Malawi, Kenya, Rwanda and Mauritius

The **PCE** is a **fully comprehensive NPPO-led, facilitator-enabled**, IPPC Secretariat-supported process of multiple phases, with a wide range of benefits, to help countries evaluate their phytosanitary capacities.

The PCE empowers NPPOs to put in place **a sovereign plan** for how they wish to address any gaps identified, to enhance their food security and international trade.

POARS: Early Warning, Global Response

The **Pest Outbreak Alert and Response System (POARS)**, an initiative of the IPPC, is designed to help countries detect and respond to emerging plant pest threats early, minimizing their spread and impact.

What it Is

A global early-warning and coordination system for new or spreading plant pests, acting as the world's plant health radar.

What it Offers

Provides timely alerts, shares critical risk information, offers scientific guidance, and connects countries to international expertise and resources.

How it Helps Countries

Enables early detection, faster preparedness and response planning, strengthens surveillance and diagnostics, and promotes coordinated action to reduce pest spread and protect agriculture, trade, and food security.

POARS significantly reduces the time from pest detection to coordinated action, transforming potential disasters into manageable incidents and safeguarding food systems.

Visit the IPPC Call for Nominations for details and access to the official nomination form.

The Role of Plant Health Systems and NPPOs in Bio-input

Biological Inputs

Biological inputs—including biopesticides, beneficial organisms, biostimulants, and biofertilizers—are **essential tools for sustainable and regenerative agriculture**. These products offer effective alternatives to synthetic chemicals while supporting soil health, biodiversity, and ecosystem services.

Biopesticides

Naturally derived pest control products with reduced environmental impact and compatibility with integrated pest management

Beneficial Organisms

Living natural enemies that provide sustainable pest suppression without chemical residues

Biofertilizers & Biostimulants

Microbial and natural products that enhance plant nutrition, stress tolerance, and soil health

NPPOs: Bio-Inputs for Sustainable Agriculture

NPPOs apply international standards and guidelines, and they play a crucial regulatory and facilitative role in integrating bio-inputs into sustainable agriculture. Their focus is on ensuring these green solutions are safe for plant health and biodiversity, while also supporting their use as vital alternatives to chemical pesticides.

Regulatory Oversight

Establish legal frameworks for authorization and inspection of bio-inputs, ensuring they pose no risks to biodiversity.

Pest Risk Analysis (PRA)

Conduct scientific assessments to prevent new pest or disease spread via bio-inputs in cross-border trade.

Inspections & Surveillance

Monitor consignments at borders and within territories for pest impact, including unintended bio-input effects.

Permits & Certification

Issue permits for the safe import, movement, and release of beneficial organisms, adhering to ISPM No. 3.

Information Exchange

Facilitate national and international data sharing on regulated pests and safe, effective bio-input solutions.

Capacity Building

Develop expertise in bio-input use and regulation through staff training and research collaborations.

NPPOs expertly balance the imperative for effective pest control with the need to protect the environment and facilitate safe trade, integrating bio-inputs into national plant protection strategies under strict phytosanitary guidelines.

From Pest Control to Plant Health Stewardship

The evolution of plant protection represents a **fundamental paradigm shift**—from reactive pest control focused on killing pests after they appear, to proactive plant health stewardship that builds resilient, healthy agroecosystems capable of resisting pest pressure.

Traditional Approach

Reactive chemical applications triggered by pest presence. High environmental impact, resistance development, and non-target effects.

1

Integrated Pest Management

Multiple tactics combined: monitoring, thresholds, cultural practices, biological control, and judicious pesticide use when needed.

2

Plant Health Stewardship

Prevention-focused systems design: healthy soil, crop diversity, habitat for beneficials, variety selection, and ecosystem resilience.

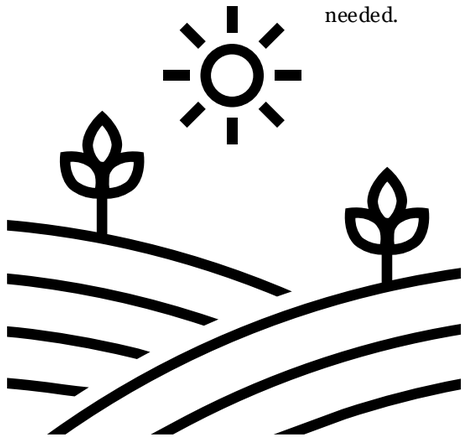
3

The IPM Foundation

Integrated Pest Management remains the technical foundation, combining:

- Pest monitoring and identification
- Action thresholds based on economic impact
- Preventive cultural practices
- Biological and physical controls
- Selective pesticide use as last resort

IPM reduces pesticide dependency while maintaining productivity—the agricultural equivalent of preventive medicine.



Alignment with Regenerative Agriculture

This evolution perfectly aligns with regenerative agriculture principles. By focusing on system health rather than pest destruction, we build agricultural systems that:

- Sequester carbon in healthy soils
- Support beneficial biodiversity
- Reduce chemical inputs and costs
- Enhance resilience to climate stress
- Produce healthier, higher-quality crops

Why This Matters for ICSCE and PMFAI

Plant health systems are not peripheral to the ICSCE mission—they are **foundational infrastructure** that enables every dimension of sustainable crop science and agricultural innovation. For PMFAI members, strong plant health frameworks create the conditions for success.

