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## CAPACITY DEVELOPMENT ON DIAGNOSTIC AND SURVEILLANCE SYSTEM OF BANANA FUSARIUM WILT DISEASE

December 2019

SDGs:



Countries: Cambodia, China, Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam

Project Codes: TCP/RAS/3619

FAO Contribution USD 499 000

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### Implementing Partner

Ministry of Agriculture in Cambodia, China, Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam.

### Beneficiaries

Around 45 personnel from the Ministry of Agriculture and related agencies in each country and a further 90 researchers, plant protection officers and local provincial extension officers, agricultural institutions in the selected countries, at least two plant pathologists and three laboratory technicians and at least 10 000 farmers. 3 million banana farmers in the region will also be reached by the project.

### Country Programming Framework (CPF) Outputs

CPF – Cambodia – 2012-2016

Priority outcome 1: Increased productivity diversification and commercialization of agriculture, including livestock and aquaculture poverty reduction and food nutrition security.

CPF – China 2012-2015

Priority area 5: Strengthening capacities for disease and natural disaster prevention and response to climate change.

CPF – Lao People's Democratic Republic 2013-2015

Priority area 4: Reduced risk and vulnerability to natural and other disaster through prevention, preparedness, response and recovery.

CPF – Myanmar 2012-2016

Priority outcome 3: Sustainable management of natural resources and environment.

CPF – Thailand 2012-2016

Priority outcome 4: Food safety and quality are enhanced and trade and food availability to consumers in international and domestic markets at affordable and stabilized prices is promoted.

CPF – Viet Nam 2012-2016

Priority 4: Support for enabling more inclusive and efficient agriculture and food systems for vulnerable rural groups.

### BACKGROUND

Banana is the fruit accounting for the largest quantity of international and domestic trade, supporting around 8 million farmers in Asia for their daily income. The banana industry, however, is beset with the damage caused by Fusarium wilt, a disease that spreads through movement of planting materials or soil attached to non-hosts. The disease caused the complete collapse in international trade of the Gros Michel banana variety in the early 1900s, although the situation stabilized following the introduction of the Cavendish cultivar in the 1920s. In the 1980's, however, the Cavendish cultivars also succumbed to *Fusarium oxysporum* f. sp. *cubense* Tropical Race 4 (hereafter referred to as "Foc TR4").

At regional level, Foc TR4 was detected in Taiwan in the 1980s and spread to Indonesia and Malaysia in the 1990s. The disease has now reached China and the Philippines, while the National Plant Protection Organizations (NPPOs) of Cambodia, the Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam have reported the observation of infested banana areas. Amid fears that the disease might spread, affecting banana production by small farmers for national and export markets, a request was made to FAO for technical support to control the disease.

The project focused on the importance of detection surveys to determine the status and extent of Foc TR4 disease infestation in recipient countries, in an attempt to mitigate and prevent its spread to new areas. Its aim was to build the capacity of the six recipient countries to develop and advocate the viable options for mitigating the incursion and preventing the spread of banana Foc TR4 disease.

As a result of project activities, regional and national control strategies for Foc TR4 were developed during a meeting of National Project Coordinators (NPCs) in Bangkok, Thailand in March 2019, while a diagnostic protocol was developed during the training workshop on molecular identification of the disease in May 2018 in Guangzhou, China. All national laboratories were upgraded, while national surveillance plans were developed and conducted. In addition, Information, Education and Communication (IEC) materials were developed for surveillance activities, awareness and training programmes.

### IMPACT

The project is expected to make banana production sustainable by reducing the risk of pests and pesticide, with a view towards food security, human health and a healthy environment.





## ACHIEVEMENT OF RESULTS

The project contributed to the alleviation of poverty, sustainable production and environmental protection through capacity development, a reliable and real-time survey to inform decision-making and by empowering farmers through Farmer Field Schools (FFS) learning approaches using Integrated Pest Management (IPM) strategies.

The project has succeeded in empowering government agencies responsible for pest management to make accurate decisions in terms of maximizing the resources and controlling the disease in real time. For farmers, this empowerment was achieved through learning-by-discovery approaches for sustainable adoption of the technologies, with the appropriate mitigation measures taken to reduce disease incidence, as well as good agronomic practices for higher yields.

Another major achievement of the project was the strengthening of capacities of government officers at national, province and district levels, who, in turn, transferred the *Foc* TR4 technologies to farmers and implemented biosecurity measures to reduce the incidence and prevent the spread of the disease.

