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

Report of Project Inception Workshop held at Oak Plaza Hotel, Accra, Ghana from 15 – 18 April 2013

Accra, May 2013

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Introduction

The project inception workshop for the project on "Integrated Management of Cocoa Pests and Pathogens in Africa: Controlling Indigenous Pests and Diseases and Preventing the Introduction of Exogenous Ones" was held at Oak Plaza Hotel, Accra, Ghana from 15 – 19 April 2013.

The objectives of the workshop were:

1. To raise awareness on the incidence, severity and damage caused by indigenous coca pests and diseases and the threat of the introduction of exogenous pests and pathogens from other cocoa producing continent into Africa.

2. To officially launch the start of project implementation in the five participating countries (Cote d'Ivoire, Ghana, Togo, Nigeria, Cameroun) and to agree on implementation procedures, protocols for assessing cocoa production losses due to pests and diseases.

3. To share experiences with experts from Brazil, Malaysia and Ecuador on exogenous pests and pathogens and measures needed to prevent their spread to Africa.

Day One: Monday 15 April 2013

The workshop was opened by the Board Chairman of COCOBOD who was represented by Mrs Afriyie Haffar, a Board Member after welcome addresses were delivered by Mr Tony Fofie (Chief Executive, COCOBOD, Dr Yaw Adu-Ampomah (Deputy Chief Executive, COCOBOD), Dr Jean-Marc Anga (Executive Director, ICCO), and Mr Francesco Gibbi (representative of CFC). They all expressed the importance of the project to the sub-region in particular and the world cocoa economy at large. They also stressed the unity and collaboration offered by the

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The workshop was jointly organized by the Cocoa Research Institute of Ghana (CRIG) from the Ghana Cocoa Board and the International Cocoa Organization (ICCO) and financially supported by the Common Fund for Commodities (CFC). The project is implemented in Cameroon, Côte d'Ivoire, Ghana, Nigeria and Togo with funding from the Common Fund for Commodities (CFC), Mars Chocolate, Mondelēz International, European Cocoa Association (ECA), as well as from the government from each country of implementation. The Project Execution Agency is CRIG and the supervisory institution is the ICCO. To contact the project team, please see page 18.

project to all major stakeholders of cocoa in the sub region and the need to support its activities at the highest levels.

The workshop was attended by about 80 participants consisting of experts from various institutions having passion for cocoa production and consumption (see Appendix 1).

Technical Sessions

The **first presentation** on "Pests and Diseases: Impact on the Sustainability of Cocoa Production" was made by Mr Yunusa Abubakar, Project Manager, ICCO, London. The purpose of the presentation was to highlight the impact of pests and diseases as a threat to sustainable cocoa production, and to show how the CFC/ICCO pests and pathogens project could address some of the concerns.

It was indicated that in the 2012/2013 cocoa year, about 4.003 million tonnes of cocoa was produced globally, out of which Africa contributed 70% (2.796 million tonnes), Latin America: 16% (644,000 tonnes) and Asia & Oceania 14% (563,000 tonnes). The 2012/2013 cocoa production forecast indicated a drop in production for Cote d'Ivoire (1486MT to 1470MT), and Ghana (879MT to 820MT). Supply trend shows slow increase from 1991 to 2012. Projection from 2007 to 2018 shows a similar trend. All these are attributable to numerous challenges facing cocoa production in the various producing countries. These challenges include low productivity of planting material, pests and diseases, unavailability of farm inputs, low soil fertility and nutrients, poor farm management practices, weather, climate and environment, inefficient marketing systems, poor knowledge transfer and inadequate extension services. Global crop losses to pests and diseases are often estimated at about 30 – 40% of annual total cocoa production. The pests and diseases identified as being of economic importance include black pod disease, cocoa Swollen Shoot Virus Disease (CSSVD), mirids, Frosty Pod Rot, Witches' Broom, Cocoa Pod Borer, Cocoa Die-back Disease, Sting bugs, Stem borers, Mistletoes and epiphytes. Crop production in Brazil indicate decline from 1988 till date since the discovery of witches' broom in late 1980s to early 1990s.

The impact that these pests and diseases is having on farmers include low yield and poor quality of beans which translates to low income, high cost of production in controlling pests and diseases, health hazards as a results of use of agrochemicals, lower morale/low investment (psychological impact). Again, the impact of pests and diseases on Governments include lost of revenue due to low production, high cost of control programmes eg. CODAPEC programme in Ghana, social and political implications (unemployment, loss of confidence in government etc.). Pests and diseases could also have impact such as low supply, supply uncertainties and high cost of products on Industry and Consumers of cocoa.

The presentation concluded that with all these challenges, it is obvious that the Pests and Pathogens project has come at a time that an intervention is of essence.

The **second presentation** on "The threat of the introduction of exogenous pests and pathogens into Africa" was delivered by Mr Andrews Y. Akrofi of Cocoa Research Institute of Ghana. Regional trend in global cocoa production since 1830 shows that in 1900, 80% of production came from the Americas but currently, the region is producing less than 20%. The principal reasons for this trend include the effect of damaging diseases in the Americas. These diseases do not occur in Africa and Asia. The main diseases in the Americas are Witches' Broom and Frosty

pod; and in Africa, *Phytophthora* pod rot due to *P. Megakarya*, CSSVD and mirids. The severity, damage and economic importance of these pests however vary from country to country. In Asia and Oceania, Cocoa pod borer and Vascular Steak Die back are the main diseases.

