Short Research Activity (SRA):

Developing and emergency response and long term management strategy for Cassava Mosaic Virus in Cambodia and Vietnam

July 19, 2017

Phnom Penh

Presentation Outline

1. Today's workshop
2. Overview: the Short Research Activity (SRA)
3. General background: about SLCMD and its importance
4. CIAT's role
5. Some thoughts for the afternoon

1. Today's workshop (objectives)

- Presentation of the main results of the 1st phase of work investigating incidence and spread of Sri Lanka Cassava Mosaic Disease (SLCMD)
- Highlighting lessons from the 1st phase and their significance for moving forwards with a long-term plan for managing this disease
- Fomenting discussion on collaborative next steps for surveillance and management strategies.

1. Today's workshop (program)

	Subject and content
MORNING	Introduction to the SRA and disease
	Results: SLCMD occurrence, incidence and spread
	Results: seed networks and patterns of exchange
AFTERNOON	Phase II of the SRA
	Implications and management options
	Discuss net steps

2. Overview SRA

OVERALL OBJECTIVE:

- Gain an in-depth appreciation of the current level of geographical spread, incidence and severity of the SLCMD in Vietnam and Cambodia, and to develop an over-arching framework to guide further applied research and action towards SLCMD containment and management

SPECIFIC OBJECTIVES:

- Generate an accurate, baseline diagnosis (including map) of the current geographical distribution of SLCMD in Cambodia and Vietnam (including measures of field-level incidence and severity) and baseline information on the insect / anthropogenic vectors involved in SLCMD spread
- Generate broad-level awareness of the risks posed by SLCMD and to build critical capacity among multiple stakeholders, including researchers, plant protection officers and extension agents, to deal with disease.

Activities – SO 1

1. Organize a multi-stakeholder workshop to share current knowledge and plan implementation of the SRA
2. Develop a survey and sampling protocol following a customized sampling design
3. Train a survey team in the implementation of the baseline diagnostics surveys
4. Implement the baseline diagnostics surveys and conduct extensive plant sampling and vector information
5. Conduct centralized data entry and data cleaning of the completed diagnostics and vectoring surveys
6. Conduct centralized disease diagnosis on cassava leaf and insect samples
7. Conduct statistical analysis, generate maps and draft a working paper on the baseline situation of the SLCMD geographical incidence, severity / incidence, and direction of spread, as well as disease vectoring

Activities – SO 2

1. Develop information-extension materials on SLCMD, its symptoms and management for public or private sector actors
2. Organize a technical training on sampling protocols, laboratory-based diagnostics and recommended post-baseline-diagnostics surveillance
3. Elaborate a focused strategy document for sector-wide sensitizing with actions, research needs or targeted biosecurity measures, based on the baseline diagnostics to devise SLCMD management / mitigation plans
4. Organize a multi-stakeholder (closing) workshop to share the project's finding and present / discuss a strategy for the short, mid- and long-term

What makes this SRA unique?

- Short duration and to the point activities
- Wide range of stakeholders consulted and involved
- Involved multidisciplinary team
- Involved two countries
- First robustly designed and geographical representative survey
- Use of published primers and uniform protocol / lab facility
- Tight link between disease surveillance and seed systems studies
- Picture database of each sampled plant

3. General background: about SLCMD and its importance

Wang et al., 2015. Plant Disease

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DISEASE NOTES

First Report of *Sri Lankan cassava mosaic virus* Infecting Cassava in Cambodia

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Citation

Open Access.

ABSTRACT

Cassava (*Manihot esculenta* Crantz) production can be severely affected by cassava mosaic disease (CMD) caused by viruses in the genus *Begomovirus* of the family *Geminiviridae*. Eight begomoviruses associated with CMD have been recorded on the African continent and two on the Indian subcontinent (Brown et al. 2015). Duraisamy et al. (2013) reported that two cassava geminiviruses on the Indian subcontinent—*Indian cassava mosaic virus* and Sri Lankan cassava mosaic virus (SLCMV)—were transmitted by the whitefly *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae), but the genetic group(s) or cryptic species of the whitefly responsible for the transmission were not determined, as *B. tabaci* is now known as a complex consisting of >35 morphologically indistinguishable species (Liu et al. 2012). Cassava cultivation in Southeast Asia started in early 1900s, and today it has become one of the major crops in many countries in this region including Cambodia (FAOSTAT). However, cassava in Southeast Asia has not previously been identified to be infected by CMD. In May 2015, a virus disease outbreak of cassava with infected plants showing typical symptoms of CMD was observed in the field in Ratanakiri, KaunMoum,

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Accepted: 30 Nov 2015

Focus Issue
Noncoding RNA Regulation of Plant-Microbe Interactions

NEW ON SALE!

