Bananas in Latin American and the Caribbean, Major Pest and Disease Challenges and Perspectives for Sustainable Management.

- Miguel Dita,
- Luis P. Vicente,
- Mauricio Guzmán,
- Mario Orozco,
- Luc de Lapeyre

Kaohsiung, November 20, 2012
Banana production in Latin America and the Caribbean [LAC] between 1961 and 2009

Source: FAOstat
Banana Production Systems in LAC

Cavendish export
Conventional/ Organic

Subtropical Cavendish

Plantain - Monocrop

Banana/Plantain – coffee agroforestry

Banana/ Plantain – small scale
# Banana Production systems in LAC: Key challenges

<table>
<thead>
<tr>
<th>Production system</th>
<th>Challenges - PEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tropical export Cavendish</td>
<td>• Black leaf streak (BLS)</td>
</tr>
<tr>
<td></td>
<td>• Nematodes</td>
</tr>
<tr>
<td></td>
<td>• Worker safety regulation</td>
</tr>
<tr>
<td>Organic Export Cavendish</td>
<td>• BSV</td>
</tr>
<tr>
<td></td>
<td>• Rust Thrips/</td>
</tr>
<tr>
<td>Subtropical Cavendish</td>
<td>• Fusarium wilt (FW)</td>
</tr>
<tr>
<td></td>
<td>• Abiotic stress</td>
</tr>
<tr>
<td>Monoculture plantain</td>
<td>• BLS</td>
</tr>
<tr>
<td></td>
<td>• Bacterial soft rot - Erwinia</td>
</tr>
<tr>
<td></td>
<td>• BSV</td>
</tr>
<tr>
<td>Banana and plantain associated in coffee and cocoa</td>
<td>• BLS</td>
</tr>
<tr>
<td>and cocoa fields</td>
<td>• FW</td>
</tr>
<tr>
<td>Mixed/ Monocrop banana and plantains produced at small</td>
<td>• BLS</td>
</tr>
<tr>
<td>scale [home consumption or local markets]</td>
<td>• Bacterial wilt</td>
</tr>
<tr>
<td></td>
<td>• FW</td>
</tr>
</tbody>
</table>
BSV
Banana Streak Virus

BSV in Cavendish bananas,
J. Tenório, CIP, Peru

BSV is a current constraint for Cavendish organic banana production in Piura, Peru

FHIA 21. Honduras, >1000 m.a.s.l.

Yield losses caused by BSV in Cavendish, Piura, Peru

<table>
<thead>
<tr>
<th>Localidad Sullana: Fruta destinada para exportación</th>
<th>Area 0.5 ha</th>
<th>Racimas</th>
<th>Porcentaje</th>
</tr>
</thead>
<tbody>
<tr>
<td>Racimas cortadas</td>
<td>29</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Racimos con virosis (verano)</td>
<td>3</td>
<td>10.3</td>
<td></td>
</tr>
<tr>
<td>Racimos con virosis (invierno)</td>
<td>6</td>
<td>20.7</td>
<td></td>
</tr>
</tbody>
</table>

Source: INIA, Peru
Bacterial Soft Rot / Erwinia

*Dyckeae* paradisiaca

*E. chrysanthemi, E. carotovora, Pectobacterium/Dickeya*

...an increasing problem, mostly Plantain – 30 to 100% losses
Bacterial Soft Rot / Erwinia

Panama – 5 ha total losses, 2012

Erwinia+ winds - Nicaragua

Generally associated to poor drainage and bad sanitation and irrigation practices
Moko [Ralstonia solanaceaeum race 2]

... Big problem in Colombia [Plantain] – 2012 - Government intervention
Fusarium wilt  \[Fusarium oxysporum\ f. sp. cubense, race 1, 2\]

Honduras, Colombia, Costa Rica, Nicaragua, Peru, Brazil
Fusarium wilt: TR4 - Prevention & Preparedness

Training courses on diagnostic and management of FW

Biodiversity International
+ MUSALAC
+ National Plant Health Organizations
Banana Rust Thrips
(Chaetanaphothrips signipennis),

Currently a big issue for ORGANIC banana industry PERU and ECUADOR

PERU: It is estimated that 90% of the banana-producing areas are suffering and a 10% is in "quarantine" (certified organic areas which are not exporting).

Source: Elregionalpiura
Publication date: 9/21/2012

Mostly a cosmetic problem, but it has zero tolerance in the supermarkets.
Banana Rust Thrips
(Chaetanaphothrips signipennis)

Research for control/management just started:
1. Better understanding of life cycle in the field
2. Natural enemies
3. Cultural practices
4. Biological/organic accepted insecticides
5. Operationalization at industry level

With high populations evolving in organic farms there is a question whether biotypes resistant to conventional insecticides used in plastic cover bags will emerge? So, ‘conventional’ banana industry should be tuned up...
LAC: 40 Years with BLSD
1972 - 2012
Global distribution of BLSD

Fig. 2. Worldwide distribution of black Sigatoka (+ = countries where black Sigatoka has been reported according to Carlier et al. [11] and Mourichon et al. [75]). Map courtesy of www.theodora.com/maps, with permission.
BLSD in LAC: Recent spread to the Caribbean Islands

- Cuba, 1992
- Dominican Rep., 1996
- Puerto Rico, 2004
- Jamaica, 1994
- Haiti, 2000
- Guadeloupe, 2012
- Dominica, 2012
- Martinique, 2010
- St Lucia, 2010
- St Vincent, 2009
- Grenada, 2005
- Trinidad & Tobago, 2003

