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UPDATE ON FRENCH CARIBBEAN SAFEGUARDING INVASIVE SPECIES CIRAD-INRA INITIATIVES

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ABSTRACT. Currently five collaborative research networks are proposed, and each is to be built as a network around topics on the security, health and emerging diseases of crops in the Caribbean region. The five proposed networks are as follows: (i) begomoviruses on tomato, (ii) coconut lethal yellowing, (iii) emerging and invasive citrus diseases (tristeza, citrus canker, CVC and greening), (iv) established and emerging diseases and pests of sugarcane and (v) cercosporiosis diseases and BSV in bananas and plantains. The first contact missions to finalize the drafts of the networks projects with the various partners began in May 2005 within the framework of a global project financed by the French Government and Guadeloupe Regional Council. Phytosanitary Risk Analyses were made in 2003 and 2004 by CIRAD with the Co-operation Mission of the French Ministry of Agriculture Plant Health Board.

A sixth network, CaribVET, has been functioning since 1999. CaribVET is an inspection network recognized at the Caribbean regional level. It includes the veterinary services, laboratories of diagnosis, universities, and national and international partners engaged in monitoring animal health. Within the framework of the activities of this network, missions of technical support and diagnosis in the member states of the Organisation of Eastern Caribbean States (OECS) began in 2004 and will continue in 2005 mainly with funding support of the French Embassy and the Ministère des Affaires Etrangères.

KEY WORDS: collaborative research networks, begomoviruses, tomato, coconut lethal yellowing, citrus diseases, sugarcane, cercosporiosis, banana streak virus, BSV, banana, plantain

RÉSUMÉ: Etat d'avancement des projets Cirad-Inra pour la protection contre les espèces envahissantes dans les départements français de la Caraïbe et dans la Caraïbe insulaire.

Cinq réseaux de recherche font actuellement l'objet de projets de constitution d'un réseau associatif de chercheurs caribéens dans le domaine de la sécurité sanitaire et des maladies émergentes et en progression dans la caraïbe : la maladie à bégomovirus de la tomate, le jaunissement mortel du cocotier, les maladies des agrumes (tristeza, chancre citrique, CVC et greening), les maladies de la canne à sucre et les cercosporioses et le BSV du bananier. Les premières missions de prises de contact et de finalisation de rédaction des projets de réseaux des partenaires débuteront en mai 2005 dans le cadre d'un projet global financé par l'Etat français et le Conseil Régional de Guadeloupe. Des analyses de risques phytosanitaires ont été réalisées en

2003 et 2004 par le Cirad en relation avec la Mission de Coopération Phytosanitaire du Ministère de l'Agriculture, de l'Alimentation de la Pêche et de la Ruralité.

Un sixième réseau fonctionne depuis 1999, il s'agit de Caribvet, c'est un réseau de surveillance des caraïbes reconnu régionalement, il inclut les services vétérinaires, les laboratoires de diagnostic, les universités, les partenaires nationaux et internationaux de la surveillance de la santé animale. Dans le cadre des activités de ce réseau, des missions d'appui technique et de diagnostic auprès des Etats de l'OECS ont débuté en 2004 et se poursuivront en 2005 principalement sur financement Ambassade de France.

INTRODUCTION

Five collaborative research networks were proposed by CIRAD and INRA in 2003 during the 39th annual CFCS meeting in Grenada CFCS 2003. These networks are being built around topics on security, health and emerging diseases of crops in the Caribbean region, as follows: (i) begomoviruses on tomato, (ii) coconut lethal yellowing, (iii) emerging and invasive citrus diseases (tristeza, citrus canker, CVC and greening), (iv) established and emerging diseases and pests of sugarcane and (v) cercosporiosis diseases and BSV in bananas and plantains.

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CIRAD-1 Traditional Crops - Banana and Plantains.

Title project: " Impact of the introduction of new hybrid varieties of bananas and plantains on the dynamic balance of the populations of some pathogenic agents and pests: nematodes, fungi and viruses ".

Countries: Cuba, Haïti, Dominican Republic, Guadeloupe, Martinique, Windward Islands, Mexico, Colombia, Ecuador.

Problems: 1. Increasing spread of Black Sigatoka disease in the Caribbean area,

2. Introduction into this area of new banana hybrids containing banana streak virus (BSV) genomic sequences in their genomes.