## IMPLEMENTATION OF WORK PLAN

All of the activities were completed successfully before the project's end date and within the budget allocated.

Initially, the project was delayed due to the lengthy procurement process and the signature of the Letter of Agreement (LoA). However, these issues were overcome through the sharing of information and the resolution of problems among the recipient countries. The delay was, to some extent, reduced by the close partnerships and mutual assistance among the implementing partners, who helped each other to procure chemicals and equipment regionally.

## FOLLOW-UP FOR GOVERNMENT ATTENTION

Follow-up and exchanges on the status and progress of the TR4 programme in the target countries are recommended, through existing platforms, such as the Asia-Pacific Plant Protection Commission (APPPC), to advocate concerted and rapid action to sustainably manage TR4 at national and regional levels.



## SUSTAINABILITY

### 1. Capacity development

Following the review of legislation with the NPCs and plant protection agency staff, an initiative was launched by the NPCs to amend biosecurity regulations, such as strengthening domestic biosecurity regulations, listing banana *Foc* TR4 as quarantine and regulating non-quarantine diseases to allow authorities to implement strategic control measures at national and farm level. The amendment was drafted and submitted for approval from a higher authority.

The project established a coordination committee headed by the plant protection agency and members of provincial, district and related agencies, such as research organizations in each country, to oversee the implementation of the project activities. The establishment of this committee and its inclusion in yearly national plant protection activities will ensure continuity in the management of banana *Foc* TR4 disease.

The project established a partnership with the Ministry of Agriculture in each recipient country and, more specifically, with the Plant Protection Department, which is designated as the NPPO responsible for the implementation of biosecurity measures in each country. These partners have their own governmental network at national, provincial and district levels to implement the project activities. The plant protection organization also has the authority to enforce the biosecurity regulations that support the successful implementation of project activities.

Capacity development of provincial and district level extension officers contributed to the development of local training of trainers (ToT).

The project's terminal meeting, held in August 2019, shared the achievements, lessons learned and successful case studies that provided input for the NPCs (or heads of the NPPOs) to include in their yearly national plant protection work plan. There will be some financial support from the national government and other regional development agencies to continue the mitigation work to reduce the incidence of banana *Foc* TR4 and to prevent its spread to non-infested areas.

## 2. Gender equality

The project involved equal numbers of women and men in the coordination and implementation of the project. The majority of farmers attending the FFS were women. Meanwhile, the majority of farm owners were men supporting their families.

## 3. Environmental sustainability

The control measures adopted by the project were based on IPM, which depends on non-chemical technology. Where chemicals are applied, this will be conducted only in infested areas that are precisely determined in real time and will be limited to the exact location in need of treatment. These approaches will have a minimal effect upon the environment within the farms and surrounding areas.

## 4. Human Rights-based Approach (HRBA) – in particular Right to Food and Decent Work

Sustainable banana production will provide food for the farmers, with excess produce sold in local markets. This will provide additional income for farmers to purchase other food items.

## 5. Technological sustainability

The control technologies based on IPM will reduce the cost of production for farmers through use of natural resources to decrease the incidence of disease. The technologies adopted by farmers through learning-by-discovery approaches in FFS sessions will ensure that mitigation measures suit farmers based on the farm situation. The e-surveillance technologies will reduce the cost of collecting disease data, while real-time reporting will minimize manpower and increase the precision of control activities.

The FFS sessions with banana farmers involved the discovery of local good agricultural practices in the IPM plots. The technologies involved utilized local knowledge. The technical support provided by the consultants, together with the capacity development of the plant protection officers, is sufficient to implement the control activities of banana *Foc* TR4, including the Standard Operating Procedure (SOP) for the management of the disease as a guideline document for all stakeholders.



## 6. Economic sustainability

It is envisaged that the project will be financed by the national government in the yearly budget of the NPPOs, although the amount may be limited to cover infested areas.

The transfer of control measures based on IPM practices, including inexpensive elements such as resistant cultivars, sanitation and biocontrol, will be affordable to stakeholders.