*The presentation indicated that pests and pathogens require no "**VISAS**" to cross national, regional or continental boundaries. Therefore, with faster communication and travel, trade links and the relatively free movement of people and commodities all over the world, there is a serious and very real risk of the introduction of major cocoa pests and pathogens to new regions or continents. This is especially important considering the behavior and mode of transmission/spread of the pathogens.*

Frosty pod rot (*Moniliophthora roreri)* (FPR) has been catastrophic to cocoa production in every country in which it has been introduced and it has rapidly replaced Witches' Broom Disease (WB) as the number one threat in any country where both exist. For example, in Peru, where FPR occurs alongside black pod and WB, FPR is most prevalent, severe and serious in terms of damage. The spores can move long distances, and the pathogen is adapted to disseminate over wide geographic areas in a relatively short period of time. FPR breached the *cordon sanitaire* that had been effective for WB.

Witches' broom (*Moniliophthora perniciosa)* attacks only actively growing tissue (shoots, flowers and pods). It is currently limited to South America, Panama and the Caribbean. It caused significant damage to cocoa production in Brazil, where within a decade the country went from the world's second largest producer to becoming a net importer of 380,000MT to 123,000MT of cocoa. This caused mass abandonment of cocoa plantations leading to a sharp drop in the area planted under cocoa from 600,000ha to 300,000ha within 15 years.

Simulations carried out by scientists have shown that an outbreak of Witches' Broom would slash the cocoa production of Côte d'Ivoire from its current level of 1.3 million tonnes to around 500,000 tonnes.

Cocoa pod borer (*Conopomorpha cramerella)* was first reported in the 1860's in Indonesia (Sulawesi) and in 1895 discovered in Java but was eradicated. It was confirmed in Philippines in the 1930s, Malaysia and Sabah in 1980 and Sarawak in 1985. In 1990 new infestation was found in Central Sulawesi. And very recently in 2006, *C. cramerella* was confirmed in PNG.

This is a clear evidence of threat to Africa if prevention is not intensified. Live borers can travel long distances. For example, Healthy C. cramerella pupae were found on Thai rambutans in a supermarket at Riyadh, Saudi Arabia in 1986.

Vascular Streak Dieback/VSD (*Oncobasidium theobromae)* shows symptoms such as yellowing leaf, dots on the leaf base and brownish on xylem. Basidiospore of the fungus is distributed by wind especially at night and inoculate flush. The disease is mainly found in South East Asia.

The question thrown to the workshop participants for reflection was: **Is Africa prepared for these introductions?**

*The presenter observes that the answer to that question can be **NO** because our boarders are porous for easy entry of pests and pathogens. Also, environmental conditions throughout the*

cocoa producing countries in Africa appear to be conducive for the establishment and rapid spread of FPR, WB and CPB. As a result, introduction of such major diseases and pests into Africa would have a devastating impact on the world's cocoa supply, a destructive effect on the livelihoods of the already poor farmers, and cause extremely serious social, economic and environmental problems.

The presenter also stated that the Inter-African Phytosanitary Council (IAPSC) recognizes the need to secure a common and effective action to prevent the introduction and spread of pests of plants and plant products as well as the need to promote appropriate measures for their control – based on best practices (IPPO and WTO–SPS) "The Maputo declaration". The National Plant Protection Organizations (NPPO) in the different countries needs to provide the regulatory and technical advisory services to the agricultural clientele in order to ensure effective control.

Other questions that should engage attention of stakeholders (policy makers, scientists, producers, processors, consumers, environmentalists etc) raised during the presentation are:

- What basic information on designated potential pests and pathogens is available?
- How well developed and coordinated are the activities of institutions that will facilitate at national and regional level collaboration in managing early warning systems, monitoring and other means of preventing introduction of exogenous pests and pathogens into Africa?
- How harmonized are the existing regulatory and legal provisions, plans and measures for the management of major indigenous and exogenous cocoa pests and pathogens?
- How well informed are various categories of people on possibility of introducing exogenous pests and pathogens into Africa?
- What is the human resource, infrastructure, equipment and standards procedures available?
- Are there comprehensive emergency response systems in place should there be an introduction of an exogenous pest or pathogen into Africa?

Conclusion and Recommendation

- *There is a possible and real threat of introduction of exogenous pests and pathogens into Africa*. In view of this, INCOPED in 1999 in Yamoussoukro cautioned on movement of scientists from endemic regions.
- There will be significant social, economic, environmental damage when introductions occur in the absence of advance preparation such as preventive breeding.
- In view of the economic, social and environmental importance of cocoa to both producers, processors and consumers, it would be prudent to have an "insurance premium" in the form of efforts to reduce introduction of exogenous pests and pathogens into Africa and guard against future losses of the cocoa crop which is already facing a myriad of problems.

The **third presentation** on "Overview of the Pests and Pathogens Project" was made by Dr A.R. Cudjoe, Entomologist, CRIG and Pests and Pathogens Project Coordinator. He identified the pparticipating countries and their institutions as follows**:**

Cameroon: Institute of Agricultural Research for Development (IRAD), Cameroon
Cote d'Ivoire: Centre National de Recherche Agronomique (CNRA), Côte d'Ivoire
Ghana: Cocoa Research Institute of Ghana (CRIG), Ghana
Nigeria: Cocoa Research Institute of Nigeria (CRIN), Nigeria

Togo: Institut Togolais de Recherche Agronomique (ITRA), Togo

The main objective of the project is to increase productivity on cocoa farms and enhance cocoa producers' incomes by reducing crop losses caused by indigenous insect pests and diseases, as well as to prevent the introduction of non-indigenous cocoa pests from other cocoa producing countries or regions.

The project has three specific objections:

i. Management of endogenous cocoa pests and diseases.
ii. Setting up early warning systems, emergency programmes and national plans for the prevention and management of all cocoa pests and pathogens including exogenous.
iii. To strengthen in-country and regional capacity for improved pest surveillance by disseminating information on the prevention, early detection, eradication and continued management of existing and invasive cocoa pests and pathogens.

