



**INTERNATIONAL COCOA ORGANIZATION
ORGANISATION INTERNATIONALE DU CACAO
МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО КАКАО
ORGANIZACION INTERNACIONAL DEL CACAO**

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**INTEGRATED MANAGEMENT OF COCOA PESTS AND PATHOGENS IN AFRICA:
CONTROLLING INDIGENOUS PESTS AND DISEASES AND PREVENTING
THE INTRODUCTION OF EXOGENOUS ONES (CFC/ICCO/43)**

SUMMARY OF PROJECT COMPLETION REPORT (PCR)

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SUMMARY OF PROJECT COMPLETION REPORT (PCR)

I. PROJECT SUMMARY:

Project Title: Integrated Management of Cocoa Pests and Pathogens in Africa: Controlling Indigenous Pests and Diseases and Preventing the Introduction of Exogenous Ones

Project Code: CFC/ICCO/43

Location: Cameroon, Côte d'Ivoire, Ghana, Nigeria and Togo

Project Executing Agency: Cocoa Research Institute of Ghana (CRIG)

Supervisory Body: International Cocoa Organization (ICCO)

Starting Date: June 2013

Completion Date: April 2018

Financing:

Total Project Cost:	US\$ 3,121,073
CFC Grant:	US\$ 1,232,102
Co-financing (Mars)	
Co-financing (Mondēlez)	
Co-financing (CRUK)	
Co-financing (ECA)	
Co-financing (others)	
Counterpart contribution in cash	US\$ 973,724
Counterpart contribution in kind	US\$ 275,205

II. BACKGROUND AND CONTEXT IN WHICH THE PROJECT WAS CONCEIVED

1. Cocoa pests and diseases are an important biotic constraint, which leads to significant crop losses worldwide. Emblematic is the witches' broom disease which ravaged the State of Bahia, Brazil, in the 1980s. Brazil's production was slashed from about 380,000 tonnes to 90,000 tonnes within a decade. An estimated 30,000 farm workers lost their job and an additional 250,000 workers were indirectly affected by the near-collapse of the Brazilian cocoa farming sector.

2. The list of pathogens harmful to cocoa trees is large and diverse. Cocoa can be attacked at different growth stages. And the same pathogen can induce different symptoms at different growth stages. Furthermore, the geographic isolation of ecosystems leads to different phytopathogeneses. For example, the witches' broom disease is endogenous to Latin America, but exogenous to Africa and South-East Asia; the swollen-shoot disease is autochthon in Africa and Sri Lanka, but alien in the rest of Asia and in Latin America. The list goes on.

3. The ICCO Secretariat in collaboration with the Centre for Agriculture and Bioscience International (CABI) and the financial support of the Common Fund for Commodities organized an international scientific workshop entitled "*Preventing and managing the Global Spread of Cocoa Pests and Pathogens*" in Abidjan, Côte d'Ivoire, from 17-20 July 2007. The specific objectives of this workshop were to take stock of the lessons learnt from the outbreak of the witches' broom disease in the State of Bahia; to review the incidence of cocoa pathogens across cocoa regions; and to formulate a global strategy so as to manage the outbreak of cocoa pathogens and prevent the introduction of alien ones. Over 100 participants from 14 countries in Africa, Asia and Pacific, Europe and Latin America attended the event.

4. However, the picture emerging from the workshop's proceedings was worrisome. On the one hand, major cocoa producing countries, particularly in West and Central Africa, were ill-prepared and ill-equipped to tackle any serious outbreak of pathogens. On the other hand, the risk of introducing alien pathogens in major cocoa producing areas was steadily growing over time as a result of the rapid expansion of trade and travel and the presence of seamless and frictionless borders. It is against this background that this project was conceived, developed and subsequently implemented.

Project Objectives and Outputs

5. The aim of the project was twofold:

- to reduce crop losses due to autochthon pathogens; and
- to prevent the introduction of alien ones.

6. The specific objectives of the project were:

- i. to raise awareness among cocoa farmers and other stakeholders on the major cocoa pests and diseases and on their impact on cocoa production;
- ii. to support the implementation of Integrated Pest Management (IPM) on black pod, cocoa swollen shoot virus disease (CSSVD), mirids, sting bugs, stem borers and parasitic plants; and

- iii. to strengthen in-country and regional capacity for improved pest surveillance for prevention, early detection, eradication and continued management of existing and invasive cocoa pests and pathogens.

