Capacity development for sustainable management of major pests threatening the stable crop production

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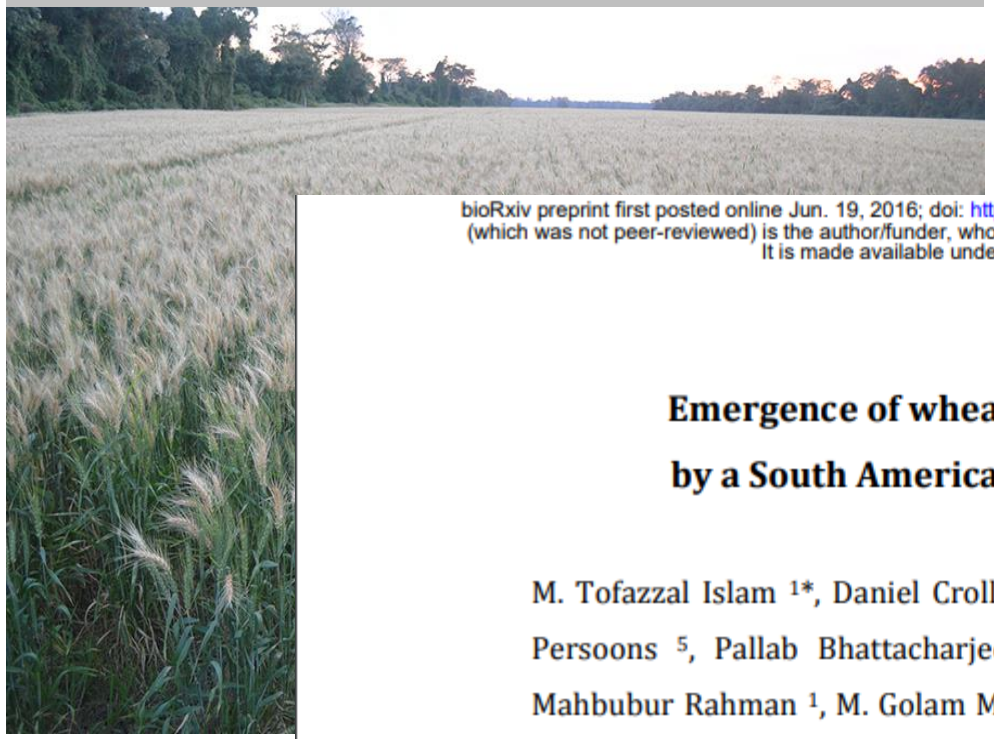
Spreading of wheat blast most likely due to international trades

Field covered by wheat blast in Bolivia



Field covered by wheat blast in Bangladesh

Emergence of wheat blast in Bangladesh was caused by a South American lineage of *Magnaporthe oryzae*

M. Tofazzal Islam [1*], Daniel Croll [2], Pierre Gladieux [3], Darren M. Soanes [4], Antoine Persoons [5], Pallab Bhattacharjee [1], Shaid Hossain [1], Dipali Rani Gupta [1], Md. Mahbubur Rahman [1], M. Golam Mahboob [6], Nicola Cook [5], Moin U. Salam [7], Vanessa Bueno Sancho [5], João Leodato Nunes Maciel [8], Antonio Nhani Júnior [8], Vanina Lilián Castroagudín [9], Juliana T. de Assis Reges [9], Paulo Cezar Ceresini [9], Sebastien Ravel [10], Ronny Kellner [11, 12], Elisabeth Fournier [3], Didier Tharreau [10], Marc-Henri Lebrun [13], Bruce A. McDonald [2], Timothy Stitt [5], Daniel Swan [5], Nicholas J. Talbot [4], Diane G.O.