There are four components of the project:
Component 1: Integrated management of endogenous cocoa pests and diseases (Black pod, CSSVD, Mirids, Sting Bugs, Stem Borers and Parasitic plants);
Component 2: Early warning systems, emergency actions and national plans for the prevention and management of cocoa pests and pathogens;
Component 3: Project Evaluation and dissemination workshop;
Component 4: Project management, coordination and supervision

The endogenous pests targeted are black pod and Cocoa swollen shoot virus as the main diseases; parasitic plants (eg. Mistletoes), mirids, stink bugs and stem borers. Exogenous pests targeted include witches' Broom, frosty pod and Pod Borer.

The main activities are:

- Develop, demonstrate and train farmers on efficient and sustainable IPM techniques to reduce the spread of pests and diseases of cocoa.
- Produce and distribute technical manuals and information tools (including posters, leaflets and DVDs) on IPM to farmers and plant health inspectors.
- Train staff at ports, land borders and airports on ways to recognize specific pests and set in place effective quarantine measures to prevent their spread.
- Develop national and regional early warning systems and procedures for the on time detection of pests and pathogens and the necessary emergency actions and plans for their eradication or control.
- Hold two regional workshops one in Abidjan and one in Accra to raise awareness on the incidence, severity, damage caused by indigenous cocoa pests and disease and sustainable control measures.

The project is scheduled to go for 48 months beginning in November 2012. It is estimated at a total cost of USD 3,121,073. The requested CFC grant contribution amounts to USD 1,232,102 (39%) of which USD 615,000 will be provided from the contribution of the OPEC Fund to CFC's second account resources. External co-financing to an amount of USD 676,043 (22%) is presently being sought from the cocoa and chocolate industry. The envisaged counterpart contributions from participating countries in cash and kind, amount to USD 937,724 (30%) and USD 275,205 (9%) respectively.

COCOBOD/CRIG, as the Project Execution Agency (PEA), has appointed an International Project Coordinator to handle the day-to-day management and to liaise with National Project Implementing Agencies (NPIAS) in each participating country. The PEA will, in consultation with the National Agricultural Research Stations (NARS), facilitate the establishment of a National Project Steering Committee (NPSC) in each country. This Committee will include representatives from different stakeholder groups such as cocoa grower associations/cooperative relevant government officials, customs, health inspectors, quarantine services, members of industry and subject matter specialists from research/academic institutions. Each NPSC will be chaired by a National Project Co-ordinator in the country to be appointed by the PIA. ICCO is the Supervisory Body for the project.

Two joint review missions will be undertaken by the SB and the Common Fund during project implementation. There will be a ***Mid-Term Review (MTR*)**: This will take place after 24 months of project implementation. Its purpose is to assess the actual implementation of the project by comparing activities executed so far with the final Work Plan of the Project. It aims to evaluate the impact of the activities carried out on the problems identified. In its approach, the mid-term evaluation will cover areas such as overall project implementation, results achieved, constraints and limitations encountered, remedial measures proposed and recommendations on the future priorities and directions of the project. A ***Final Evaluation*** will be conducted at the end of the fourth year of the project. This will encompass assessment in terms of implementation, achievements, outputs and any lessons to be learned for future projects.

The **fourth presentations** were delivered by the National Coordinator for each participating country on "Major pests situations and damage assessment protocols:

Cameroun presentation by Dr Luc Diblog, National Co-ordinator.

There were currently 6 main cocoa producing regions in Cameroon, South-West, Centre, Littoral, South, East and West. Adamaoua is considered a very small producing zone. Total area cultivated is 400,000ha. Eight million Camerounians benefit directly or indirectly from cocoa revenue. Cameroun is the 5th world largest producing country after Côte d'Ivoire, Ghana, Nigeria and Indonesia. Actual Production in 2011 was 220,000MT, but the country seeks to produce 600,000MT by 2020.

In spite of the efforts to increase productivity, the country is still faced with the constraints of aging farmers (80%) and their farms, poor soil fertility, inadequate fertilizer use, *very high disease and pest pressure*, and unavailable improved seeds for farmers. The diseases and pests include mirids, phytophthora pod rot, die back, stem and branch borers.

Côte d'Ivoire presentation by Mr Aka Aka Romain, representing the National Co-ordinator

The country on average produces 1.4 million MT of cocoa per year. The current production constraints include ageing of the cocoa farmers and their farms, decline of soil fertility, *high pest and disease pressure*, effect of climate change, and low level of adoption of research recommendations regarding the use of improved planting material and the application of appropriate cultural practices.

Major pests and diseases are mirids, *phytophthora* pod rot, CSSVD, stem borers and parasitic plants such as mistletoe. Mirids damage causes 30-40% loss. Cocoa stem borer has become a serious pest in Côte d'Ivoire since the 1990s, *Eulophonothus myrmeleon* being the most important. *Phytophthora* pod rot is the oldest and most widespread disease of cocoa; *Phytophthora palmivora* being the most common and *Phytophthora megakarya*, the most aggressive causing yield losses up to 60%. CSSV is known in Côte d'Ivoire since the 1940s. New outbreaks were discovered in Côte d'Ivoire since 2003. Survey is ongoing to identify outbreaks in other cocoa producing regions. Parasitic plants are often neglected. However it should be given more concern is they are becoming economically important. Two species of *Loranthaceae* are common in Côte d'Ivoire which cause serious damage to cocoa trees, sometime death of trees; and they are difficult to manage.

Damage assessment protocol:
Mirids: Cocoa plots are selected in different region and regularly visited. Assessment is done on chupons and scoring of damage carried out by using a 5-point scale from 0 to 4 according to the importance of the damage. Damage on pods is also assessed with the same method. Yield loss is done by comparing treated and untreated plots. Stem borer assessment is done by counting holes bored on trunk and main branches. Black pod assessment is done by counting healthy pods, pod rot and wilted pod. CSSVD is assessed by inspecting of plots to find main symptoms on leaves, shoot, pods and roots. Yield loss is also assessed by counting the pods and beans on the infected trees. Parasitic plants damage is assessed by assessing the dieback of trees and comparing the yield of infected and non infected trees.