Boom Crops & Boomerang Effects

Cassava mosaic disease
Sri Lanka mosaic virus

First record: 2015 – Cambodia

Insect-vectored, seed-borne

Cassava yield impact: unknown
Starch content: unknown

witches broom
phytoplasma

d: 1993 – Thailand

tored, seed-borne

impact: 30-35% loss
, unpublished)
: 25-30% loss (Hoat et
l., 2011)

ccus marginatus
aya mealybug

d: 2008 – Indonesia
mbodia, Thailand

: 80 host plant spp.
apaya, sweetpotato

d impact: 10-40% loss
013, India)

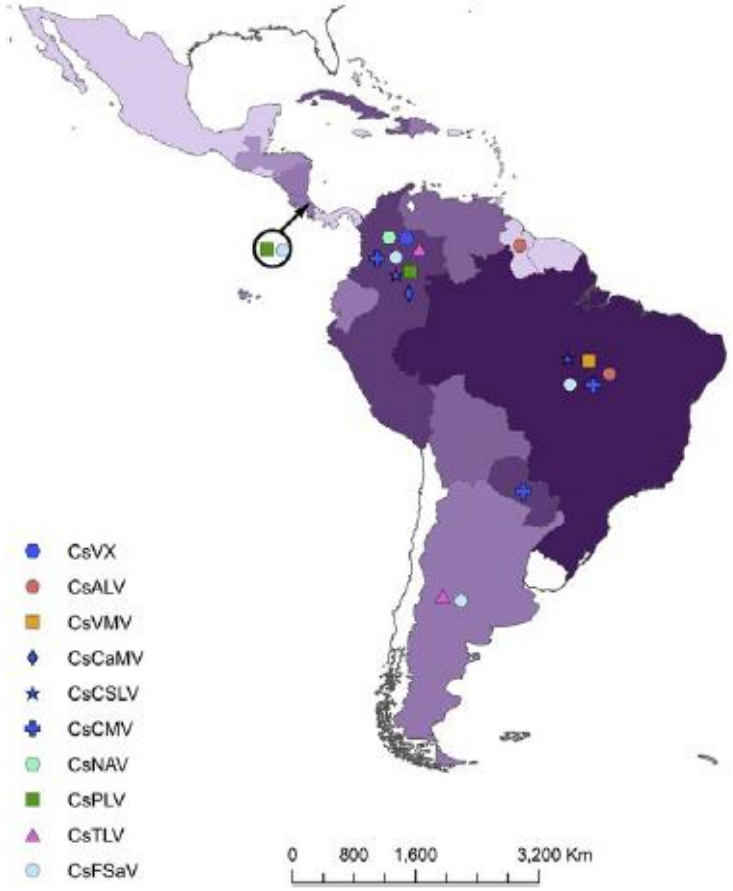
ccus manihoti
va mealybug

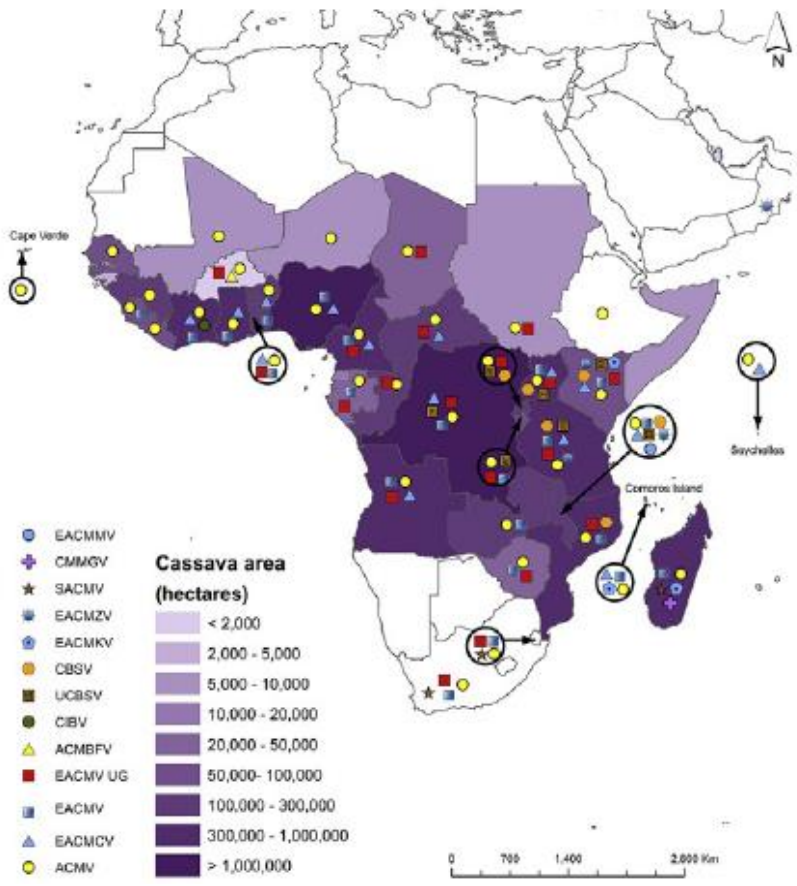
ecord: 2009
aboard Thailand

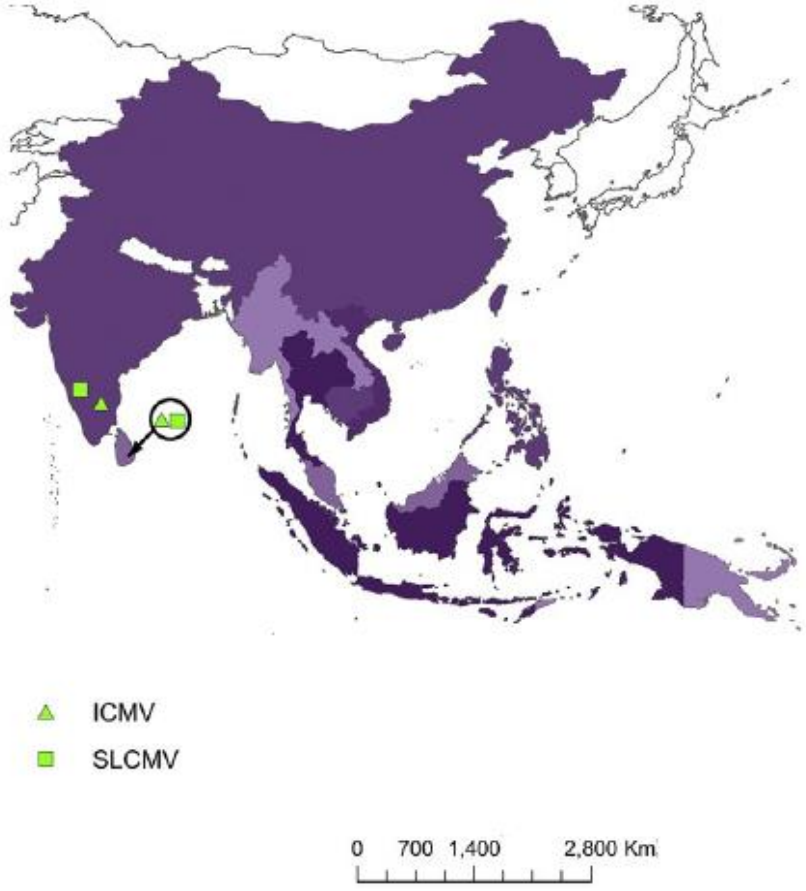
9 host plant spp.
soybean, citrus

t: up to 84% loss
20-40% loss (2010,
ailand)

