Technical Background and Use in Control of Soybean Rust

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Innovative Natural Product Solutions for Pest Management
AgraQuest’s Sourcing and Isolation of Microorganisms

Collect from targeted sources and habitats based on our experience and database of 20,000+ microbes.

Isolate bacteria, fungi, actinomycetes on proprietary media.
• Ballad is the first organically-approved fungicide for the treatment of Asian Soybean Rust.

• 2005 Trial results show that Ballad effectively controls Asian Soybean Rust, significantly increases yields and protects against secondary plant diseases.
Ballad® Biofungicide

How does it work?

Bacillus Pumilus’ Patented, Complex Mode of Action works in 3 ways:

1. Antifungal amino sugar compounds are present in every drum of Ballad

2. Bacillus spores form physical barrier to pathogens

3. Bacillus spores activate the plant’s own defense systems
Ballad Mode of Action

Antifungal amino sugars present in Ballad formulation compete for the enzyme that uses glucose to build cell walls.

Which Results In:

- Inhibition of septum formation
- Inhibition of new cell wall formation
- Destruction of cell integrity
- Death of pathogen cells
Ballad Mode of Action

*Bacillus pumilus* creates a bacterial barrier preventing pathogen spores from establishing on the plant surface.

Ballad (yellow) covers the surface of the leaf
(Image is artificially-colored to show contrast, actual product leaves no colored residue).

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Ballad Biofungicide Effectively Controls:

- Asian Soybean Rust
- Secondary Diseases
  - Frogeye leaf spot
  - Powdery mildew
  - Cercospora blight
  - Brown spot
Ballad Value Proposition

• Significant Yield Increase
  – Through Secondary Disease Control
  – Average Yield Increases: 17%
  – Economic Disease Control with Substantial Returns

• Resistance Management
  – Novel, Complex Mode of Action
  – Extends Life of Single-Site Synthetics
Organic Asian Soybean Rust Control

Rates and Application Timing

• Apply beginning at R1 / R2

• 14-day spray intervals

• Use Rate: 1 - 2 qts/a

  • Depending on disease pressure of ASR and secondary diseases

  • Apply in sufficient water to attain good coverage

  • Tank mix compatible with all other products tested
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**Ballad vs. Asian Soybean Rust**

Trial 1, South Africa, Neil Van Rij, March 2005

5 apps at 14-day intervals

![Bar graph showing disease severity comparison between Ballad 2 qts/a, Azoxystrobin, and untreated samples.](image)
Ballad vs. Asian Soybean Rust
Argentina, Mircza Colombo, April 2005
1 app at R5

% Incidence ASR

Yields bu/ac

Ballad 1 qt/a  Strobi + Triazole  Untreated
Ballad vs. Asian Soybean Rust - % Disease

Dr. Jim Marois, UFL, Quincy, FL - October, 2005

3 apps at 14-day intervals

% Disease Incidence

- Ballad 1 qt/a
- Ballad 1 qt/a plus Microsulf 2 lb
- Ballad 1 qt/a plus Champ WP 1.5 lb
- Untreated

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Innovative natural product solutions for pest management.

Ballad vs. *Cercospora* Leaf Spot - Yield,
Dr. Boyd Padgett, LSU, Macon Ridge, LA - October, 2005

2 apps at 14-day intervals

![Graph showing yield comparison](image)
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Ballad Secondary Pathogen Disease Control and Yield Response on Soybeans
Trial 2 Argentina, Mircza Colombo, March 2005
3 apps at R1, R3 and R6

% Disease Severity
Septoria, Cercospora, Powdery Mildew

Yields bu/a

- Ballad 1 qt/a
- Strobi + Triazole
- Untreated

Innovative natural product solutions for pest management.
New for 2006

• Now formulated for global organic certification (IMO, JAS)
• Proven Control of Asian Soybean Rust
• *Plus* Proven Control of Secondary Diseases
• *Plus* Proven Yield Increases
• *Plus* New Standard Use Rate of 2 qts per acre
# Ballad Plus

**Features and Specifications**

<table>
<thead>
<tr>
<th>Features</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potency QST 2808 (<em>Bacillus pumilis</em>)</td>
<td>1.38% or $1 \times 10^{10}$ CFU/g</td>
</tr>
<tr>
<td>Aerial application</td>
<td>Yes</td>
</tr>
<tr>
<td>Tank mixes readily</td>
<td>Compatible with all other products</td>
</tr>
<tr>
<td>Low Warning Level</td>
<td>Caution</td>
</tr>
<tr>
<td>Pre-Harvest Interval (PHI)</td>
<td>0 days</td>
</tr>
<tr>
<td>Re-Entry Interval (REI)</td>
<td>4 hrs.</td>
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<tr>
<td>Can be Used for Organic Production</td>
<td>OMRI-Listed, NOP, IMO, JAS</td>
</tr>
<tr>
<td>Environmental Safety</td>
<td>Non-toxic to beneficials</td>
</tr>
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**Innovative natural product solutions for pest management.**
AgraQuest is a biotechnology company that focuses on discovering, developing, manufacturing and marketing effective, safe and environmentally friendly natural pest management products for the agricultural, institutional and home markets. AgraQuest markets Serenade®, Serenade® Garden, Sonata® and Rhapsody® Biofungicides and Biotune™ Adjuvant, and is developing and commercializing a pipeline of other natural pest management products including Arabesque™ Biofumigant and Virtuoso™ Bioinsecticide. AgraQuest received the 2003 Presidential Green Chemistry Award for developing Serenade® Biofungicide.

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Ballad EPA Registration No: 69592-13.

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