Conclusion:
Pests and diseases are major constraints for cocoa production in Côte d'Ivoire and yield losses are important. Concerted efforts are made by researchers and others cocoa stakeholders to manage these constraints. Integrated management of these constraints is necessary to ensure the sustainability of cocoa production in Côte d'Ivoire.

Ghana presentation by Dr. H. Dzahini-Obiatey, National Co-ordinator

Major cocoa pests and diseases in Ghana are Mirid (*Sahlbergella singularis, Distantiella theobrama)*, blackpod disease (*Phytophthora megakarya, P. Palmivora)*, Cocoa swollen shoot virus disease.

Steps in Damage Assessment Protocol include:
- Exploratory studies on the crop's biological, social, economic and industrial environment
- Diagnosis and validation of causal and nodal constraints including institutional issues
- Identification of relevant tools e.g. causal diagrams and problem trees
- Identification of relevant stakeholders to address the problems
- Establishment of multi-stakeholder platforms and processes e.g. the Thrust system at CRIG
- Development of activities and timelines

Insect Pests damage assessment is done by conducting surveys to establish temporal and spatial distribution (population dynamics) and assess factors responsible for changes in populations. In achieving this, actual damage assessment, establishment of threshold levels, estimation of total damage and remedies are carried out. Disease assessment is done by conducting surveys to determine incidence and spread. This is achieved through symptom identification, pathological

tests, actual damage assessment, estimation of total damage and remedies. Black pod damage assessment is carried out by determining disease incidence expressed in ratio of disease pods to total harvested pods. In evaluating efficacy of fungicide in black pod control, we separate harvested pods on the trunk (<3.0 m) from those in the canopy (>3.0 m). CSSVD is controlled by eradication or cutting-out campaign, mild-strain cross-protection, barrier cropping with immune crops and breeding for CSSV resistance.

Nigeria presentation by Dr Lelia Dongo, National Co-ordinator

Nigeria used to be the second leading producer of cocoa in the world. Today it is in forth position after Côte d'Ivoire, Ghana and Indonesia attributed to labour shift in favor of the industrial sector (Oil & Gas), exploitation of cocoa farms for arable crops, deforestation, Soil infertility and land degradation for urbanization, old age of plantations, and *most importantly pest and disease outbreak.* Major pests and diseases in Nigeria include insect pests (Mirids, Stem borer, Pod borer, Shield bug & Termites), fungal disease (Black pod), viral disease (CSSVD), parasitic weeds (Mistletoes) and nematodes.

Damage assessment:
Cocoa pests damage assessment has been based on visual symptoms caused by the various pests. Most damage assessments are based on the proportion of trees or pods in such farm, which show symptoms of attack by the various pests. Also pest damage assessment becomes very difficult because cocoa trees are attacked simultaneously by different pests. In most cases, the adverse effects of damage caused by pests, are usually not fully manifested until several months *or* years later. In some situations where attack leads to the death of infected cocoa trees or seedlings, damage assessment is very difficult because it can not be attributed to any particular pest.

Togo presentation by Dr Pascal Komlan Wegbe, National Co-ordinator

Cocoa plantations in Togo are facing many constraints due to many factors which include total liberalization of the sector in 1996, ageing of existing plantations, abandoned plantations, decrease of soil fertility, and *resurgence of pests and diseases*.

Insect pests damage control methods are based on the use of chemical insecticides:

- Penncap M (methyl parathion), Caoforce 600 EC (diazinon) and 30 EC Gawa (imidacloprid)
- Use of tolerant plant materials such as:
- T86/799 x Na 32, Na T60/887 x 32, 100 x Na ICS 32, IMC67 SNK x 64 x IMC67 CS 100

Cocoa mirids *p*opulation dynamics are not established in Togo. However, it is known that the damages are observed during drought periods (October to February). Nevertheless, mirids are present in all Togolese cocoa farms. Damages are characterized by bites of soft tissue, of greedy or twigs, pods, causing their drying. Chemical control methods are employed using Diazinon, Fénobucarbe, Methyl parathion, Imidacloprid Swollen Shoot Disease present in all cocoa growing areas in Togo. It is estimated that more than 5,000 ha have been attacked by this disease (roughly one third -1/3- of the total area). Quantitative losses due to CSSVD have never been evaluated. However, it is estimated that when a cocoa tree is attacked, it dies after 3 - 4 years.
Control methods of CSSVD are based on an IPM approach, breeding, cultural practices (complete uprooting of all trees on the plot), using of barrier crops against vectors, and chemical

control against vectors. Losses due to black pod disease are estimated at 80% if no treatment is carried out. Control methods for black pod include crop sanitation, chemical control (Metalxyl + copper oxide), and selection of tolerant materials.

Conclusion:
Cocoa growing in Togo is facing many biotic constraints such as insects: mainly mirids, stem borer and some emerging pod borers, and diseases such as CSSVD, Black pod disease due to Phtophthora spp. To ensure the survival of this speculation, research activities need to continue, linkage between research, extension services, plant protection services and producers needs to b strengthened, proven technologies need to be effectively transfers to farmers, exchange of tolerant materials within the framework of regional cooperation should be encouraged.

Day Two: Tuesday 16 April 2013

A one-day field trip was organized for the workshop participants to the research facilities of the Cocoa Research Institute of Ghana (CRIG) and to visit farmers' field for a first hand experience on the damage caused by cocoa pests and pathogens and efforts at controlling them.

Day Three: Wednesday 17 April 2013

The **fifth presentation** on "Risk Analysis procedures and Modalities for Effective Quarantine Measures" was delivered by Mrs. Ruth Woode, Deputy Director and Head of Plant Quarantine (PPRSD- MOFA, Ghana), Member of IAGPRA and IPPC Standards Committee. The objective of the presentation was to make participants aware of the requirements for effective quarantine (phytosanitary) measures with emphasis on Pests risk Analysis.