t al., 2017

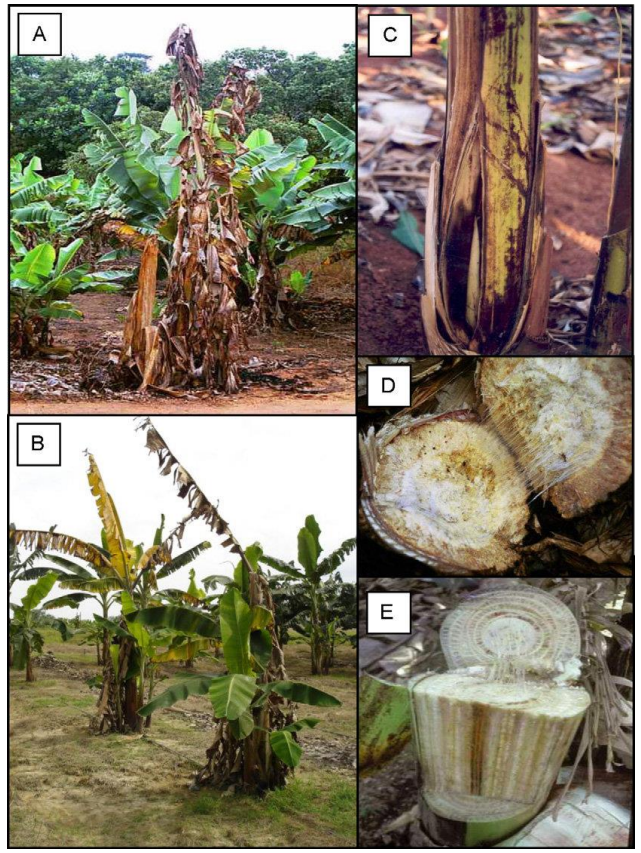
Reasons for pest surveying

- To develop a list of pests or hosts present in an area
- To demonstrate a pest-free area (the absence of a particular pest in an area) or places of low pest prevalence for trade purposes
- To develop a baseline list of pests before ongoing monitoring for changes in pest status
- For pest management and control
- For early detection of exotic pests
- For early detection of established organisms becoming pests
- To delimit the full extent of a pest following an incursion
- To monitor progress in a pest eradication campaign.

Teresa McMaugh, 2005

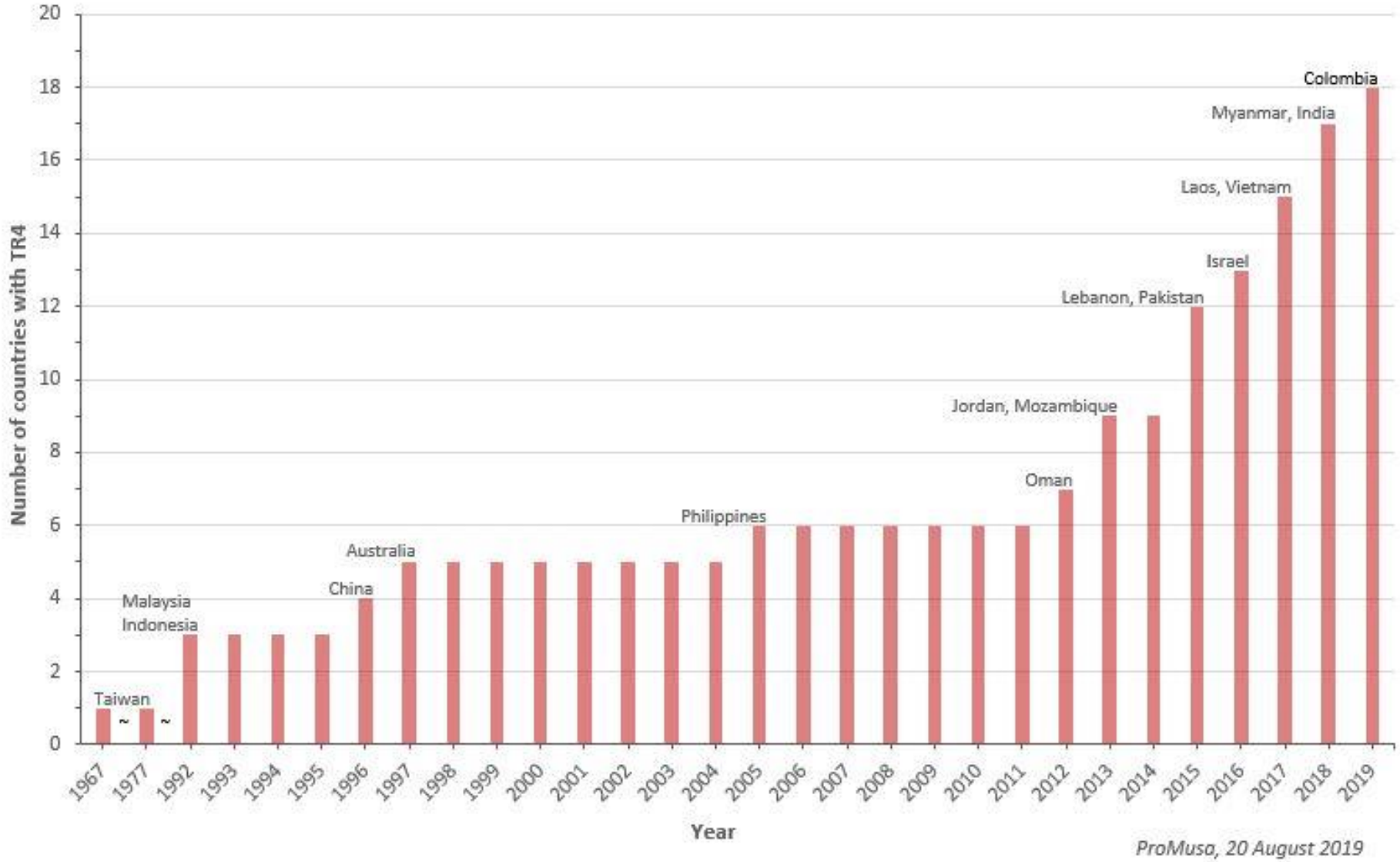
Fusarium wilt is the greatest threat to banana production