Objective of the study and proposed solutions: This project aims to evaluate (i) the durability of resistances to the cercosporioses - black and yellow (*Mycosphaerella fijiensis* and *M. musae*) - obtained in interspecific banana hybrids, (ii) the impact of the diffusion on a large scale of these hybrids on the populations of nematodes affecting the banana production, and (iii) potential risks of diffusion of BSV resulting from the activation of BSV sequences integrated into the genome of these hybrids. By the establishing or strengthening scientific exchanges and transfer of methodologies, this project will lead to improved management of the resistance obtained in hybrid varieties, and of the risk of spreading BSV through the diffusion of these hybrids,

Current status: Studies on the molecular diversity of BSV populations have started in South America (Mexico, Colombia). The collaborative network should be extended to nearby countries (such as Ecuador) and the Caribbean (Cuba).
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CIRAD-2 Traditional Crops - Sugarcane.
Title: "Support of sustainable sugar and rum production, and preservation of the agricultural landscape in the Caribbean by optimizing the processes of variety selection".
Countries: Bélize, Cuba, Haïti, Dominican Republic, Trinidad, Guadeloupe and Barbados.
Problems: New or undetected diseases can have a negative impact on Caribbean sugarcane production.
Objective of the study and proposal solutions:
The studies to be integrated in the project would be:

1. Characterization of the genetic resources, study of their diversity (microsatellite, and other tools), identification of new quantitative trait loci (QTL);
2. Impact study of the emergent diseases and the major diseases on production and selection (SCYLV phytoplasmas, RSD, etc.);
3. Impact study of the variability of pathogenicity on the durability of varietal resistance (leaf scald);
4. Database on genetic improvement.

Sugarcane, along with banana, is one of the main crops in Guadeloupe. Around 46% of cultivated area is planted with sugarcane. Because sugarcane is important for Guadeloupe, the sugarcane crop needs to be protected from invasive species present in Guadeloupe since long ago, or from those recently introduced. The major damaging pathogens and pests are *Ustilago scitaminea* (c.a. of smut on sugarcane), *Leifsonia xyli* subsp. *xyli* (c.a. of ratoon stunting disease), *Xanthomonas albilineans* (c.a. of leaf scald) and *Sugar Cane Yellow Leaf Virus* (c.a. of the yellow leaf disease), the West Indies sugarcane fly, *Saccharosydne saccharivora* and the sugarcane borer *Diatraea* spp. The sugarcane crop also needs to be protected from any disease or pest that may be introduced in Guadeloupe.

Basic knowledge of sugarcane diseases and pests - including disease dispersion, pathogen variability and condition of epidemics - is important for establishing plant protection plans. To protect sugarcane crops from local invasive species CIRAD has developed local screening procedures to select sugarcane for resistance to major diseases. In addition a seed nursery scheme was established in Guadeloupe using disease free in vitro cultivated plants as the primary source of seed plants. Plants will then be multiplied for 3 years by farmers.

Introduction of invasive species through germplasm movement is limited by a 2 years quarantine process at CIRAD - Montpellier. The quarantine process is validated by the plant protection services of French government.

Sharing knowledge on sugarcane diseases, diagnostic tools and varietal status among Caribbean countries will be helpful to protect sugarcane crops form diseases and pests.
Current status: Contacts have been established with the main Caribbean partners to develop a data base on genetic improvement and for diagnosis training for the major emergent diseases in the countries and in CIRAD CA Guadeloupe
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CIRAD-3 Diversification Crops – Citrus.

Title: "Promotion of a sustainable citrus fruit cultivation and plant health observatory".

Countries: Cuba, Dominica, Haïti, Jamaica, Dominican Republic, Trinidad and Tobago, and Guadeloupe.

Problems: Progressive spread of the tristeza virus in the Caribbean area. Risk of additional invasive pests (citrus variegated chlorosis (CVC), bacterial canker and citrus greening disease).

Objective of the study and proposal solutions:

Assist citrus growers in a project of rehabilitation, which would consist of establishing durable citrus fruit cultivation within an integrated fruit-bearing and production system. This regional project will be based on research projects developed in the field on varietal development and plant protection (plant health observation), involving integrated pest management and agronomic programs, training and technology transfer, and socioeconomic studies.

Current status: Two surveys have been made in 2004 by Cica Urbino, CIRAD FLHOR virologist on the spread of tristeza in Saint Lucia and Dominica. In Saint Lucia the survey completed the diagnosis for CTV. It showed that CTV has spread in the main citrus production areas of Saint Lucia and the recommendation of changing the rootstock is still a topical question.