7. The project components and expected outputs were:

Component 1: Integrated management of autochthon cocoa pests and diseases (Black Pod, CSSVD, Mirids, Sting Bugs, Stem Borers and Parasitic Plants)

Outputs:

- Output 1.1 Project inception workshop and awareness-raising
- Output 1.2 Reduction in the incidence and damage caused by Black Pod disease
- Output 1.3 Data on geographical distribution of *Phytophthora (P.) megakarya* and laboratory determination of the species causing Black Pod disease
- Output 1.4 Media material for training farmers to control and manage Black Pod disease
- Output 1.5 Promotion of bio-fungicides for the control of Black Pod disease
- Output 1.6 Distribution of Black Pod tolerant varieties to farmers
- Output 1.7 Reduction in the incidence, spread and damage caused by Cocoa Swollen Shoot Virus Disease (CSSVD)
- Output 1.8 Distribution of CSSVD tolerant varieties to farmers
- Output 1.9 Exchange of information and experience on the control of CSSVD
- Output 1.10 Effective control of Mirids on cocoa
- Output 1.11 Efficient methods for determining the incidence of Mirids
- Output 1.12 Bio-insecticides for the control of Mirids made available to farmers
- Output 1.13 Distribution of Mirids resistant varieties to farmers
- Output 1.14 Effective control of *Bathycoelia (B.) thalassina* on cocoa
- Output 1.15 Efficient methods for determining incidence of *B. thalassina*
- Output 1.16 Bio-insecticides for the control of *B. thalassina* made available to farmers
- Output 1.17 Control measures for parasitic plants and epiphytes identified

Component 2: Early warning systems, emergency actions and national plans for the prevention and management of cocoa pests and pathogens

Outputs:

- Output 2.1 Pest Risk Analyses (PRAs) on the spread of Witches' Broom, Frosty Pod and Cocoa Pod Borer to Africa
- Output 2.2 Pest recognition tools, including posters, manuals and short DVDs at airports/ports made available to relevant staff at ports, land borders, airports and to up country plant health inspectors
- Output 2.3 Effective quarantine measures in place; extension agents and farmers trained on new diseases and plant health surveillance techniques; information tools such as posters, manuals and DVDs on emergency control measures available; pest recognition tools made available to plant health inspectors; training manuals produced
- Output 2.4 Training guides and crop protection manuals, decision-making tools for planning and management

Component 3: Project evaluation and dissemination workshop

Outputs:

- Output 3.1 Evaluation and dissemination of project results

Component 4: Project management, coordination and supervision

Outputs:

- Output 4.1 Efficient coordination, supervision and management to ensure achievement of the project objectives

Project Beneficiaries

8. The main beneficiaries of the project were (i) cocoa farmers and their communities; (ii) research institution and extension services; and (iii) government agencies.

- i. Farmers benefited from an increased capacity to prevent and control damages caused by cocoa pests and pathogens. As a result, cocoa farm income is expected to rise.
- ii. National cocoa research institutions and extension services benefited from the increased capacity to develop and implement measures aimed at controlling and preventing the spread of cocoa pests and pathogens.
- iii. The governments of the participating countries benefited from the increased capacity to:
 - to design and implement adequate contingency and emergency plans, including quarantine regulations for crop protection;
 - to identified key entry pathways of alien pests and diseases;

- to implement national/regional bio-security plans

Project Management and Implementation Arrangements

9. The Project Executing Agency (PEA) was Cocoa Research Institute of Ghana (CRIG) and ICCO was the project Supervisory Body (SB).

10. The National Project Implementation Agency (NPIA) in each of the five participating countries are as follows:

- Cameroon - *Institut de Recherche Agricole pour le Développement (IRAD)*
- Côte d'Ivoire - *Centre National de Recherche Agronomique (CNRA)*
- Ghana - Cocoa Research Institute of Ghana (CRIG)
- Nigeria - Cocoa Research Institute of Nigeria (CRIN)
- Togo - *Institut Togolais de Recherche Agronomique (ITRA)*

11. The approved budget for the project was US\$ 3,121,073.

III. PROJECT RESULTS ACHIEVED

12. The project raised awareness among cocoa farmers and research institutions on cocoa pests and diseases in countries where the project was implemented. Also, it enhanced their capacity to apply Integrated Pest Management (IPM) to control and prevent the spread of autochthon pathogens (black pod, CSSVD, mirids, stink bugs, stem borers and parasitic plants) as well as aliens ones (Witches' Broom, Frosty Pod and Cocoa Pod Borer).