- Banana Fusarium wilt is caused by a soil-borne fungal pathogen, *Fusarium oxysporum f. sp. cubense* (*Foc*).
- *Foc* is subdivided into four different races, which each attack a different group of banana genotypes. They are TR1, TR2, STR4, and TR4.
- Different races of *Foc* caused symptom is indistinguishable and DNA-based diagnosis is required for determining the causal races
- *Foc* can be spread through infected planting material, infested soil and water.
- *Foc* cannot be controlled using fungicides and cannot be eradicated from soil using fumigants. It can survive decades in the soil.
- The outbreak of Fusarium wilt decimating the variety of Gros Michel which was first reported in Latin America is caused by TR1 whereas the quick spreading of Fusarium wilt in the variety of Cavendish firstly reported in Taiwan, China is caused by TR4.



Distribution of *Fusarium* wilt of banana

Increase in the number of TR4 first reports



Wipe-out of banana plantation by TR4 in 3 years

A Cavendish field in Yunnan, China

2010 2011 2014

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FAO actions

- Awareness raising (at national, regional, and global level)
- Capacity building, trainings (LAC, Asia, Mozambique)
- Emergency support (Mozambique)
- Regional TCP (Asia, LAC)
- Surveys (Asia, Mozambique)
- International collaboration, dialogue
- Guidance materials (Guides for surveillance, diagnosis, travellers policy and technical people).

Elkahky M

A regional project for tackling challenge of TR4 to banana production and industry