## DOCUMENTS AND OUTREACH PRODUCTS

### Documents

- ❑ The protocol for molecular identification of banana *Foc* TR4 using specific primers (Power Point). May 2018. Guangzhou, China.
- ❑ Surveillance planning, sites selection and survey procedures for *Foc* TR4 (Technical document). Hanoi, Viet Nam. July 2018. 5 pp.
- ❑ Standard Operating Procedure for the management of *Foc* TR4 in Myanmar (Technical document). W. Tan and Y. Othman. Yangon, Myanmar. September 2019. 14 pp.
- ❑ Standard Operating Procedure for the management of *Foc* TR4 in Lao People's Democratic Republic (Technical document). K. Chittarath and Y. Othman. Vientiane, Lao People's Democratic Republic. September 2019. 13 pp.
- ❑ Standard Operating Procedure for the Management of *Foc* TR4 in Cambodia (Technical document). O. Samol and Y. Othman. Phnom Penh, Cambodia. October 2019. 9 pp.

### Outreach Material

- ❑ *Foc* TR4 field Identification and awareness pamphlet. Guangzhou, China. May 2018. 5 pp (translated into six languages).
- ❑ Media release: Capacity Development on Diagnostic and Surveillance System of Banana Fusarium Wilt Disease in Cambodia (Technical document). March 2019. 2 pp.
- ❑ Media release: Capacity development on diagnostic and surveillance system of Banana Fusarium Wilt Disease in Sub-Mekong Region. P. Yongfan and Y. Othman. Bangkok, Thailand. January 2019. 5 pp.

## ACHIEVEMENT OF RESULTS - LOGICAL FRAMEWORK

Expected Impact	Sustainable banana production by reducing the risk of pests and pesticide for food security, human health and healthy environment	
Outcome	The Ministry of Agriculture in the recipient countries will have the capacity to advocate options to mitigate the incursion and prevent the spread of banana TR4 disease (which impacts upon the sustainable development of the banana industry), reduce pesticide usage for human health and promote safe trade through proper diagnosis of the disease and a harmonized and specific detection survey based on a multidisciplinary approach and international standards	
	Indicator	<ol style="list-style-type: none"> <li>1. Developed control strategies for management of <i>Foc</i> TR4 to mitigate losses and prevent spread within countries and region.</li> <li>2. Development of molecular technique procedure for the identification of <i>Foc</i> TR4.</li> <li>3. Upgrade of laboratory capacity to conduct molecular techniques for the detection and identification of <i>Foc</i> TR4.</li> <li>4. Development of specific detection survey plan for <i>Foc</i> TR4 surveillance.</li> <li>5. Communication materials developed on guidelines and procedures for <i>Foc</i> TR4 control measures, including IPM.</li> </ol>
	Baseline	0
	End Target	<ol style="list-style-type: none"> <li>1. National and regional banana <i>Foc</i> TR4 disease control strategies established and standardized.</li> <li>2. The diagnostic protocol standardized in the six recipient countries.</li> <li>3. Small equipment, capacity and capability of laboratories upgraded in at least three recipient countries.</li> <li>4. National surveillance plan and operationalization for banana <i>Foc</i> TR4 developed and standardized.</li> <li>5. IEC materials developed and produced in local languages.</li> </ol>
	Comments and follow-up action to be taken	<ol style="list-style-type: none"> <li>1. The regional and national control strategies for banana <i>Foc</i> TR4 were developed during the meeting of the NPCs in Bangkok, Thailand from 5 to 7 March 2019. Control strategies were adopted for managing the <i>Foc</i> TR4 disease in the respective countries and implemented through a coordinated committee at regional, national, provincial and district levels. In future, the six countries can continue to implement the strategies to contain, manage and prevent the spread of <i>Foc</i> TR4 and sustainable banana production.</li> <li>2. The diagnostic protocol was developed during the training workshop on molecular identification of <i>Foc</i> TR4 from 7 to 16 May 2018 in Guangzhou, China. The diagnosticians from the six countries were given hands-on experience of how to use the protocol and were able to optimize molecular identification techniques in their own laboratory. During the project duration, 786 samples were analysed, of which 289 were positive for <i>Foc</i> TR4. In future, the molecular identification of <i>Foc</i> TR4 will be carried out to support future surveillance of the disease. The finding of TR4 specific primers capable for TR1 identified by the Chinese group raised concerns over the further validation and optimization of more race-specific primers for the diagnosis.</li> <li>3. The national laboratory of each recipient country was upgraded with standard primers and small equipment for DNA analysis. The laboratories are able to conduct analysis with reliable results.</li> <li>4. The national surveillance plan was developed and conducted at 477 sites in 93 provinces throughout the six recipient countries. The results showed that all countries were infested with <i>Foc</i> TR4 to varying degrees, with an incidence between 5 and 80 percent, with the exception of Cambodia, which was free from banana <i>Foc</i> TR4. This baseline data was utilized for the control strategies in real time and for reliable reporting in maximizing the limited resources and optimum impacts of the disease management.</li> <li>5. IEC materials for surveillance activities, awareness and a training programme were developed during the workshop on molecular identification in China and the workshop for planning and operationalization of the national surveillance system in Viet Nam. These IEC materials were translated into local languages and disseminated to all stakeholders in the affected <i>Foc</i> TR4 provinces. They were also disseminated through YouTube, television, newspapers and government web sites.</li> </ol> <p>It is recommended that follow-up and exchanges on the status and progress of the TR4 programme in different countries be carried out through the existing platforms, such as the APPPC, to advocate concerted and rapid action to sustainably manage TR4 at national and regional levels.</p>