13. The results achieved in relation to:

- i. Reduction in the incidence and damage caused;
- ii. Assessment of geographical distribution and spread;
- iii. Enhance capacity to control and prevent;
- iv. Adoption of control measures;
- v. Pest Risk Analysis (PRA);
- vi. Pest recognition tools;
- vii. Effective quarantine measures and institutional capacity building;
- viii. Policy decision making tool for early warning and emergency systems

vis-à-vis each pathogen and project implementing country are summarized in synoptic tables appended to this document.

14. At this juncture, it is important to note that some of the project activities could not be implemented due to:

- the inadequate and untimely release of project counterpart contribution in cash; and
- the inability of the project to secure all the required co-financing.

For example, the following planned project activities have either not been carried out or only partially completed:

- Select, formulate and conduct participatory testing of bio-fungicides in Ghana, Cameroon, Nigeria and Togo (Output 1.5)
- Explore biocontrol of mealy bug, the carrier vector of CSSVD in Ghana (Output 1.7)
- Organize regional meeting for Ghana to share its experience in CSSVD control (Output 1.9)
- Demonstrate effective spraying routes (pattern) of insecticides for control of mirids and *B. thalassina* on farms (Outputs 1.10 and 1.14)
- Estimate population dynamics of mirids using pheromone traps in Cameroon, Côte d'Ivoire, Nigeria and Togo (Output 1.11)
- Train farmers on safe application of insecticides including disposal of pesticide containers for the control of mirids and *B. thalassina* (Output 1.14)
- Review existing national regulatory and legal provisions, plans and measures for the management of pests and pathogens (Output 2.4)
- Develop a comprehensive national plan of action for the management of cocoa pests and pathogens (Output 2.4)
- Conduct national workshops and disseminate the best methods for the management of pests and pathogens (Output 2.4)

IV. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

15. The project had a very ambitious goal. But the difficulties encountered in coordinating the national project implementation agencies, on the one hand, and the delay and the inadequacy of the disbursement of counterpart contributions, on the other hand, limited the size and the scope of achievements.

16. Nevertheless, the project has:

- increased awareness on the impact of cocoa pests and pathogens;
- enhanced the capacity of cocoa research institutions in project-implementing countries;
- increased the adoption and the uptake of new technologies and innovation; and
- showed the need for greater transnational collaboration to tackle the outbreak of cocoa pathogens in the region.

Recommendations

17. Cocoa producing countries should:

- take seriously the threat of pathogen's outbreak and should adopt and/or enhance early warning systems;
- strengthen their institutional capacity for monitoring, surveillance systems and emergency plan of actions to be activated in a very short period of time; and
- upscale the achievements of the project by reaching out to more farmers outside the scope of the project;

18. While some cocoa pests and pathogens cannot be eradicated, a lot can be done to minimise their impact and reduce their economic damage, thereby enhancing the profitability of cocoa production. This should be the main focus and policy direction of cocoa producing countries.

ANNEX A

Integrated Management of Cocoa Pests and Pathogens in Africa (CFC/ICCO/43)

Table of Results Achieved

1. Black Pod Disease of Cocoa – *Phytophthora megakarya* and *Phytophthora palmivora*

	Major Outputs	Cameroon	Côte d'Ivoire	Ghana	Nigeria	Togo
1	Reduction in the incidence and damage caused	350 farmers trained on safe and efficient application of fungicides.	1,757 farmers and 25 extension agents trained on safe and efficient application of fungicides.	3,081 farmers and 453 extension agents trained on safe and efficient application of fungicides.	700 farmers trained on safe and efficient application of fungicides.	200 farmers and 4 extension agents trained on safe and efficient application of fungicides.
2	Assessment of geographical distribution and spread	<i>P. megakarya</i> is present in six cocoa-growing regions and <i>P. palmivora</i> is present in all cocoa-growing regions.			<i>P. megakarya</i> is the predominant and aggressive species in all cocoa producing states.	
3	Enhance capacity to control and prevent	250 brochures, posters, manuals and flyers were produced and distributed. 6 radio broadcasts were made to complement the materials.	6,600 brochures, posters, manuals and flyers were produced and distributed. 2,520 radio broadcasts were made to complement the materials.	3,000 brochures, posters, manuals and flyers were produced and distributed. 10 radio broadcasts were made to complement the materials.	1,600 brochures, posters, manuals and flyers were produced and distributed. 60 radio broadcasts were made to complement the materials.	750 brochures, posters, manuals and flyers were produced and distributed. 2 radio broadcasts were made to complement the materials.
4	Adoption of control measures	<i>Trichoderma asperellum</i> – a bio fungicide was developed and tested with 50 farmers. 50 farmers participated in the demonstration of black pod tolerant varieties.	Two bio fungicides – <i>Trichoderma asperellum</i> and <i>Bacillus thuringiensis</i> were selected and tested. 834 farmers and 25 extension agents participated in the demonstration of black pod tolerant varieties.	150 farmers participated in the demonstration of black pod tolerant varieties.	Two bio fungicides were selected and tested for efficacy. 40 farmers participated in the demonstration of black pod tolerant varieties.	Two bio fungicides – Heliocuire and Photophor V were selected and tested.