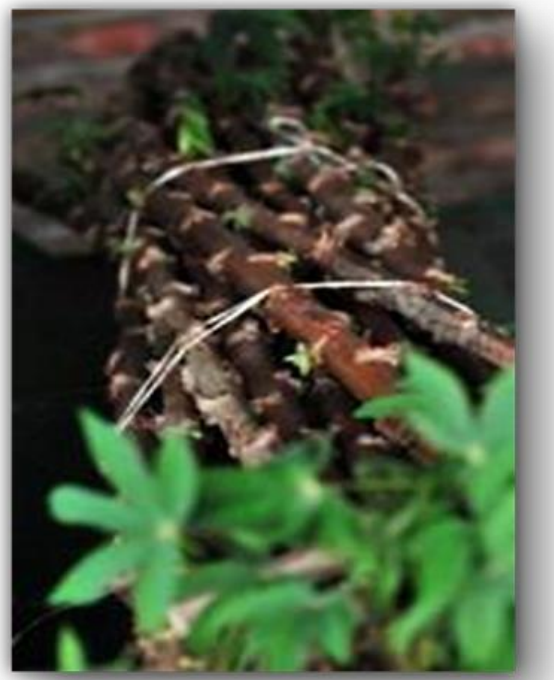
Global distribution viruses – late 2015

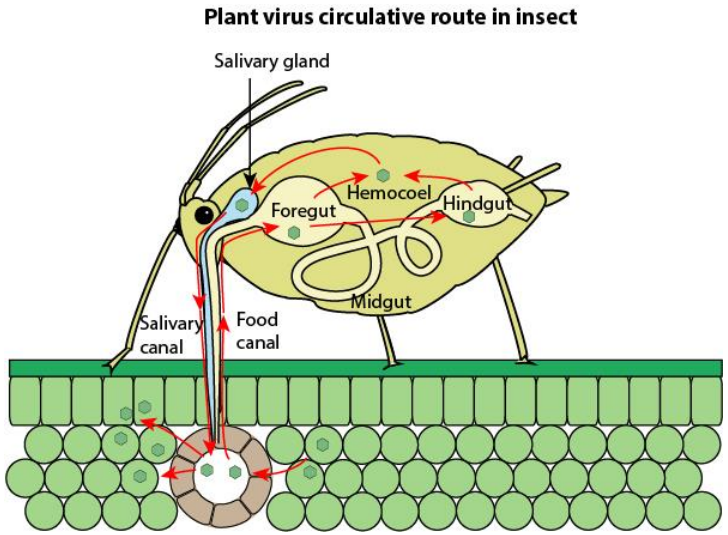






Vectoring: two main mechanisms





Human-mediated movement

Long-distance disease spread
Between-field movement
Most important driver of spread

Insect-mediated movement

Short-distance disease spread
Within-field movement
Presumably of lesser importance

Laboratory-based confirmation SLCMV presence

Report shared with Cambodian authorities & FAO on March 8, 2016

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CIAT Report, March 8th, 2016

Confirmation of the presence of Cassava Mosaic Disease (CMD) and *Sri Lankan Cassava mosaic virus* (SLCMV) in Cambodia: February, 2016.

Sophearith Sok, Monica Carvajal-Yepes, Wilmer J. Cuellar
International Center for Tropical Agriculture (CIAT).

After a Dec 2015 journal publication reported presence of Cassava mosaic disease (CMD) in the province of Ratanankiri (Cambodia), molecular assays were carried out to confirm pathogen identity and a larger field survey was initiated to determine the geographical distribution of CMD disease in Cambodia. More specifically, extensive sampling and PCR-based diagnostics was carried out in different Cambodian provinces, and on samples previously collected in a number of key Vietnamese cassava-growing regions.

The present document complements an earlier CIAT report – as presented to FAO Cambodia representatives and GDA officers on February 8th, 2016, in Phnom Penh (Cambodia). At the time, presence of the disease was suspected based upon visual confirmation of plants with CMD-like symptoms in cassava fields at the Holley Eco-Industrial Company in Ratanankiri (**Figure 1**).