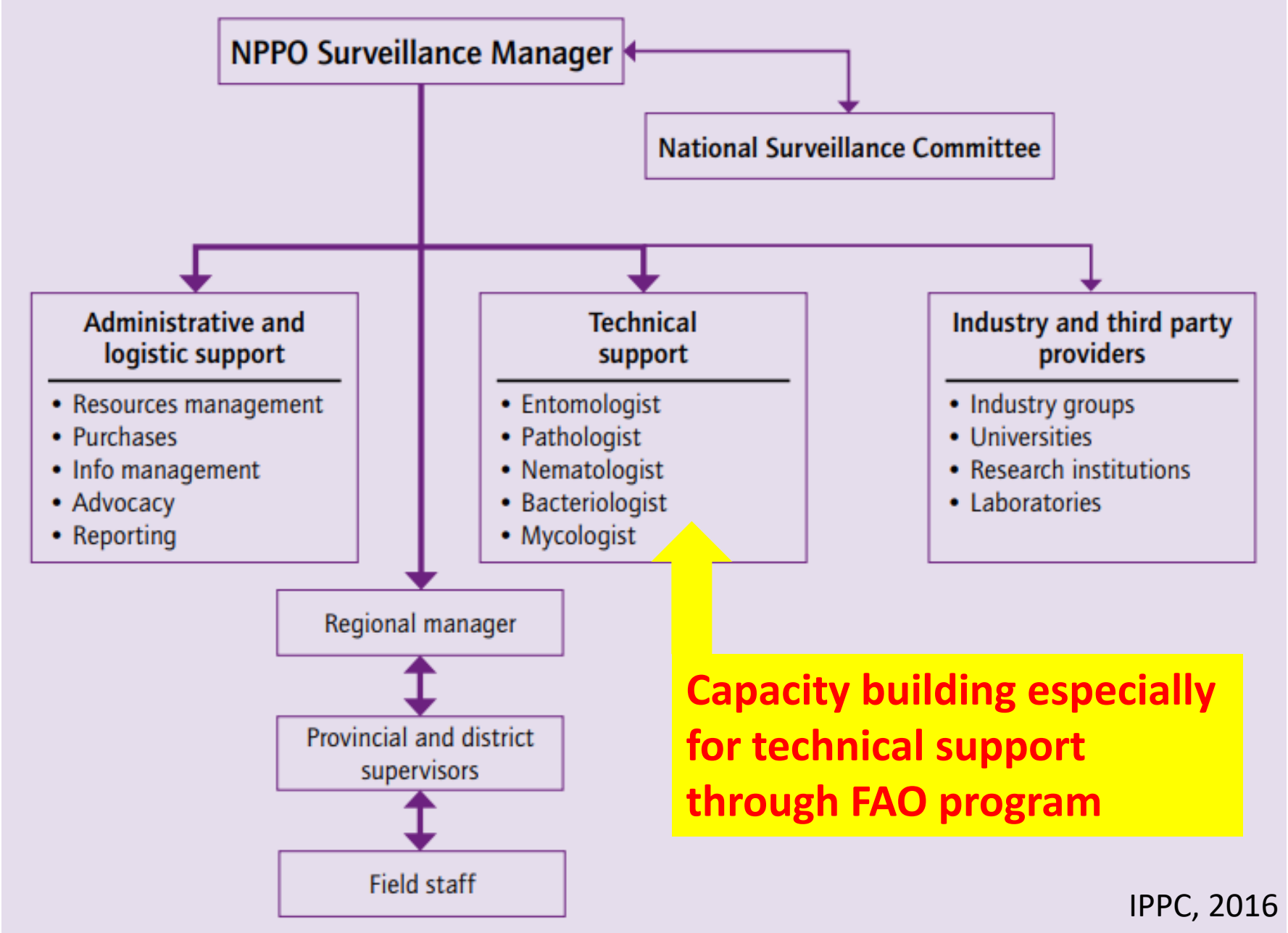
TCP/RAS/3619: Capacity development on diagnostic and surveillance system of banana Fusarium wilt disease

Participating countries: Cambodia, China, Laos, Myanmar, Thailand, Vietnam

Project duration: January 2018 - October 2019

FAO Strategic Objective 4: Enable more inclusive efficient agriculture and food system.

