

STATEMENT OF WORK

Integrated Pest Management Program for Black Sigatoka

Mycosphaerella fijiensis Morelet in Puerto Rico

August 1, 2007 to December 31, 2007.

Project Summary

In June 2004, Black sigatoka, (BS), *Mycosphaerella fijiensis* Morelet was detected for the first time in Puerto Rico. The presence of the disease was confirmed after observing the microscopic characteristics of the pathogen's anamorph, *Paracercospora fijiensis*, on affected leaves. For the species occurring on *Musa*, anamorph morphology are more informative and can be used to separate the major pathogens. BS, which is also known as black leaf streak, causes significant reductions in leaf area, yield losses of 50% or more and premature ripening, a serious defect in exported fruit. It is more damaging and difficult to control than Yellow Sigatoka (YS), *Mycosphaerella musicola*, and has a wider host range that includes the plantains and dessert and ABB cooking bananas that are usually not affected by YS. This makes it necessary to develop a sustainable approach for the management of the disease. This proposal requests \$12,000 in federal funds to develop educational materials and workshops about Integrated Management of Black Sigatoka in Plantain and Banana. The development of these educational resources will assist Extension agents and plantain and banana growers to understand Black Sigatoka management using the IPM approach. The period of performance of the proposed work is from August 1, 2007 to December 31, 2007.

Literature Review, Previous Work and Related Experience

For 2002-2003, the Puerto Rico Agricultural Annual Income was estimated in \$756.19 millions. Of these, \$241 millions (31%) were crops (OAS, 2004). Plantain and Banana production was 734,918 thousands of fruits (388,086 thousands for plantains fruits and 346,832 for banana fruits). With an average farm price per thousand of \$140.45 for plantain and \$39.00 for banana, it was \$68,065 millions of total gross income for these commodities.

Plantain (*Musa balbisiana*) and banana (*Musa acuminata*) production occupies the first place in importance among crops in Puerto Rico. Around 26,582 acres in 6,340 farms are devoted to plantain and 11,071 acres in 3,958 farms to banana. Around 85% of the total acreage is harvested. One acre of plantain and banana has about 800 - 900 plants and the average production varies from 30 thousand for plantain and 100 thousand for banana per acre. A hundred percent of plantain and banana production is destined for the local fresh market. Plantain and banana suffers from damage by several pests. The most important are nematodes, black weevil and yellow sigatoka. A preliminary economic analysis made before BS was introduced in Puerto Rico reported a chemical control cost of \$408.0/acre/year (\$1,020.0/ha/year) and a profit mean reduction of \$3,308.8/acre/ano (\$8,272.0/ha/year) with yield loss from 20.0% to 80.0% (Alamo, C., M. Cortez y J. Palacios).

In June 2004, BS was detected for the first time in Puerto Rico. (Almodovar, W., 2004). The presence of the disease was confirmed after the following characteristics of the pathogen's anamorph, *Paracercospora fijiensis*, were observed on affected leaves: simple conidiophores occurring singly or in groups of two to four with one to several septa, scars, and usually a broadened base; and conidia much more abundant on lower leaf surfaces, straight to variously

bent with one to several septa and a conspicuous scar at the base. For the species occurring on Musa, anamorph morphology are more informative and can be used to separate the major pathogens, namely eumusae leaf spot diseases (*Mycosphaerella eumusae*), sigatoka (*M. musicola*), black leaf streak (*M. fijiensis*). (Crous, et. al.)

Once the disease was detected, the Puerto Rico Department of Agriculture (PRDA) conducted a survey to establish the municipalities that were positive for the presence of BS. The PR Extension Service collaborated in the survey by processing the diseased samples in the Diagnostic Clinic. At the same time an educational program was continued in collaboration with the Extension Agents to educate farmers in identification and management of BS.