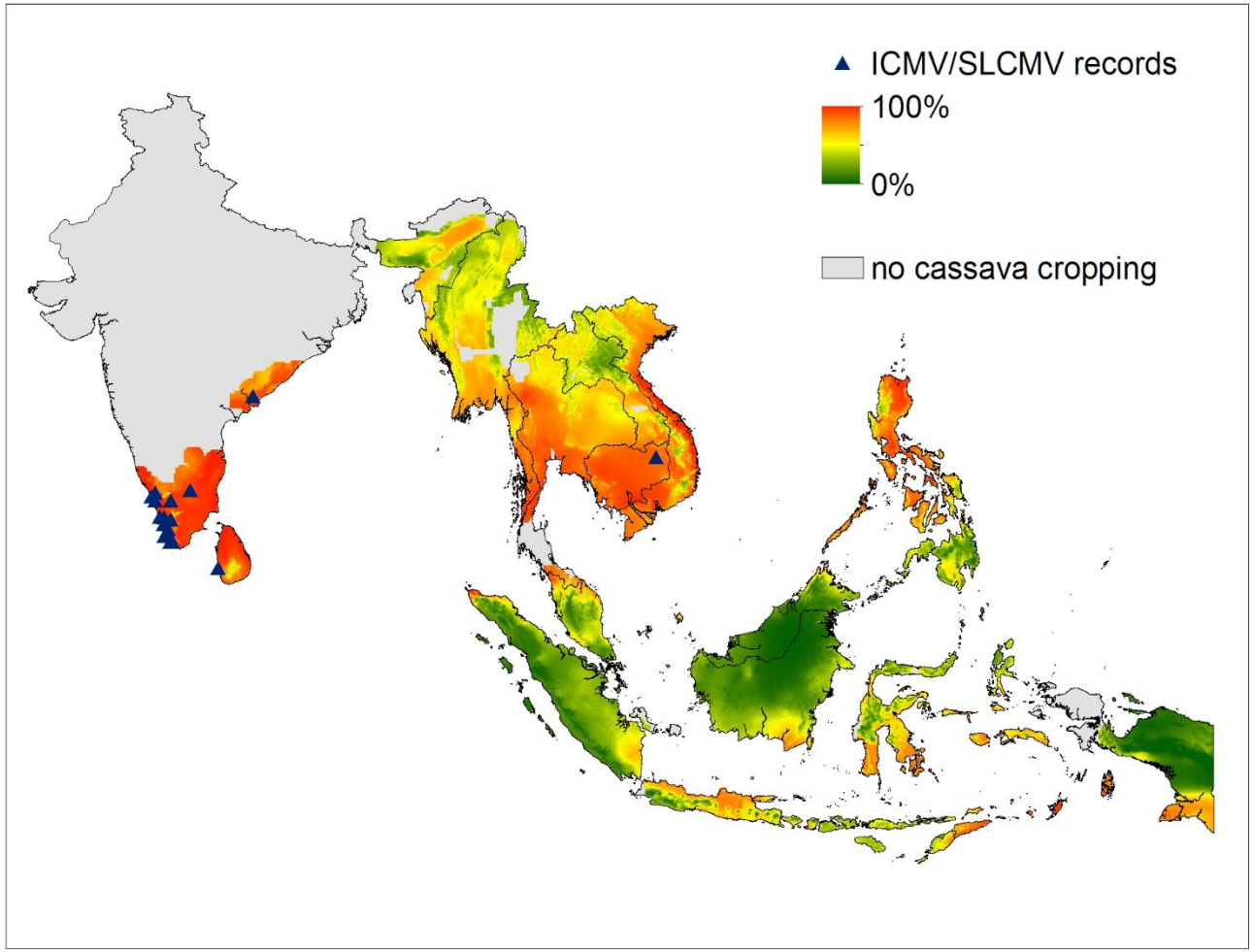
Administrators at Holley Eco-Industrial Company assured that affected fields were established with planting materials from the Vietnamese province of Tay Ninh. Nevertheless, after visual inspection of cassava plantlets collected in Tay Ninh in October-November 2015 (as part of another CIAT-led research program), no CMD symptoms were observed. Also, cassava plantlets that were collected in late 2015 in the Vietnamese provinces of Kon Tum, Gia Lai, Dak Lak and Dak Nong were inspected and equally did not exhibit symptoms of CMD.

Furthermore, the virus detected in Ratanankiri was identified as *Sri Lankan cassava mosaic virus* (SLCMV), indicating a likely origin of the planting material in Sri Lanka or South India - where SLCMV has been officially reported. Whitefly populations in Cambodia during the time of this inspection (4-11th of February) were low. Interestingly, no symptoms of CMD were observed in any other cassava plot inspected around the location of the Company or in other provinces of Cambodia. Therefore, CMD in Cambodia appeared to be limited to fields of the Holley Eco-Industrial company in Ratanankiri.