2. Cocoa Swollen Shoot Virus Disease (CSSVD)

	Major Outputs	Cameroon	Côte d'Ivoire	Ghana	Nigeria	Togo
1	Reduction in the incidence and damage caused	100 farmers trained on virus recognition and control.	108 farmers trained on virus recognition and control. 12 demonstration plots established to train 108 farmers on barrier cropping.	597 farmers trained on virus recognition and control. 4 demonstration plots established to train 100 farmers on barrier cropping.	250 farmers trained on virus recognition and control. 2 demonstration plots established to train 150 farmers on barrier cropping.	100 farmers trained on virus recognition and control. 10 demonstration plots established to train 100 farmers on barrier cropping.
2	Enhance capacity to control and prevent	60 mobile phones with call credit distributed to famers to provide feedback.	100 mobile phones with call credit distributed to famers and facilitators to provide feedback. Molecular diagnostic tool based on PCR developed and tested. A manual of CSSVD alternative hosts developed and distributed.	245 mobile phones with call credit distributed to famers to provide feedback. Primers, template and PCR reagents procured as part of diagnostic tools.	400 mobile phones with call credit distributed to famers to provide feedback. 8 primers procured as part of diagnostic tools.	750 flyers were produced and distributed.
3	Adoption of control measures		108 farmers trained on tolerant varieties on farmers' plots			4 demonstration plots on tolerant varieties established

3. Mirids - *Sahlbergella singularis* and *Distantiella Theobroma*

	Major Outputs	Cameroon	Côte d'Ivoire	Ghana	Nigeria	Togo
1	Reduction in the incidence and damage caused	100 farmers trained on calibration of spraying machines and on safe application of insecticides	834 farmers and 25 extension agents trained on calibration of spraying machines and on safe application of insecticides	2,532 farmers and extension agents trained on calibration of spraying machines and on safe application of insecticides.	245 farmers trained on calibration of spraying machines and on safe application of insecticides	100 farmers and 2 extension agents trained on calibration of spraying machines and on safe application of insecticides
2	Assessment of geographical distribution and spread		Data on 66 trials shows the presence of mirids in 11 cocoa growing regions	5,085 farmers and 24 extension agents trained on using pheromones to assess population of mirids		
3	Enhance capacity to control and prevent	63 farmers trained on mirid identification and damage. 180 farmers trained on establishing threshold levels.	834 farmers and 25 extension agents trained on establishing threshold levels.	231 farmers and 26 extension agents trained on mirid identification and damage. 3,084 farmers and extension agents trained on establishing threshold levels.	245 farmers trained on mirid identification and damage. 200 farmers trained on establishing threshold levels.	
4	Adoption of control measures	The entomopathogenicity of different isolates of <i>Beauveria bassiana</i> and <i>Metarhizium anisopliae</i> was assessed against mirids under laboratory conditions. 80 farmers and extension agents trained on demonstration plots with mirid resistant varieties.	1 bio insecticide (bacillus thuringiensis) was tested in the laboratory. 834 farmers and 25 extension agents trained on demonstration plots with mirid resistant varieties.	1 bio insecticide selected and tested with 245 farmers. 2,568 farmers and extension agents trained on demonstration plots with mirid resistant varieties.	2 bio insecticides (Nimbecedine and Biomagic) were selected and tested with 60 farmers. 60 farmers and extension agents trained on demonstration plots with mirid resistant varieties.	