Conceptual organization of a management structure for a national pest surveillance programme



IPPC, 2016

Logical framework of the project

Outcome:

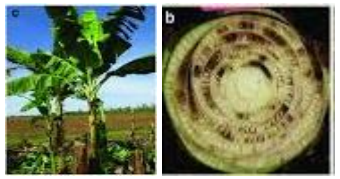
- The Ministry of Agriculture of the selected countries will have the capacity to advocate the options to mitigate the incursion and preventing the spread of banana TR4 disease that impacting the sustainable development of the banana industry, reduce pesticide usage for human health and promote safe trade through proper diagnosis of the disease and harmonized specific detection survey based on multi-disciplinary approach and international standards

Outputs

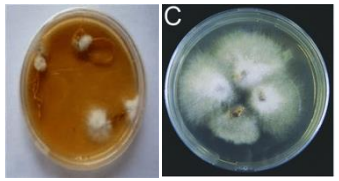
- Enhance the technical capacity in the diagnostic of banana *Foc* TR4 disease for proper and reliable specific detection surveys
- Conduct specific detection surveys on the incursion of *Foc* TR4 in 9 high risk countries
- Development of strategic mitigation and intervention of *Foc* TR4 incursion
- Sharing of success story of *Foc* TR4 management practices among disease infested and high risk countries in Asia

Technical capability of the diagnostic of banana *Foc* TR4 disease improved

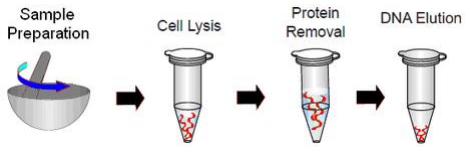
Sample collection



Pathogen isolation, purification, and preservation



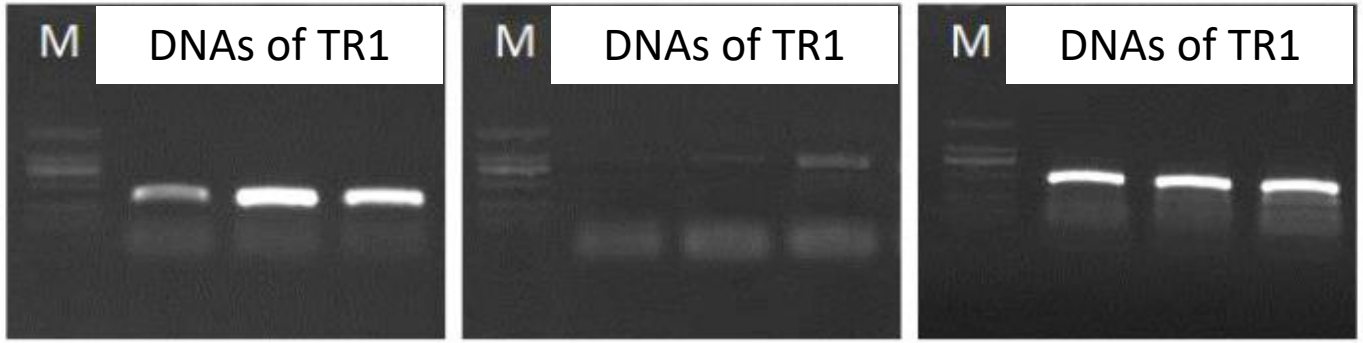
DNA isolation



PCR amplification and electrophoresis

Result decoding and data recording

Optimization of TR4 specific primers used for the diagnosis



Foc1 primer

Foc4 primer (Li et al., 2012)

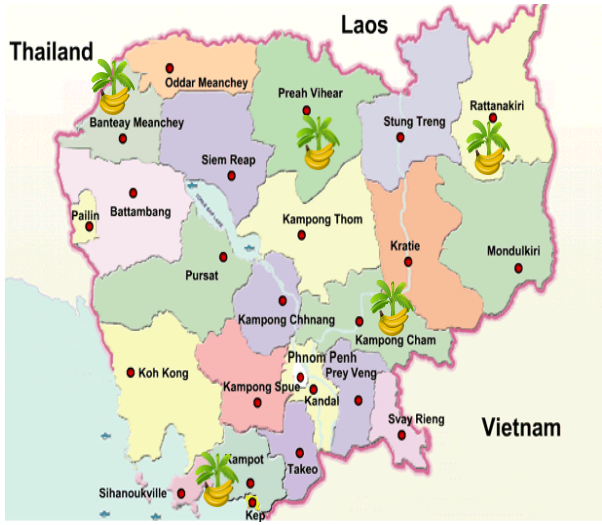
TR4 primer (Dita et al., 2010)