Next, laboratory tests at CIAT HQ were initiated on February 18th, using available ELISA and PCR detection tools. ELISA tests were carried out using a kit available from the "German Collection of microorganisms and Cell Cultures" (DSMZ) specific for SLCMV (Catalog#: AS-0424-0424/1). PCR primers were designed according to the specific sequence of the component-A of the SLCMV isolate reported in Cambodia (Genbank id. KT861468).

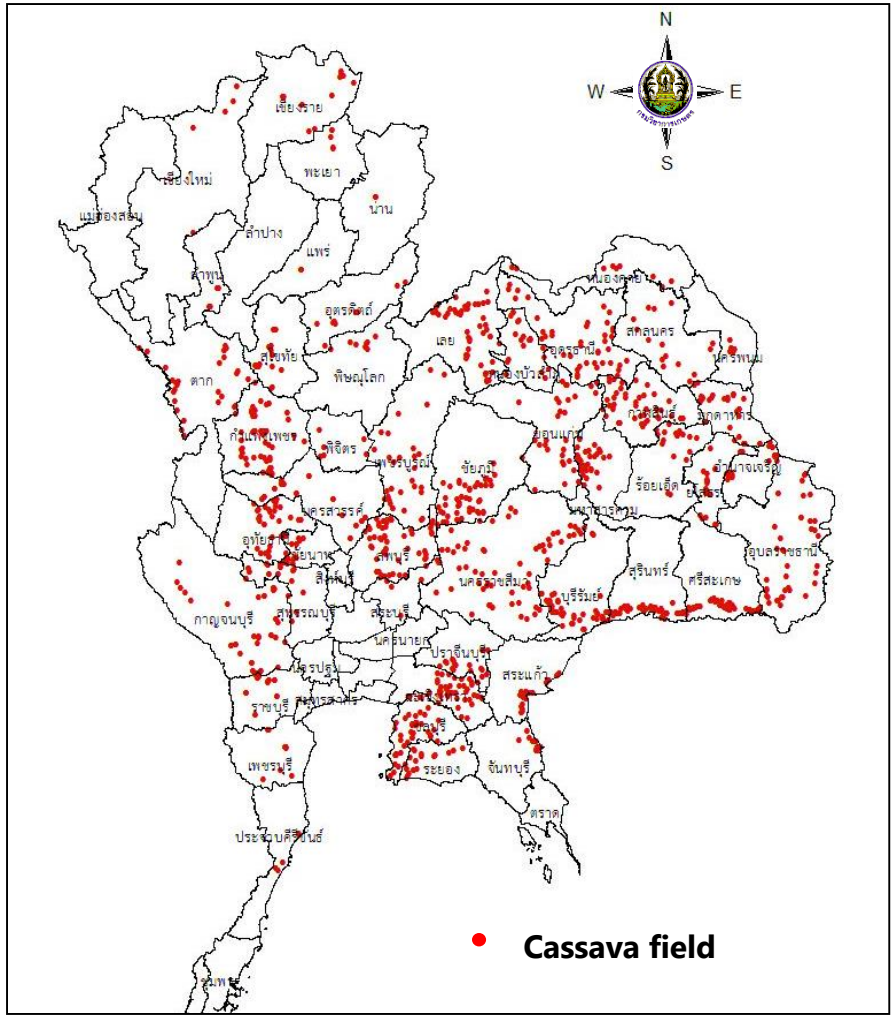
Planning Workshop Short Research Activity, 2016