The modalities for the protection of plants and the application of phytosanitary measures in international trade are based on two main principles. These are the *Basic Principles* and the *Operational Principles*. These principles relate to the protection of cultivated and non-cultivated/unmanaged plants, wild flora and aquatic plants and the application of phytosanitary measures to the international movement of people, commodities and conveyances.

The basic phytosanitary principles for effective quarantine measures include sovereignty, necessity, managed risk, minimal impact, transparency, harmonization, non-discrimination, technical justification, cooperation and equivalence of phytosanitary measures and modification.

With regards to sovereignty, contracting parties have sovereign authority to prescribe and adopt phytosanitary measures to protect plant health within their territories. They also have the sovereign right to determine the appropriate level of protection for plant health to minimize interference with international trade and to regulate the entry of plants and plant products and other regulated articles. They can prescribe and adopt phytosanitary measures concerning the importation of plants, plant products and other regulated articles e.g. inspection, prohibition on importation, and treatment. They can as well refuse entry, detain, treatment or destruction of consignments which do not comply with the phytosanitary measures, prohibit or restrict the movement of regulated pests into their territories, prohibit or restrict the movement of biological

control agents and other organisms of phytosanitary concern claimed to be beneficial into their territories

Pest Risk Analysis (PRA) has been defined as the process of evaluating biological or other scientific and economic evidence to determine whether an organism is a pest, whether it should be regulated, and the strength of any phytosanitary measures to be taken against it. For any specified country or area, the objectives of a PRA are to identify pests and/or pathways of quarantine concern and evaluate their risk, to identify endangered areas and, if appropriate, to identify risk management options or to make decision to review or revise phytosanitary measures or policies. The PRA processes consist of three stages: Stage 1: Initiation, stage 2: Pest risk assessment, stage 3: Pest risk management.

Pest initiated PRA and *policy initiated PRA:* The pests and pathways of concern and the PRA area will have to be identified. Also, the relevant information has to be collected and the pests have to be identified as possible candidates for phytosanitary measures, either individually or in association with a pathway.

Pest risk assessment: The process for pest risk assessment can be broadly divided into three interrelated steps: pest categorization, assessment of the probability of introduction and spread, and assessment of potential economic consequences (including environmental impacts). The categorization of a pest as a quarantine pest include identity of the pest, presence or absence in the PRA area, regulatory status, potential for establishment and spread in PRA area, and potential for economic consequences (including environmental consequences) in the PRA area.
Conclusion of pest categorization: If it is determined that the pest has the potential to be a quarantine pest, the PRA process should continue. If a pest does not fulfill all of the criteria for a quarantine pest, the PRA process for that pest may stop, and in the absence of sufficient information, the uncertainties should be identified and the PRA process should continue.

In conclusion, the pest risk assessment would identify all or some of the categorized pests which may be considered appropriate for pest risk management. For each pest, all or part of the PRA area may be identified as an endangered area. Also, a quantitative or qualitative estimate of the probability of introduction of a pest or pests, and a corresponding estimate of economic consequences and environmental consequences are obtained and documented and utilized in the pest risk management stage of the PRA.

Pest risk management: The result of the pest risk management procedure will be either no measures are identified which are considered appropriate, or the selection of one or more management options that have been found to lower the risk associated with the pest(s) to an acceptable level. These management options form the basis of phytosanitary regulations or requirements.

Main conclusion at the end of the presentation:

- International Standards for Phytosanitary Measures provide adequate guidance for preventing the introduction and spread of plant pests

- Contracting parties are therefore encouraged to apply these phytosanitary measures to promote harmonized scientific and justified procedures to enhance international trade in plants and plant products.

The **sixth presentation** on "Introduction to the use of "CocoaLink" platform to enhance feedback from farmers in research, development and extension of farmer centered technologies" was made by H. Sona Ebai, Chief of Party, World Cocoa Foundation/African Cocoa Initiative.

Background: CocoaLink is a low-tech innovation, established in 2011 and uses mobile technology. It seeks to communicate practical, critical, agricultural and social information to rural cocoa farmers in Ghana.

Key Features: it provides free and timely text messages on farming, social needs, health and marketing to improve income and livelihoods, it is a two-way system where farmers receive texts and voice messages on one hand, and farmers are able to submit queries on specific issues on another hand. It is a weekly farmer education system. The system encourages communication among farmers and enhances government extension, including responding directly to farmers' information needs.

Key results to date: Mobile ownership has increased in pilot communities from 84% during baseline in 2011 to 93% in 2012. There has been higher increase in ability to perform key mobile functions in pilot communities than control. 40% of farmers in pilot communities used their mobile phones to discuss agricultural production related issues compared to less than 20% in control communities. 68% of farmers in pilot communities used mobile phone to communicate with an Extension Agent at least once a month; 29% do so twice a month.

Expansion:

Ghana: Scale up to 100,000 farmers by 2014. Scale up CocoaLink's technology and build an efficient technical support system within COCOBOD for sustainability. Voice message system expansion.

Cote d'Ivoire: Launching CocoaLink in Cote d'Ivoire – Mid-year 2013. Program partnership with CCC. Implementation partnership with ANADER.

Dr George Ameyaw, Virologist, CRIG delivered the **seventh presentation** on "Review dynamics and basic information on pests and diseases situations in participating countries with reference CSSVD". The objective of the presentation was to provide a review of the dynamics of CSSVD and Black pod disease in West & Central Africa.

Diversity of the virus in West Africa: The virus is highly variable across locations (both within and between countries). Recent diversity study has categorized the viral strains into six distinct groups in Ghana, Togo and Cote D'Ivoire. Distinct species are noted to be within specific locations with some trans-border similarities. Management options include removal of infected trees and replanting with tolerant cocoa varieties, barrier cropping, resistant varieties, mild strain cross protection, and vector control.

