SUSTAINABLE MANAGEMENT OF BLACK SIGATOKA WITH BIOLOGICALS:

SERENADE AND SONATA

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INNOVATING TOGETHER FOR SUSTAINABLE HORTICULTURE
Biologics can significantly contribute to industry’s needs in banana production.

The industry seeks for biological solutions

Dole makes extensive use of natural techniques including biological control, bioantagonists, and alternative sources for fertilization and soil improvement. Furthermore, the company has a comprehensive research program dedicated to biological control agents and closely monitors worldwide scientific research in this area.

Source: Dole Sustainability » Integrated Pest Management

While consumers and global retail demand reduction of chemical load, the industry is challenged to balance all needs.

We don’t like using agrichemicals but sometimes they are the only means to successfully control pests, weeds and diseases that thrive in the hot and humid climate and fertile soils of tropical Latin America. Indeed, positive careful use of the lowest toxicity agrichemicals effectively enables us to produce bananas and provide many jobs.

Source: Chiquita.com - Our Commitment to Workers Health & Wellbeing
Bayer’s biological contact fungicides provide an alternative to currently widely used low resistance risk fungicides

Black Sigatoka management in low to medium disease pressure situations

- **Bacillus subtilis QST 713**
  - Contact fungicide via cell membrane disruption
  - FRAC code listed, in separate class: F6
  - For Black Sigatoka control as a mixing partner with systemic fungicides

- **Bacillus pumilus QST 2808**
  - Contact fungicide inhibiting enzymes required for cell wall formation
  - For Black Sigatoka control in solo protectant applications

The biological alternative for multisites such as Mancozeb & Chorothalonil

- Broad product miscibility for flexible use in practical field conditions
- Exempt from tolerances
- Global trade enablement
- Low risk mode of action
- Resistance Management
- Biological solution
- Safe to the environment & Worker safety
- High quality Bayer formulation
  - a reliable alternative
Serenade - a tool to reduce chemical load, manage the disease and secure high yield

### Customizing the program with innovative systemic mixture and biological products can reduce chemical load up to 50%

<table>
<thead>
<tr>
<th>Product class</th>
<th>Standard program</th>
<th>Customized program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no. of applicat.</td>
<td>Q total</td>
</tr>
<tr>
<td></td>
<td>(gr a.i./ha)</td>
<td>(gr a.i./ha)</td>
</tr>
<tr>
<td>Multi-sites</td>
<td>34</td>
<td>47.240</td>
</tr>
<tr>
<td>Amines</td>
<td>19</td>
<td>9.430</td>
</tr>
<tr>
<td>DMIs</td>
<td>10</td>
<td>1.119</td>
</tr>
<tr>
<td>Qols</td>
<td>2</td>
<td>200</td>
</tr>
<tr>
<td>APs</td>
<td>3</td>
<td>900</td>
</tr>
<tr>
<td>SDHIs</td>
<td>3</td>
<td>600</td>
</tr>
<tr>
<td>B. subtilis QST 713</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>total</td>
<td>59.5 kg a.i./ha/year</td>
<td>30.9 kg a.i./ha/year</td>
</tr>
</tbody>
</table>

Reference: Quevedo, Los Rios, Ecuador. Temperature: 30°C; rainfall 3000mm/year; %rH: >80%

### Substitution of multi-sites with biological products such as Serenade has the potential to increase yield

Average yield:
- Mancozeb: 75.6 t
- B. subtilis: 79.8 t
→ 5.5% weight increase

**Mexican trial:** 13 protectant applications; B. subtilis QST 713 (1.5 L/ha), 20 ha trial

Weight: of whole bunch (incl. spindle); 2100 plants/ha; average yield w/o spindle on this area: 51 t/ha
Thank You!

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