From China's group

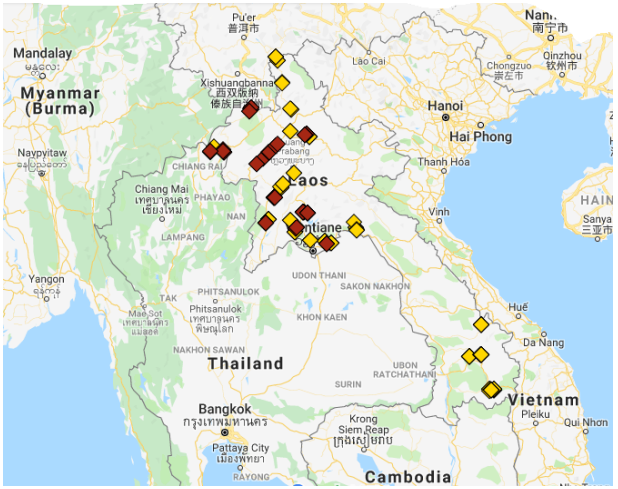
Infestation status of *Foc* TR4 in high risk countries identified through specific detection surveys

All 5 provinces are reported for TR4 infection (4.5%)

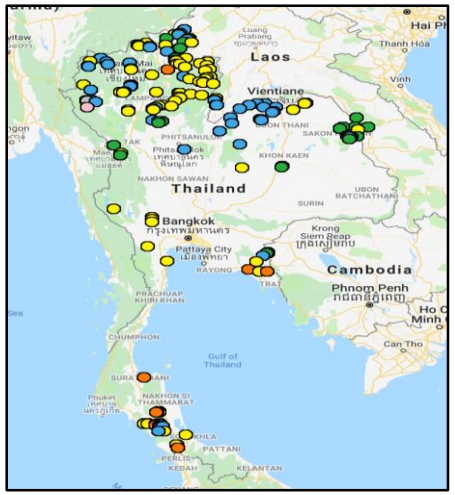
4 out of 12 provinces are reported for TR4 infection



No TR4 was identified in 5 surveyed provinces.



5 out of 12 provinces are reported for TR4 infection



2 out of 377 farms were reported for TR4 infection.

2 out of 3 states/regions were reported for TR4 infection

In the project, e-surveillance system is used for the data collection with GPS information.

From project terminal report

Mitigation and intervention strategy for *Foc* TR4 incursion developed

- Established national coordinating committee to develop the national surveillance system
- Strengthened the laboratory capacity for identification of *Foc* TR4
- Conducted the surveillance activities using an optimized protocol
- Conducted capacity development training on *Foc* TR4 to national and provincial officers and implement the FFS in selected province
- Established Standard Operating Procedure (SOP) for proper management of TR4 including proper containment, distribution of pest-free plant materials, etc

Combined use of resistance variety and beneficial microorganism for the sustainable management of TR4

Resistant variety Nantianhuang + beneficial microorganism

< 5% of disease incidence

Susceptible variety Baxi without beneficial microorganism

50% disease incidence

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An integrated farming system for sustainable management of TR4 and promoting agriculture production

An integrated farming system (livestock-waste-banana) for agriculture production in a previously TR4 infected banana plantation area in Yunnan, China.

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New regional TCP concept note

Title: Capacity development of diagnosis and surveillance of transboundary plant pests

Objectives:

- To establish a standard operating procedure (SOP) for the diagnosis and surveillance of both banana Fusarium wilt disease (TR4 and TR1) and cassava diseases (CWBD and SLCMV)
- To establish a data management system for early warning and monitoring of transboundary plant pests
- To establish a regional platform of a concerted and rapid response to transboundary plant pests
- To capacitate national plant protection extension system surveillance and management of transboundary plant pests