<b>Output 1</b>	Laboratory capacities and capabilities developed for molecular identification of banana <i>Foc</i> TR4		
	Indicators	Target	Achieved
	Laboratory capacities and capabilities developed for molecular identification of banana <i>Foc</i> TR4.	A minimum of three recipient countries.	Yes
<b>Baseline</b>	0		
<b>Comments</b>	The national laboratory in each of the recipient countries was upgraded through training of the diagnostician and the supply of chemicals and small equipment to enable the laboratory to conduct molecular analysis on the banana tissue samples collected during the surveillance activities. This will confirm the identity of the banana <i>Foc</i> TR4 race in ensuring the reliability of surveillance data. To date, 786 banana tissue samples have been analysed, of which 289 were positive for banana <i>Foc</i> TR4. In future, the laboratories will be able to conduct DNA analysis to support the surveillance activities and biosecurity measures.		
<b>Activity 1.1</b>	Development of molecular diagnostic procedure for the identification of <i>Foc</i> races		
	Achieved	Yes	
	Comments	The diagnostic procedure for molecular identification of banana <i>Foc</i> TR4 disease was developed by the banana TR4 molecular expert from the Guangdong Academy of Agriculture Science in Guangzhou, China. The procedure was standardized in each national laboratory across the six recipient countries.	
<b>Activity 1.2</b>	Regional training workshop on the use of molecular techniques for the identification of <i>Foc</i> races		
	Achieved	Yes	
	Comments	The regional training workshop on the molecular identification of banana <i>Foc</i> TR4 disease was held at the Guangdong Academy of Agriculture Science in Guangzhou, China from 7 to 16 May 2018. The training was attended by 12 diagnosticians (2 participants from each country), who received hands-on training on the use of this procedure. The procedure was optimized in all the laboratories of recipient countries and was used to analyse all of the samples collected from the surveillance activities.	
<b>Activity 1.3</b>	Development of <i>Foc</i> identification materials for reference for the specific detection survey teams and translation into local languages		
	Achieved	Yes	
	Comments	The banana <i>Foc</i> TR4 disease field identification pamphlet was prepared at the training workshop in Guangzhou, China, together with the banana tissue sampling procedure for the surveyors to collect the samples for laboratory DNA analysis. The samples were taken from suspected <i>Foc</i> TR4 disease plants, based on external and internal field symptoms. These documents were later translated into the respective local languages.	