Action points for effective management of endogenous diseases and pests in Africa:

- Need to generate more information on the pathogens and pests e.g. yield loss estimates for the diseases/pests, effect of CODAPEC on black pod and mirid incidence in Ghana.
- Well informed stakeholders on diseases/pests in the sub-region.
- Harmonise and co-ordinate activities to control and manage cocoa disease/pests regionally.
- Organise human/infrastructure/equipment resources for standard procedures/protocols (countries work together in a collaborative manner)
- Have a comprehensive regional emergency systems to deal with introduction of exogenous diseases/pests
- Strengthen international co-operation for strategic funding of key activities of scientists, training of quarantine and custom agents etc

The **eighth presentation** on Managing cocoa pests and diseases within Vision for Change (V4C) project in Cote d'Ivoire was presented by D. Kouassi, CNRA, Côte d'Ivoire. The project has two main components: *Productivity* and *Community Development*

In terms of managing diseases and pests, three approaches are adopted:

1. Contribute to the national strategy for cocoa pests and diseases control
2. Implement effective management schemes of cocoa pests and diseases management
3. Minimize the risks of cocoa swollen shoot virus disease (CSSV) during propagation of planting material

Progress made so far: Conducted a regional workshop in Accra to promote understanding of field management of CSSV, update current management guidelines, and propose short term research priorities. Technicians have been trained on CSSV management methods. Study conducted to develop a protocol for risk mitigation in pm propagation. Guidelines have been produced to minimize the risk of spreading CSSV. CNRA scientists have been trained on developing a PCR-based diagnosis tool in order to regularly screen clonal garden trees. monitoring of CSSV outbreaks in the surroundings of the on-farm demonstration plots has been initiated.

The way forward: Increase awareness on CSSV management strategies; Strengthen the capacity of scientists and extension agents; Enable farmers and extension agents to master CSSV management; Strengthen Partnership with NARS to develop reliable diagnosis tools for virus detection, develop CSSV tolerant clones and make available clean planting material for grafting. There is also the need to isolate clonal gardens with barrier crops, develop safety guidelines for visitors of the clonal gardens, translate research findings into on-farm solutions and take part in the national plan for CSSV risk management.

Conclusion:

- ❑ MARS V4C Project is aware of the potential risks in propagation of planting material in the rehabilitation of cocoa orchards
- ❑ V4C Project has integrated IPM in its project strategy and components
- ❑ V4C is contributing to the elaboration of a national protocol in order to mitigate risks in CSSV propagation

The **ninth presentation** on "Sustainable Cocoa Initiative" was made by Mr Edward Kuma of Mondelēz International. Mondelēz is collaborating Ghana Cocoa Board, Cocoa Research Institute of Ghana (CRIG), The Dutch Government, Cocoa Research (UK) Ltd, Ghana Cocoa

Growing Research Association and Mars Incorporated. Some of the projects being supported by Mondelēz include the Mabang Megakarya Selection Programme (MMSP), Effect of light and temperature on leaf flush, nutrients and phenolic content in cocoa.

Conclusion:
As the World's largest chocolate company, Mondelēz International remain committed to the sustainability of the cocoa sector and will continue to support initiatives that are crucial to the long term sustainability of the crop. We are therefore committed to the fight against common cocoa diseases to reduce loss and increase cocoa yield.

Prof. Carmen Suarez-Carpello, Technical University of Quevedo, Ecuador delivered the **tenth presentation** on "Witche's Broom and monilia diseases". The presentation highlighted the economic importance of the diseases, especially in respect of mode of spread. Various programmes such as integrated pest/crop management and farmer participatory research and training, have been organised to eradicate the diseases.

The **eleventh presentation** on "Regulatory and Legal Provisions, Plans and Measures for the Management of Pests and Pathogens – The Case of Ghana" was presented by Mrs. Ruth Woode, Deputy Director and Head of Plant Quarantine (PPRSD- MOFA, Ghana), Member of IAGPRA and IPPC Standards Committee. The objective of the presentation was to create awareness of the legal and regulatory framework for the management of pests in Ghana and to create awareness of the plans for the management of pests and pathogens.

There are two legal provisions which regulate plant pests in Ghana:

- Plants and Fertilizer Act, 2010 (Act 803) and
- Plant Protection Regulations, 2012 (L.I.2193)
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The *Plant and Fertilizer Act, 2010* (Act 803) requires that the Minister of Food and Agriculture of the Republic of Ghana, make regulations by legislative instrument for better performance of functions of the Act. The current *Plant Protection Regulations, 2012* (LI 2193) conform with International Standards for Phytosanitary Measures (ISPMs) and World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary (SPS) Measures and the Act and its regulations are harmonized with the requirements of the Inter African Phytosanitary Council (AU- IAPSC).

Highlights of Legal and Regulatory framework:
Act 803 and LI 2193 provide the required framework for efficient conduct of plant protection to prevent the introduction and spread of plant pests, regulate the importation and facilitate the export of plant and plant materials, and provide requirements for marketing quality standard.

Regulatory Body and its functions:
The Act establishes a Regulatory body known as Plant Protection and Regulatory Services Directorate (PPRSD) under the Ministry of Food and Agriculture. The functions of PPRSD include the following:

- Conduct surveillance to report the occurrences, outbreak and spread of pests and the control of pests.
- Inspection and certification of consignment moving in international trade.

- Dissemination of information within the country about requirements and procedures to prevent and control plant pests.
- Conduct Pest Risk Analysis
- Co-operate with National , Regional, International Institutions and member countries of IPPC in matters relating to plant health and
- Notify the National Plant Protection Organization of exporting country of any interceptions for non compliance to phytosanitary requirements.
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Requirements for importation of plants and plant materials

- All imports of plants and plant materials shall be subjected to inspection.
- An importer is notified in writing of the result of inspection if imported items present the risk of introduction and spread of plant pests, does not satisfy the provisions of the Act or are not accompanied with requisite documents.
- A plant commodity imported from a prohibited location, shall be subjected to appropriate measures including quarantine treatment to reduce risk, re- export or destruction of the commodity.
- A consignee who suspects that an imported item contains plant pests shall notify the Plant Quarantine Division for the necessary action to be taken.