Cassava witches' broom

Caused by phytoplasma transmitted by whitefly

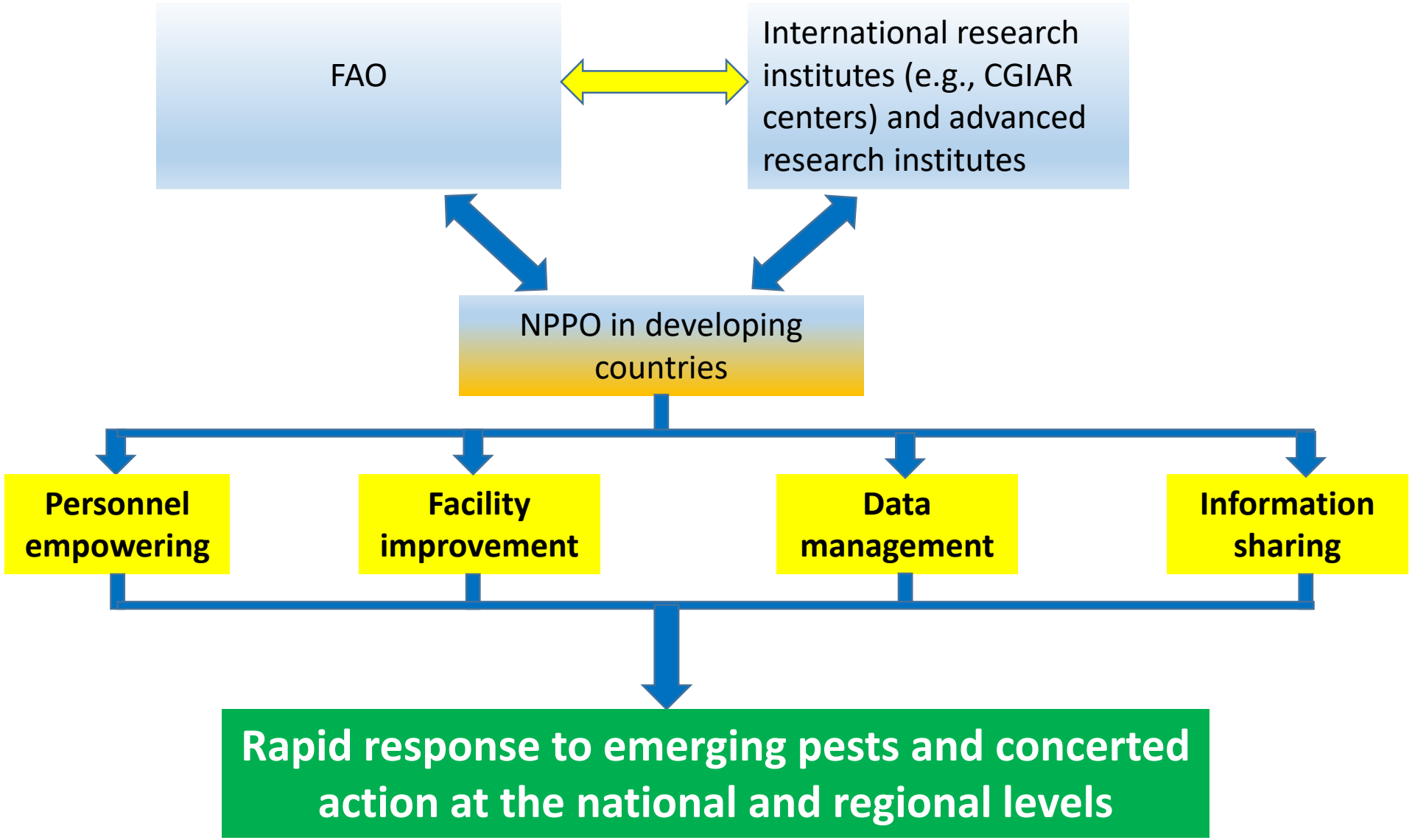
Cassava mosaic virus

Caused by geminivirus transmitted by whitefly

Banana Fusarium wilt

Caused by different races of *Foc*, e.g., TR1 and TR4

A more efficient and transparent surveillance system for transboundary plant pests



Acknowledgements

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Thanks you for your attention!