<b>Output 2</b>	Infestation status of <i>Foc</i> TR4 in high-risk countries identified through specific detection surveys		
	Indicators	Target	Achieved
	Detection survey plan for banana <i>Foc</i> TR4 developed and operationalized in all recipient countries.	All major Cavendish banana-growing provinces in the six recipient countries surveyed for banana <i>Foc</i> TR4.	Yes
<b>Baseline</b>	0		
<b>Comments</b>	Surveillance of the banana <i>Foc</i> TR4 was conducted in all major banana-growing provinces in the recipient countries, based on the standardized national surveillance plan and operationalization developed at the training workshop in Hanoi, Viet Nam from 23 to 27 July 2018. Based on DNA analysis of the samples collected from the surveillance, the survey results showed that all recipient countries were infested with banana <i>Foc</i> TR4 disease, with the exception of Cambodia. The baseline surveillance data can be the reference for future surveillance activities to determine the efficacy of the control strategies and to contain the spread of the disease in the region for sustainable development of the banana industry. In future, the NPPOs will continue to conduct the surveillance for precise control decision and evaluation on the efficacy of the mitigation measures implemented.		
<b>Activity 2.1</b>	Mentoring of Ministry of Agriculture and related national agencies, including research organizations and universities, in developing specific detection survey plan and operationalized survey teams		
	Achieved	Yes	
	Comments	The mentoring visit by the surveillance consultant to all of the recipient countries provided the guidance to the respective national agencies in the operationalization of the surveillance system, including the establishment of the coordination committee, while a specific survey plan was developed and hands-on training provided to surveyors in conducting the banana <i>Foc</i> TR4 surveys. The mentoring visit also provided the guidance in processing the surveillance data for real-time, reliable mapping of infested areas using the GeoJot Core software.	
<b>Activity 2.2</b>	Conduct specific detection survey and collection of banana samples suspected infested with <i>Foc</i> for laboratory analysis for confirmation		
	Achieved	Yes	
	Comments	All recipient countries conducted banana <i>Foc</i> TR4 surveillance activities. By the end of the project, 477 sites in 93 provinces had been surveyed. The results were analysed and mapped for decision-making in managing the banana <i>Foc</i> TR4 disease to maximize the limited resources and optimum impacts in controlling the disease. In future, these surveillance activities will continue and will be extended to analyse the efficacy of the control measures and determine the spread of the disease under the yearly national plant protection activities.	
<b>Activity 2.3</b>	Data management of the specific detection surveys including mapping of survey outcomes		
	Achieved	Yes	
	Comments	The data collected during the surveillance activities was processed, analysed and mapped using the GeoJot core software. All recipient countries conducted the analysis and reported in their country terminal report. The surveillance data was used for the formulation of the regional and national control strategies. The processed and mapped data informed decision-making on the implementation of control measures at the precise location, in order to maximize the limited resources, and optimized impacts in preventing the spread of the disease, with a view to sustainable banana production.	

<b>Output 3</b>	Mitigation and intervention strategy for <i>Foc</i> TR4 incursion developed		
	Indicators	Target	Achieved
	Regional and national banana <i>Foc</i> TR4 control strategies developed.	One regional and six national control strategies developed.	Yes
<b>Baseline</b>	0		
<b>Comments</b>	<p>The meeting of NPCs in Bangkok in March 2019 featured discussion of the banana <i>Foc</i> TR4 surveillance results to determine the distribution and severity of the disease in each country. Based on the surveillance data, disease distribution maps and available resources in the region, a regional control strategy was developed and followed up with the six specific national control strategies. The regional strategies were implemented by sharing the resources and expertise through a single-drive cloud folder and a line messenger communication group on <i>Foc</i> TR4 status information, as well as through the resolution of problems in the implementation of molecular diagnostic and surveillance data activities among members of the network group and the implementation and results of control measure activities. The national strategies include strengthened legislation, domestic biosecurity, FFS transfer of technologies, awareness programmes and national empowerment of all stakeholders in the management of banana <i>Foc</i> TR4.</p>		
<b>Activity 3.1</b>	Review on quarantine legislation and regulation on import and national distribution of planting materials for pest-free status, including resistant clones		
	<b>Achieved</b>	Yes	
	<b>Comments</b>	<p>The legislation in each country was reviewed during the meeting with NPCs in Bangkok in March 2019. In essence, all of the target countries have biosecurity acts, however some are in need of strengthening, in particular in terms of regulation on domestic biosecurity, ensuring pest reporting by stakeholders, movement of infested seedlings, control of infested farms etc. In some countries, there is a need to include banana <i>Foc</i> TR4 as a quarantine pest or regulated quarantine pest in the plant quarantine acts, based on the disease status in each country. Cambodia, Myanmar and Viet Nam are undertaking a revision of their existing plant quarantine acts to strengthen the management of banana <i>Foc</i> TR4 disease. The entry point inspection capability was strengthened on account of the availability of the DNA analytical laboratory in each country, as stipulated in the International Standards for Phytosanitary Measures (ISPM) guidelines.</p>	
<b>Activity 3.2</b>	Develop training, poster, pamphlet and awareness materials to be translated into local language for capacity building and awareness campaign		
	<b>Achieved</b>	Yes	
	<b>Comments</b>	<p>The training curriculum of the FFS, a banana <i>Foc</i> TR4 poster, pamphlet, video and awareness materials were produced by the national coordinating committee of each recipient country. Cambodia, for instance, produced banana <i>Foc</i> TR4 identification and control pamphlets, FFS curricula, farmer field days etc. China produced banana <i>Foc</i> pamphlet and disseminated 25 000 copies to stakeholders. The Lao People's Democratic Republic produced video clips on YouTube and a newspaper article, Thailand established a web site to inform stakeholders, a hotline for reporting, a banana <i>Foc</i> degree and posters on banana <i>Foc</i> TR4, while Viet Nam produced a banana <i>Foc</i> TR4 poster and disseminated it to all stakeholders.</p>	
<b>Activity 3.3</b>	National training on advocacy, awareness and adoption of <i>Foc</i> TR4 control strategies among all stakeholders including researchers, plant protection officers, plant quarantine officers, extension workers and farmers		
	<b>Achieved</b>	Yes	
	<b>Comments</b>	<p>An in-country meeting/training workshop on the management of banana <i>Foc</i> TR4 was organized by each country, over at least two sessions, to discuss surveillance activities, control strategies, control planning and reporting involving all stakeholders at national, provincial and district levels. Each country established a coordinating committee to oversee the implementation of the management activities of banana <i>Foc</i> TR4, which greatly facilitated the successful implementation of the project activities.</p>	