Pest Surveillance: PPRSD is mandated to collaborate with other institutions to carryout surveillance of growing plants. Information obtained from surveillance are used to define pest-free areas, areas of low pest prevalence, new populations of quarantine pest, and populations of quarantine pest with limited distribution in Ghana.

PPRSD plans for the management of pests and pathogens

- Create awareness on the Plants and Fertilizer Act and its regulations.
- Develop procedures for effective Plant Health and phytosanitary controls.
- Promote Integrated Pests Management (IPM) for major crops.
- Rear bioagents against pests of cassava, papaya and mango to sustain National Biological Control Programmes.
- Establish systems approach for the management of fruitflies in accordance with international standards for phytosanitary measures.
- Initiate compliance programmes to increase competitiveness of export crops.

The **twelfth presentation** on "Existing IAPSC Regulatory and Phytosanitary measures for the importation of cocoa" was delivered by Dr. Maria Ayodele, IITA Ibadan. Quarantine was defined as a technique for insuring disease and pest free plants by isolating them during a period while performing tests for latent diseases (often used when importing new cultivars). The principles and practices of quarantine is to try as much as it is humanly feasible to prevent the introduction/entry of exotic pests into countries where they do not exist.

Quarantine Conditions for cocoa importation:

The consignment must be accompanied by phytosanitary certificate issued by the Director of plant protection and quarantine of the exporting country. Additional declaration that the cocoa seedlings were raised from cocoa pods harvested from plants inspected during active growth on the field and found to be free from the major pests of cocoa. The consignment on arrival to be submitted to plant quarantine service with the enclosed labels. On arrival, the seedlings must be subjected to post entry quarantine for 6-9 months.

Import of plant propagative materials from countries where exogenous pests and diseases exist is prohibited to the public. Import of plant propagative materials for research purposes is permissible on the conditions that the plant propagative materials were obtained from areas known to be free from exotic pests. The materials must undergo a 3rd Country quarantine for at least 9 months before release to the importing country.

Conclusion
If we must protect our cocoa from devastative exotic pests, then importation of cocoa propagative materials from continents where these pests occur must be prohibited. We need a Regional phytosanitary measure if our cocoa industry has to remain viable and relevant.

Day Four: Thursday 18 April 2013

The **thirteenth** presentation on "Cocoa Pod Borer, *Conopomorpha cramerella*, current status and recommended control" was presented by D r(Mrs) Endang Sulistyowat of Indonesian Coffee and Cocoa Research Institute (ICCRI). Indonesia is the third largest cocoa producer in the world after Cote d'Ivoire and Ghana. In 2003 – 2009, cocoa productivity in Indonesia declined. The main factors causing the declined productivity include ageing, Cocoa Pod Borer (CPB) and Vascular Streak Die-back (VSD) damage.

Symptoms of CPB: early and uneven ripening (sometimes with exit holes), pulp forms a callus-like tissue causing petrifying of beans in clumps.

Life Cycle of CPB: Egg ± 7 days, Larvae (14-18 days), Pupae ± 7 days, Moth (1-7 days).

Current situation of CPB in Southeast Asia & Pacific: All cocoa areas in Indonesia are infested by CPB with annual losses approx. US$ 200million. CPB is one of the main reasons for the strong reduction of cocoa production in Malaysia. Vietnam is still free from CPB. Cocoa clones (SULAWESI 3, ICCRI 7) resistant to CPB has been released by Indonesia Ministry of Agriculture.

Focus Group Discussions

Group one: Harmonization of Disease Assessment protocol for CSSVD/Black pod/ Mistletoes

- Identify infected districts/division/LGA based on information on the ground
- Using the reference districts/division/LGA, select 4 locations 16km apart (for Cameroun 10km apart)
- Select 3 farms per location at least 6km apart
- Draw a diagonal transect on the farm and at every 30 m inspect for infection
- Farm size should be a minimum of 2-3 ha. Farms less than 2 ha should be aggregated
- Look out for symptoms of CSSVD/Black pod/Mistletoe and score for presence or absence
- Have a table of symptoms for CSSVD/black pod / mistletoes

- Take samples for confirmation in the lab through indexing and isolation and identification
- Ask if farmers have other farms to use as a check box

Group two: Harmonization of Protocol for participatory demonstration of barrier cropping for CSSVD with farmers

- Recommended barrier crops are citrus, oil palm and coffee or any other non-host crops
- The barrier should cover at least 10m from the boundaries of the cocoa farm taking into accounts the planting distances of the barrier crops.
- The selected barrier crop should cover the entire boundaries of the cocoa farm within the 10m Condon
- For example, Oil palm should be 2 triangular rows at 9m apart; citrus should be 2 rows at 6m apart, coffee should be 3 rows at 3m apart

Conclusions and Recommendations

After each presentation and session, general discussions were held to discuss matters arising out the presentations. The following were the highlights of issues arising:

1. Breeders in their search for resistant varieties must look out for multiple gene based materials to avoid the possibility of developing varieties which could be resistance to a particular strain of pathogens but susceptible to others.
2. In our efforts to control the introduction of exogenous pest and pathogens, we must have an integrated approach which involves the farmer and researcher.
3. Pest risk analysis (PRA) should be a key component of this project to ensure effective control of the introduction of exogenous pests and pathogens.
4. Chemicals used in the control of these pests and pathogens in these project areas must be harmonised to ensure consistency and effectiveness.
5. Intensification of training of farmers to understand the principles behind recommendations for the management of pests and diseases.
6. Importation of pods and seeds for whatever purpose must be under strict control and should pass through quarantine process.
7. Movement of materials from hotspots where pathogens are prevalent must be highly monitored.
8. Projects should consider equipping labs of research stations with modern equipment to ensure results obtained from project activities are consistent.
9. The issue of heavy metals such as cadmium should be taken into consideration in our search for chemicals to manage the pests and diseases.
10. There should be comprehensive regional emergency systems to deal with problems of pests and pathogens as and when they arise.
11. Project implementing countries should resource their quarantine department to effectively implement laws and protocols to prevent the introduction of exogenous pests and pathogens.
12. Comprehensive and consistent public education strategies must be developed to sensitise the public on the importance of these pests and pathogens to ensure effective control.