In Dominica_CTV was not detected along the western coast, nor in the north and north western sectors of the island. However, CTV was detected in the samples collected in the central and southern areas of Dominica where it been detected previously (10 positives out of 18 samples collected at Layou, Soufriere, Laudat, Grandbay). All the varieties were affected, especially limes. Young plants were found positive at Grand Bay. This reveals the activity of the vector for the transmission of the virus. Lime plants grafted on swingle were found positive at Botanic Gardens Nursery.

A proposal for the development of certified citrus plant propagation has been made.

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CIRAD-4 Tomato.

Title: "Incidence and epidemiology of tomato begomovirus diseases in different countries of the Caribbean ".

Countries: Cuba, Dominican Republic, Trinidad, Guadeloupe and Martinique.

Problems: The introduction of the B biotype of *Bemisia tabaci* was concomitant with the appearance and spread of different begomovirus diseases on tomato in the Caribbean. These diseases have caused severe yield losses, and sometimes, preventing profitable cultivation in the countries of the Caribbean.

Objectives of the studies and proposed solutions:

To determine the respective incidences of different begomoviruses species on tomato (mainly TYLCV and PYMV).

To determine the key factors in the development of epidemics with respect to the production area scale, and to the plot scale.

To model progress of the disease in the plots, in relation with environmental factors; in order to create and evaluate IPM practices, adapted to the different agronomic and socio-economic contexts.

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CIRAD-5 Diversification Crops – Coconut

Title: "Towards a global research program on integrated control of the coconut lethal yellowing disease in the Caribbean".

Countries: Cuba, Haiti, Jamaica and Guadeloupe.

Problems: Lethal yellowing of coconut is one of the most devastating coconut diseases. To date the French West Indies and lower Caribbean have not been touched by this dreaded scourge. As for the coconut production areas of Cuba, Haiti and Jamaica, they are now partially devastated, and the disease in progressing relentlessly in the Caribbean. Its repercussions are particularly serious in the area with respect to employment in rural areas, conservation of biodiversity, impact on ecosystems, degradation of landscapes, and reduction in visits of tourists to typical Caribbean landscapes and beaches.

Objectives of the study and proposed solutions:

The project will aim at characterizing the diversity and the variability of the phytoplasmas associated with this disease, identifying its vectors, defining their etiologic role and identifying resistances in the host plants. Acquired knowledge will make it possible to establish recommendations for varietal selection and methods of a rational struggle for the control of the disease, and for halting its diffusion in the Caribbean.

Current status:

For 3 years CIRAD CP has given fresh impulse to research on lethal yellowing of coconut (JMC - YLC). In Africa this thrust resulted in the creation of a PCR-based diagnostic laboratory in Ghana and a triangular collaboration Ghana-Mozambique-Cirad Montpellier. In the Caribbean, several researchers of CIRAD CP carried out missions of expertise on the JMC since 2000, in Honduras, in Haiti, in Cuba and Jamaica. Various types of collaborations are set up gradually including (i) reception in Montpellier of Ph.D. students from Jamaica (from the Coconut Industry Board (CIB)) and from Cuba (from the IIFT), (ii) participation in the Ph.D. examining board in Jamaica, (iii) follow-up of a student in Honduras by electronic mail, and (iv) scientific missions of supports in entomology, phytopathology. A. Slackness joined CIRAD and an agreement has been signed with the Coconut Industry Board of Jamaica (CIB). The implication of CIRAD in this area also results in the membership of the person in charge for the UPR "Jaunissement mortel du cocotier" to Caribbean division of American Phytopathological Society and its participation in several of its meetings, and by the nearest assignment of one of its research entomologists in Mexico in September 2005.

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CIRAD-6 The Caribvet network and OECS countries

Title: The Caribbean Animal Health Network (CaribVET), a collaboration network between institutions and people to improve animal health and the quality and safety of animal products with emphasis on the Organization of Eastern Caribbean States (OECS).

Countries : Saint Lucia, Saint Vincent and Grenadines, Saint Kitts and Nevis, Antigua and Dominica

Objectives of the study and proposed solutions:

The 2004 and 2005 CIRAD missions in the countries of the OECS in relation with the agriculture ministries mainly consisted in identifying the assets and the needs for the veterinary services in terms of diagnosis of the animal diseases, formation, and technology transfer; and the need to actively integrate the veterinary services of the countries of the OECS into regional dynamics. These missions are thus integrated perfectly in the development of the Caribbean network of animal health in complement of the FCR sets of themes, FSP épidémiosurveillance, and of the development of the Caribvet.net Web site. They contribute thus to the success of these improvements of regional collaboration in animal health. http://www.caribvet.net .

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