Activity 3.4	Provide technical support to the NPPO in implementing mitigation measures in TR4 infested areas to prevent outbreak	
	Achieved	Yes
	Comments	The six mentoring visits by the pest management consultant, one to each target country, provided the necessary technical support for the implementation of the mitigation measures, as outlined in the control strategies, including hands-on training on conducting surveillance and control practices in infested fields. The training was also attended by provincial and district-level extension officers to ensure competency at field level in transferring the banana <i>Foc</i> TR4 disease control technologies. The use of surveillance data, as well as macro- and microcontrol measures, was also discussed during the mentoring visits.
Activity 3.5	Provide hands-on practical training in the fields, and introduce integrated pest management in banana farms for pest management to farmers	
	Achieved	Yes
	Comments	Dissemination of banana <i>Foc</i> TR4 identification and control technologies was conducted by each country through FFS approaches. Two locations were selected in each country to conduct the FFS activities, which involved six training sessions. The farmers were exposed to the IPM fields and discovered by themselves the positive and negative impacts of IPM practices upon banana <i>Foc</i> TR4, other pests, as well as disease populations and environment. They also discussed the findings among themselves and with FFS facilitators and later concluded that the practice needed to be implemented in order to reduce the incidence of pests and diseases and to strengthen agronomic practices to maximize yield. The empowerment provided will ensure that farmers continue these activities in the future.
Output 4	Public awareness on the transboundary disease <i>Foc</i> TR4 improved by sharing case studies among banana-growing countries in Asia	
Baseline	0	
Comments	The regional consultation, followed by the inception meeting, was organized in Chiang Mai, Thailand in March 2018. All of the newest research results and control measures experienced by the experts were taken into consideration in formulating the TCP project, including the biosecurity measures to contain the disease and prevent the spread into non-infested areas, both within the region and in individual countries. During the project terminal meeting in Bangkok in August 2019, the results achieved, lessons learned and successful case studies, including recommendations for up-scaling and adoption by the respective countries in the region, were reported and shared.	
Activity 4.1	Regional consultation meeting to share information and finalization of the regional TCP proposal	
	Achieved	Yes
	Comments	
Activity 4.2	Inception workshop for all NPCs for project planning	
	Achieved	Yes
	Comments	The inception meeting was held in Chiang Mai, Thailand on 7 March 2018 to finalize the TCP proposal and implementation schedule. Minor changes to the draft proposal were recommended and the implementation schedule was finalized by the NPCs.
Activity 4.3	Terminal workshop on TR4 status in Asia and success story	
	Achieved	Yes
	Comments	The terminal meeting was held in Bangkok, Thailand from 6 to 7 August 2019 to share the achievements, case studies and success stories from all recipient countries. At the end of the meeting, a number of recommendations were suggested to ensure the continuity of the project and the scaling-up of transfer of technologies. These included the strengthening the e-surveillance system, using GeoJot software and tablets for real-time and reliable data collection to support precise decision making, maximizing the limited resources by targeting infested areas and ensuring optimum impacts to the control of banana <i>Foc</i> TR4 disease.

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