Closing Ceremony

The closing ceremony was chaired by Dr Yaw Adu Ampomah, Deputy Chief Executive (Agronomy and Quality Control). In closing remarks of each of them they expressed gratitude to all participants in the workshop for their active participation for a successful workshop. There were closing remarks from the Executive Directors of CRIN and CRIG expressing hope for the project. Support was expressed by the Projects Manager of ICCO on behalf of international Commodity Boards, ICCO and CFC. They stressed the need to support the project to achieve the important objectives set out to be accomplished under the project.

Rapporteurs

- Stephen Yaw Opoku, CRIG
- Samuel Saka Boateng, COCOBOD

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Appendix 1 List of workshop participants:

REGIONAL WORKSHOP ON INTEGRATED MANAGEMENT OF COCOA PESTS AND PATHOGENS IN AFRICA.

Venue: Oak Plaza Hotel, Accra Date**:** 15-18 April, 2013

LIST OF PARTICIPANTS from outside Ghana

NO	NAME	DESIGNATION/ORG	COUNTRY	E-MAIL ADDRESS
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3	Mr Yunusa Abubakar	Project Manager, ICCO International Cocoa Organisation (ICCO)	United Kingdom	project.manager@icco.org
4	Mr. Kouassi Koffi Daouda	Rep. Mars Incorporated, ICRAF/MARS V4C Project World Agroforestry Centre (ICRAF) COTE D'IVOIRE 01BP2024 San Pedro	Cote d'Ivoire	
5	Mrs. N'Guessan Amenan Marie Paule	Rep. Mars Incorporated, ICRAF/MARS V4C Project World Agroforestry Centre (ICRAF) COTE D'IVOIRE 01BP2024 San Pedro	Cote d'Ivoire	
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19	Prof. Malachy Ogbenovo Akoroda	Executive Director, Cocoa Research Institute of Nigeria (CRIN)	Nigeria	
20	Dr. Maria Ayodele	IITA, Ibadan, Nigeria	Nigeria	M.AYODELE(IITA)@cgiar.org
21	Ms. Opeewa Omololu	Desk Officer for Common Fund for Commodities (CFC) Ministry of Industry, Trade and Investment, Abuja,	Nigeria	

		Nigeria		
22	Mr. Uche Evarestus Asogwa	Researcher (Project), Cocoa Research Institute of Nigeria (CRIN)	Nigeria	
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26	Mr Tagba Atsu	Chef Division, Plant Protection Division	Togo	
27	Dr (Mrs) Endang Sulistyowat	Expert on Cocoa Pod Borer, Indonesian Coffee and Cocoa Research Institute (ICCR)	Indonesia	liessuro@yahoo.co.id
28	Mr. Suryo Wardani Dwi Suryadi	Indonesian Coffee and Cocoa Research Institute (ICCR)	Indonesia	
29	Prof . Carmen Suarez-Capello	Expert on Frosty Pod/Witches Broom	Ecuador	suarezcapello@yahoo.com

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PROJECT SECRETARIAT

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CRIG GUEST FOR SUPPORTING STAFF

1	Dr. Francis Baah	COCOBOD	Workshop Facilitator	
2	Mr. Saka Boateng	COCOBOD	Rapporteur	
3	Mr. Stephen Opoku	CRIG	Rapporteur	
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5	Mr Joel Aboagye	CRIG	Driver for project secretariat	

LOCAL WORKSHOP PARTICIPANTS

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4	Mr. William Mintah Wiafe	CSSVD/CU	Dep. Tech. Manager	
6	Mr. Kwame Adjei	CSSVD/CU	Technical Manager	
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8	Dr Oppong Dwapanyin	COPAL	Head of Research	adwapanyin@yahoo.com
9	Mrs Afriyie Haffar	COCOBOD	Board Member,	
10	Mr. Anthony Fofie	COCOBOD	Chief Executive	
11	Dr. Yaw Adu-Ampomah	COCOBOD	Deputy Chief Executive (A&QC)	
12	Mr. Kwabena Asante Poku	COCOBOD	Deputy Chief Executive (Ops)	
13	Dr. Francis Oppong	CSSVD- CU/COCOBOD	Ag. Executive Director	
14	Mr. Michael Owusu – Manu	COCOBOD/Research	Snr. Manager	
15	Mr Peter Okyere Boateng	CSSVD/CU	Dep. Tech. Manager	
16	President and One(1) other Executive	Cocoa Coffee and Sheanut Association (COCOSHE)	Farmers' reps	
17	Managing Director	Sidalco company ltd	Inputs suppliers	
18	Managing Director	Wienco (Gh) Ltd	Inputs suppliers	
19	Managing Director	Chemico	Inputs suppliers	
20	Managing Director	BASF (Dizengoff Ghana Ltd)	Inputs suppliers	
21	Managing Director	BASF-Ghana	Input Supplier	
22	President + 1 Rep	LICOBAG	Licensed Buying Agency Rep	
23	Prof (Dr). Oteng Yeboah	Cocoa Research Institute of Ghana (CRIG)	Board Chairman, /Chairman for launching of workshop	
24	John Pwamang	Director	Chemicals Control and Management Centre (CCMC), Environmental Protection Agency (EPA)	