Increased tolerance of the black sigatoka pathogen to fungicides has made it necessary to increase applications in several countries. Disease control with fungicides is expensive and loss of effectiveness as a result of acquisition of resistance makes mandatory to develop IPM strategies to control the disease. Farmers must use different strategies to manage black Sigatoka. These include the removal of older leaves to reduce inoculum levels in a plantation, management of nutrition and irrigation, elimination of weeds, interplanting with other nonsusceptible crops, use of resistance cultivars and planting in partial shade which results in less severe disease development. (Ploetz, Perez Vicente, L.)

E. Objectives and Procedures

The goal of this project is to promote the adoption and implementation of effective strategies to reduce the effect of black sigatoka on plantain and banana and to protect the environment from unnecessary pesticide applications.

1. Create a field guide about Identification and Management of Black Sigatoka. Existing educational materials will be included in the guide to assist Extension agents and growers to understand Black Sigatoka management and have this useful tool in a very accessible form. The field guide will contain all the necessary information needed for a grower to detect the disease on time, evaluate disease incidence and available management practices to control the disease. The field guide will include information on: disease symptoms, climatic factors and development of the disease, scouting and evaluation of disease incidence in the field, cultural management practices and available fungicides, mode of action and pesticide safety.
2. We will develop regional workshops, that will also include a hands-on session on disease identification, monitoring, and diagnosing, to train participants in Identification and Management of Black Sigatoka. The project director and support staff will implement five workshops, one in each of the five regions of UPRAES. Afterward, local Extension agents will collaborate in material distribution. A register of educational materials recipients will provide for subsequent evaluation purposes and future educational activities. Workshop participants will include Extension agents, agronomists of the Department of Agriculture and plantain and banana growers. The University of Puerto Rico will provide all training facilities sites.

Literature Cited

Alamo, C., M. Cortez y J. Palacios. **Economic Impact Analysis on the plantain Commodity in Puerto Rico due to a posible introduction of Black Sigatoka.** In: Special Publication, ACORBAT XVI International Meeting, 2004. Oaxaca, Mexico.

Almodovar, Wanda. 2003. IPM Program Report for Puerto Rico for FY2003, USDA-CSREES.

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Merchan, V. 1996. Prevencion y Manejo de la Sigatoka Negra. ICA, Ministry of Agriculture and Rural Development, Colombia. 30pp.

Office of Agricultural Statistics (OAS). 2004. **Gross Farm Income of Puertorican Agriculture; 1997-98.** Puerto Rico Department of Agriculture, San Juan, PR pp. 20-21.

Perez, L. 1996. Manual para el manejo integrado de sigatoka negra (*Mycosphaerella fijiensis* morelet) y sigatoka amarilla (*Mycosphaerella musicola* Leach ex Mulder) en banano y plátano. FAO Project- Ministry of Agriculture TCP/CUB/4454. 56pp.

Ploetz, R.C. 2001. **Black Sigatoka of Banana.** *The Plant Health Instructor.* DOI: 10.1094/PHI-I-2001-0126-01.

Duration of the Project

From August 1, 2007 to December 31, 2007.

Evaluation Plans

By the development of IPM educational materials and workshops we will provide farmers useful information about Black Sigatoka identification and management so they obtain greater understanding of available management strategies in banana and plantain production. We also want to increase farmers awareness of the risks of pesticide use so that they will be able to increase their use of on-farm IPM practices.

The expected results are accurate identification and early detection of the disease, appropriate selection of pesticides for improved control, reduced human health hazards, reduced unnecessary pesticide use, and reduced costs of control practices.

At the beginning of the workshops, a survey among participants will determine their awareness and confidence in IPM. At the end of each workshop, a post activity survey will collect data about the effectiveness of the training in meeting behavior-based objectives.

Timetable

This project will be conducted from August 1, 2007 to December 31, 2007. The schedule to produce the educational materials is as follows:

August 2007 to October 2007

To compile existent educational materials about Identification and management of Black Sigatoka and make a Field Guide.

November 2007 to December 2007

Offer workshops for Extension Agents and growers to train in Black Sigatoka and deliver the educational materials.