Sources: Cirad / FruItrop

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honduras</td>
<td>1972</td>
</tr>
<tr>
<td>Belize</td>
<td>1975</td>
</tr>
<tr>
<td>Guatemala</td>
<td>1977</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>1979</td>
</tr>
<tr>
<td>El Salvador</td>
<td>1979</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>1979</td>
</tr>
<tr>
<td>Panama</td>
<td>1981</td>
</tr>
<tr>
<td>Colombia</td>
<td>1981</td>
</tr>
<tr>
<td>Mexico</td>
<td>1980</td>
</tr>
<tr>
<td>Ecuador</td>
<td>1986</td>
</tr>
<tr>
<td>Venezuela</td>
<td>1991</td>
</tr>
<tr>
<td>Perú</td>
<td>1994</td>
</tr>
<tr>
<td>Bolivia</td>
<td>1996</td>
</tr>
<tr>
<td>Brazil</td>
<td>1998</td>
</tr>
<tr>
<td>USA (Florida)</td>
<td>1998</td>
</tr>
<tr>
<td>Bahamas</td>
<td>2004</td>
</tr>
<tr>
<td>French Guiana</td>
<td>2008</td>
</tr>
</tbody>
</table>
1. Resistance of *M. fijiensis* to fungicides (benzimidazols, triazols and QoI’s) increasing. **Costa Rica, Colombia, Ecuador, Dominican Republic.**

2. Resistance breakdown- some cultivars [FHIA’21,FHIA’18, Yamgambi Km.5] are already affected in some areas.

3. **HOWEVER**- BLSD is under control in Cavendish export countries, even in countries like Costa Rica, were weather conditions [4000 mm – high temperatures] are highly favorable .... WHAT ARE THE COSTS – economical, environmental, human health?. Is the current approach sustainable?
BLSD: Current situation in LAC

45-52 (up 70) aerial spray applications

mm

Weeks

1 4 7 10 13 16 19 22 25 28 31 34 37 40 43 46 49 52

0 0.4 0.6 0.8 1 1.2 1.4

[Logos of various institutions]
which is very strict when compared with most banana-growing countries, since 2004 only 2 triazoles are authorized due to the French registration system.

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBI Group 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antifungal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBI Group 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorophenol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mancozeb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Limitations for BLSD control - French Island**

- Strong limitations on the registration of fungicides.
Limitations BLSD chemical control

- Aerial spraying is banned in the UE
- Derogations must be attributed every 6 months by local authorities
- In 2012 a judge cancelled the derogation - complaints of various environmental organizations
Limitations BLSD chemical control

Ground [mechanical] spraying applications an alternative to circumvent legal issues on aerial applications.
M. Fijiensis: Multiple Resistance to fungicides

Wild type isolates

<table>
<thead>
<tr>
<th>Check</th>
<th>propic</th>
<th>azoxt</th>
<th>beno.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 ppm</td>
<td>1.0 ppm</td>
<td>5.0 ppm</td>
<td></td>
</tr>
</tbody>
</table>

FRAC 2010, Guzman 2012.
High rates of oil applications = chronic phytotoxicity
**M. fijiensis**: fungicide resistance

Identifying genes responsible for mutation

![Graph showing sensitivity to propiconazole fungicide](image)

**mutations**

Chong et al., 2010
Black Sigatoka – Resistance breakdown?

FHIA’21, Dominican Republic

© Miguel Dila
Yangambi Km. 5
Affected in Costa Rica

Not related to nutrition!

Source: M. Guzmán (Corbana)
M. Fijiensis: high variability across regions

Is this variability always considered by chemical companies or by BLSD managers?
BLSD: Current actions and R&D initiatives in LAC

BLSD management: cultural practices
BLSD: Current actions and R&D initiatives in LAC
BLSD management: cultural practices
BLSD management: cultural practices
BLSD management: cultural practices

Leaf pruning + urea application

Pseudotecies/lesion

Ascospores released/lesion
BLSD management: cultural practices

Leaf pruning Vs. controlled defoliation – What it does means?

Before

After

Early leaf pruning consists in to eliminate the more older leaves (3-4 leaves per plant) and leave at least 8 leaves per plant.

Apparently healthy leaves removed

Actively growing lesions releasing conidia.
Validation of controlled leaf pruning approach
San Pablo farm, Costa Rica: 285 ha
Biological control for BLSD: Myth or reality?

SC-19

Clorotalonil

Control

The potential exist, but we need more research and effort – funds!
What would be the future for the BLSD control?

Integration?
An Integrated Approach to Control the Black Leaf Streak Disease (BLSD) of Bananas, while Reducing Fungicide Use and Environmental Impact

Jacky Ganry\textsuperscript{1}, Eric Foure\textsuperscript{2}, Luc de Lapeyre de Bellaire\textsuperscript{2} and Thierry Lescot\textsuperscript{2}

\textsuperscript{1}International Cooperation, Agreenium, CIRAD,
\textsuperscript{2}CIRAD- Persyst, UPR "Systèmes de culture bananiers, plantains et ananas", Montpellier, France
Increase *productivity* and competitiveness across the value chain of bananas and plantains *through scientific and technological development*, strengthening national R&D programs, integrating actors, prioritizing and coordinating actions in Latin America and the Caribbean.

**Next Meeting May, 2013**
Colombia, Armenia
Banana : Smart Production Systems
¡GRACIAS!