Climate-model based suitability



Le, Newby & Wyckhuys, unpublished

SLCMV surveillance in Thailand



Source: Surveillance of *SLCMV* in Thailand by Department of Agriculture, 2016

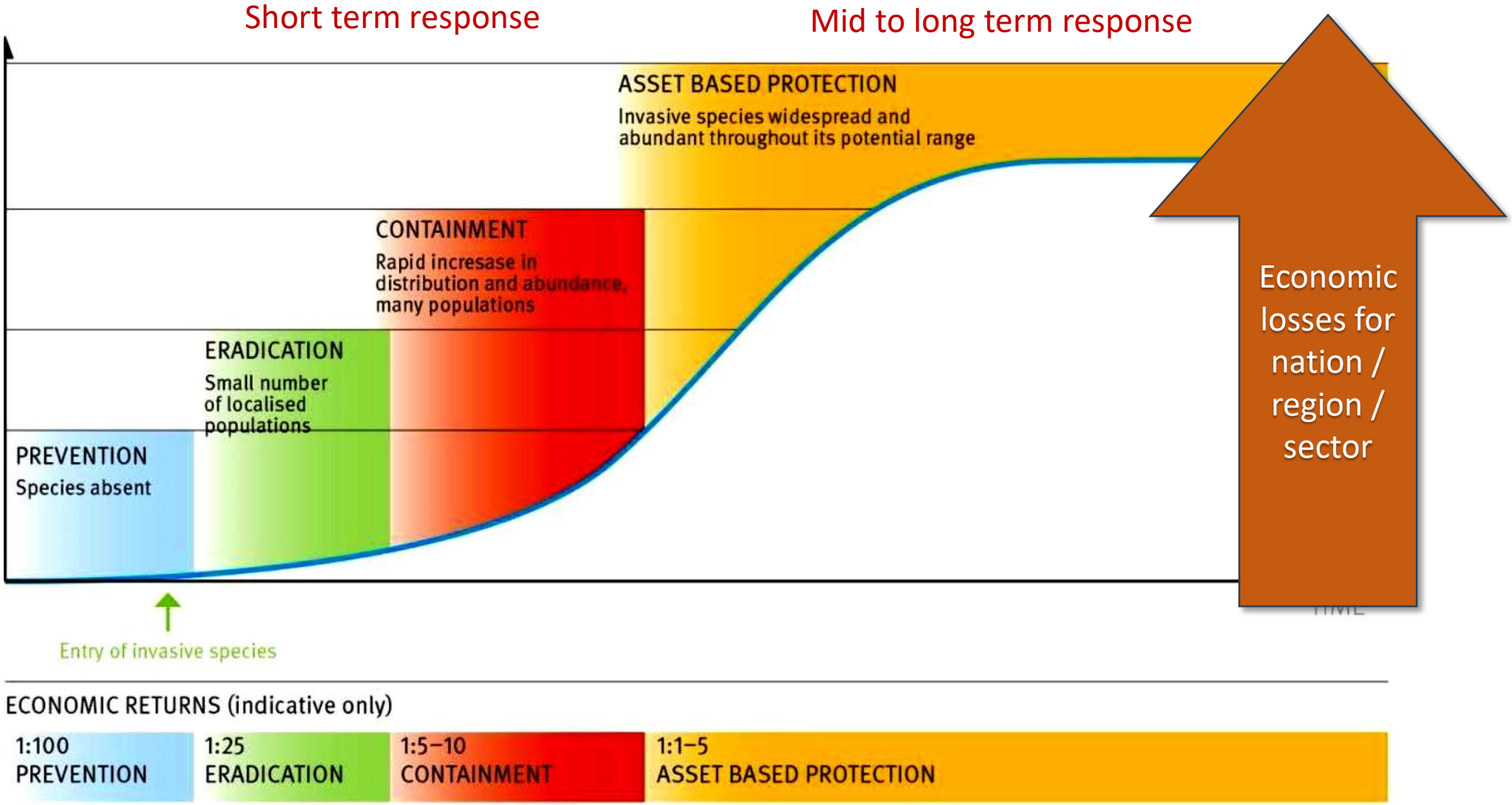
No. of province	No. of surveillance field	No. of sample	PCR detection for SLCMV
6 (close to Cambodia border)	129	542	**Negative**
50 (all cassava planted area in Thailand)	1,227	1,106	**Negative**
Total	1,356	1,648	**Negative**

- The minimum field site is one hectare.
- SLCMV detection at Virology research group Department of Agriculture, Thailand.
- PCR detection used specific primers for SLCMV.
- All samples are Negative.

4. CIAT's Role

- Provide science-based evidence and solutions
- Support regional intelligence (i.e. spatial / temporal monitoring, south-south learning)
- Participate in national and regional for a / platforms that deal with / strategize about the problem
- Backstop collective action to deal with complex problems
- Enhance national capacity and extension where demanded

Options for Managing the Situation



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