5. Stink Bugs – *Bathycoelia thalassina* and Stem Borer – *Eulophonotus myrmelon*

	Major Outputs	Cameroon	Côte d'Ivoire	Ghana	Nigeria	Togo
1	Reduction in the incidence and damage caused	66 farmers trained on <i>B. thalassina</i> identification and damage control.	834 farmers and 25 extension agents trained on effective control methods. Training was done using 9 farmer-field days. 66 trials on assessment were established in 11 major cocoa growing regions.	2,544 farmers and extension agents participated in field assessment. 215 farmers and 25 extension agents trained on <i>B. thalassina</i> identification and damage.		Stem borer control demonstrated on selected farms. 4 staff trained as instructors to train farmers.
2	Assessment of geographical distribution and spread				Distribution and incidence of stem borers were recorded in the 4 cocoa producing states of Oyo, Ogun, Osun and Ondo.	
3	Enhance capacity to control and prevent					
4	Adoption of control measures					

6. Parasitic Plants and Epiphytes

	Major Outputs	Cameroon	Côte d'Ivoire	Ghana	Nigeria	Togo
1	Reduction in the incidence and damage caused					
2	Assessment of geographical distribution and spread	A map of geographical distribution has been produced.	2 parasitic plants, 8 epiphytic plants and 1 bryophytic plant were identified in 8 cocoa producing regions.	Survey conducted but data analysis has not been completed.	A map of geographical distribution has been produced for 6 cocoa growing states.	2 parasitic plants identified.
3	Adoption of control measures	4 trial plots established to demonstrate mechanical method of removing epiphytes and parasitic plants.			1,000 farmers trained to use motorized pruner to remove parasitic plants.	

7. Exogenous Pests and Pathogens – Witches' Broom, Frosty Pod and Cocoa Pod Borer

	Major Outputs	Cameroon	Côte d'Ivoire	Ghana	Nigeria	Togo
1	Pest Risk Analysis (PRA)	2 scientists and 2 Plant Quarantine Officers trained at regional level on PRA methodology developed by a consultant. 5 scientists and 5 technicians trained at national level and conducted the national PRA. A guideline document on safe movement of germplasm within country and another one on movement across nations is provided.	5 scientists, 1 Plant Quarantine Officer and 1 extension officer trained at regional level on PRA methodology developed by a consultant. 4 scientists and 1 technician trained at national level and conducted the national PRA. A guideline document on safe movement of germplasm within country and another one on movement across nations is provided.	2 scientists and 2 Plant Quarantine Officers trained at regional level on PRA methodology developed by a consultant. 7 scientists and 3 technicians trained at national level and conducted the national PRA. A guideline document on safe movement of germplasm within country and another one on movement across nations is provided.	2 scientists and 1 Plant Quarantine Officer trained at regional level on PRA methodology developed by a consultant. 7 scientists and 4 technicians trained at national level and conducted the national PRA. A guideline document on safe movement of germplasm within country and another one on movement across nations is provided.	2 scientists and 2 Plant Quarantine Officers trained at regional level on PRA methodology developed by a consultant. 3 scientists and 2 technicians trained at national level and conducted the national PRA. A guideline document on safe movement of germplasm within country and another one on movement across nations is provided.
2	Pest recognition tools	400 flyers, 100 posters and 200 training manuals produced and distributed. Information disseminated on 4 radio stations.	200 flyers on autochthon and 3 flyers on alien pests and diseases produced and distributed. Information disseminated on 30 radio stations.	Information disseminated on 3 radio stations.	300 training manuals produced and distributed. Information disseminated on 3 radio stations.	7 flyers produced and distributed. Information disseminated on 1 radio station and 1 TV station.
3	Effective quarantine measures and institutional capacity building	5 scientists, 2 customs officers, 13 quarantine officers, 5 extension agents and 5 farmers trained.	12 quarantine officers, 7 extension agents, 5 cocoa product inspectors, 4 scientists and 1 technician trained.	14 quarantine officers, 2 extension agents, 2 officers from Cocoa Health and Extension Division and 2 customs officers trained.	3 extension agents, 20 quarantine officers, 6 farmer organizations, 2 customs officers, 3 produce inspectors and 1 cocoa trader trained.	9 quarantine officers, 5 extension agents, 2 customs officers, 1 trader, 2 farmers, 2 technicians and 4 researchers trained.
4	Policy decision making tool for early warning and emergency system					