Appendix C

Major Participants

Project coordinator

Wanda I. Almodóvar-Caraballo, MS., Extension Plant Pathologist

Support Staff

Ada Alvarado, MS, Agricultural Agent in charge of Pesticide Education
Manuel Diaz, MS, Plantain and Banana Specialist

Budget Narrative

	FTE (6 months)	Funds Request by Proposer	PR Agricultural Extension*	TOTAL
Salaries and Budget				
Professional:				
Wanda Almodóvar – Project Director	.20		5,062.00	5,062.00
Ada N. Alvarado Ortiz	.10		2,184.00	2,184.00
Manuel Diaz	.10		2,532.00	2,532.00
Total Salaries and Wages			9,778.00	9,778.00
Fringe Benefits			3,438.00	3,438.00
Total Salaries, Wages and Fringe Benefits			13,216.00	13,216.00
Materials and supplies for workshops		800.00		800.00
Laser paper, cartridges for color laserjet, CD's, pens, pads				
Publication Costs		4,380.00		4,380.00
Educational materials (Field guide, posters, fact sheets)				
Travel				
		1,620.00		
In Puerto Rico – travel to workshops throughout the Island.		4,000.00		
Out of Puerto Rico – Attendance of the Annual Caribbean Food Crop Society Meeting to be held in Costa Rica by the PD and the Co-PD's.		5,620.00		5,620.00
All other costs		1,200.00		1,200.00
TOTAL		12,000.00	13,216.00	25,216.00
*Matching funds (in-kind)				

Budget Narrative

1. Salaries

Wanda Almodóvar – Project Director/Principal Investigator - 20% \$5,062.00

Ada N. Alvarado Ortiz - Principal Investigator - 10% \$2,184.00

Manuel Diaz - Principal Investigator – 10% \$2,532.00

Total Salaries \$9,778.00

2. Fringe Benefits

Wanda Almodóvar - \$1,757.00

Ada N. Alvarado Ortiz - \$801.00

Manuel Díaz - \$880.00

Total Fringe Benefits \$3,438.00

3. Material and Supplies \$800.00

Educational supplies

CD's, laser paper, pens – \$200.00

Cartridges for color laserjet - \$600.00

Materials needed for the preparation of educational materials for workshops

4. Publication Costs \$4,380.00

IPM Manual (Printing) – \$7 x 500 copies - \$3,500.00

The project will print 600 copies of the IPM Manual. The copies will be free to banana growers and other agricultural educators that attend the workshops. From January to May 2007, the IPM Program funds were used to print 300 copies of the IPM Manual.

Posters*- \$40 x 2 copies - \$80.00

*Two posters about black sigatoka IPM in Puerto Rico will be presented in the Annual Caribbean Food Crop Society Meeting in Costa Rica.

Fact sheets – \$4 x 200 copies - \$800.00

One fact sheet with basic information about identification and management of Black Sigatoka was prepared for personnel of the Department of Agriculture that make insurances of farms affected by the disease. Other fact sheets were prepared by the IPM Specialist and the Banana and Plantain Specialist in 2005 and 2006. These educational materials will be reproduced and disseminated to growers, agronomists and the general public.

5. Travel \$5,620.00

In Puerto Rico \$1,620.00

Planned routine trips to travel to workshops and field days in growers farms.

II. Out of Puerto Rico \$4,000.00

The Project Director and Co-PD's will attend the Annual Meeting of the Food Crop Caribbean Society to present two posters about black sigatoka in Puerto Rico. Estimate cost \$3,920.00 to cover air tickets, hotel, meals and ground transportation.

6. All other Direct Cost - \$1,200.00

Communications – To cover mailing and postage cost (0.37¢ per letter, \$15.00 average per express mail service) - \$600.00

Fax and telephone long distance charges (0.15¢ per minute) - \$250.00

Photocopying – In house reproducing of technical and informative materials - \$ 350.00