Sustainable Agriculture

Plant health systems enable the prevention-focused, ecosystem-based approaches that define sustainability. Without effective pest management, intensive chemical use undermines sustainability goals.

Bio-Inputs & Green Chemistry

Regulatory frameworks for safe movement and use of biological products remove barriers to adoption. Harmonized standards facilitate market development for sustainable alternatives.

AI, Drones & Precision Agriculture

Digital plant health data—from surveillance, diagnostics, and monitoring—feeds precision agriculture systems. Early pest detection enables targeted responses that reduce input use.

Supply Chain Efficiency

ePhyto and digital certification eliminate bottlenecks, reduce costs, and enable traceability throughout value chains. Time-sensitive products reach markets faster with less loss.

Regulatory & Trade Confidence

Science-based international standards reduce trade disputes and non-tariff barriers. Predictable, transparent plant health measures facilitate market access for all countries.

Climate Adaptation

Plant health surveillance and forecasting systems provide early warning of climate-driven pest risks, enabling proactive adaptation rather than reactive crisis response.

PMFAI members benefit directly from every dimension of strengthened plant health systems—from farmer productivity to export competitiveness to sustainable intensification.

Key Take-Home Messages

1. Foundation of Sustainability

Plant health is not separate from sustainability—it is foundational infrastructure. Sustainable agriculture cannot succeed without effective plant health systems that prevent pest devastation and reduce chemical dependency.

2. Climate Makes Preparedness Essential

Climate change is actively reshaping pest risks now, not in the distant future. Surveillance, forecasting, and adaptive capacity are no longer optional—they are essential for agricultural resilience.

3. Capacity Development is a Priority

Strengthening capacities is essential to reinforce plant health systems and promote regenerative agriculture. Raising awareness and enhancing the skills of key stakeholders—especially NPPO staff—is critical for ensuring effective implementation and long-term sustainability.

4. Prevention is Most Cost-Effective

Every analysis confirms prevention and preparedness deliver exceptional return on investment compared to managing established pests. Prevention is both economically optimal and environmentally preferable.

> **These four principles should guide investment decisions, policy development, and strategic planning across the agricultural sector.** Plant health systems represent strategic infrastructure deserving priority attention and resources.

The Way Forward: A Call to Action

Strengthening international plant health systems requires **concerted action across government, industry, and research communities**. The path forward is clear, proven, and achievable—what remains is mobilizing the political will and resources to implement it systematically.

01

Invest in NPPO Capacity

Prioritize sustainable funding for national plant protection infrastructure—diagnostics laboratories, surveillance systems, trained personnel, and modern equipment. Strong NPPOs are the foundation for everything else.

02

Strengthen Surveillance & Diagnostics

Deploy systematic monitoring networks with molecular diagnostic backup. Early detection is the gateway to effective response. Invest in both technology and the trained personnel to use it.

03

Adopt Digital Certification

Implement ePhyto systems to facilitate trade while enhancing security. Countries not yet participating should prioritize this—the technology exists, support is available, and the benefits are proven.

04

Foster Public-Private Partnerships

Plant health is a shared responsibility. Industry, government, and research institutions must collaborate on surveillance, innovation, capacity building, and response. PPPs leverage resources and expertise from all sectors.

For Governments

- Allocate sustained funding for NPPO operations
- Implement IPPC standards, join ePhyto, and request PCE
- Integrate plant health into climate adaptation planning
- Support regional cooperation mechanisms

For Industry & PMFAI Members

- Engage NPPOs in surveillance and information sharing
- Support capacity building and technology transfer
- Champion harmonized standards and digital systems
- Invest in sustainable pest management R&D

Thank You

Plant health is protection, sustainability, and opportunity

By investing in plant health systems today, we secure agricultural productivity, environmental sustainability, and economic prosperity for future generations. The frameworks exist, the technology is proven, and the benefits are clear.

Let us work together to build the plant health infrastructure our world needs.

Questions and Discussion

References and Resources

Key International Organizations

- **International Plant Protection Convention (IPPC)** – www.ippc.int
- **Food and Agriculture Organization (FAO)** – Plant Production and Protection Protection Division
- **IPBES** – Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Ecosystem Services
- **WTO SPS Agreement** – World Trade Organization Sanitary and Phytosanitary Measures

Standards and Guidelines

- IPPC Strategic Framework 2020–2030
- ISPM 12 – Phytosanitary Certificates
- IPPC National Plant Protection Organization Guidelines
- FAO Biosecurity and Preparedness Frameworks

Key Research and Data

- FAO (2021) *Plant Health and Food Security*
- FAO (2018) *Fall Armyworm Impact Assessments*
- IPBES/FAO/UNEP (2023) *Invasive Alien Species Report*
- Deutsch et al., *Science* (2018) – Climate change and crop pest losses
- IPCC AR6 WGII, Chapter 5 – Food, Fibre and Other Ecosystem Products
- Day et al., *Journal of Pest Science* – Fall armyworm economics
- ABARES Biosecurity Cost-Benefit Studies

Digital Systems

- IPPC ePhyto Programme – www.ephytoexchange.org
- ePhyto Country Adoption Status (updated regularly)

Contact Information: For more information on IPPC standards, ePhyto implementation, or capacity building support, contact your National Plant Protection Organization or the IPPC Secretariat at ippc@fao.org