Beauveria bassiana GHA Persistence in the Environment

Lisa Keith
March 2016
Topics

• Sampling Methods
• Persistence (Population Dynamics) & Efficacy (Destructive)
• Prediction Model
• Rate of Infestation (Non-destructive)
• Conclusions

Tracie, Steve & Sandy W, Nick, Ray, Robbie, Andrea, Suzanne
Persistence & Efficacy of *B. bassiana* GHA

- Potential for using the commercially available *B. bassiana* GHA strain as a control method for CBB in Hawaii
- Goal: optimize effectiveness and economics for farmers
- Determine how timing and frequency of commercial *Beauveria* applications affect persistence and efficacy
- Suppression sprays
- Strip pick
- Compare 2013 to 2015
- Effect on quality/harvest

Elevation:
- A. 1800 ft
- B. 1547 ft
- C. 624 ft (shade)
Coffee Data

• Field plot maps/Strip pick
• Persistence: *Beauveria* GHA
  – Rate: 32 oz + 8 oz surfactant in 30 gal of water/acre
• Efficacy (Destructive method)
  – % AB, % AB Dead, % CD, % Infestation
• Efficacy (Non-destructive method)
  – % Infestation, % Beauveria
• Environmental
  – Temp, % RH, Leaf moisture, Rainfall, UV
• Quality/Harvest
Field & Lab Samples per Tree

Persistence

1 subsample = 15 random berries
10 trees

high
middle
low

Weigh
Wash
Dilute
Plate

Count *Beauveria*

USDA
Field & Lab Samples per Tree

Efficacy: Destructive

1 subsample = 10 green berries
4 trees

Dissect berries
Count beetles
AB alive/dead; CD; Beauveria
Field Samples per Tree

Efficacy: Nondestructive

1 subsample = branch 4 trees
Data: Persistence & Efficacy
Data: Stripped, Honaunau Low, 2015

99,166 sq ft (2.2 acres); 12 people, 6 hours

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<thead>
<tr>
<th></th>
<th>Hole</th>
<th>No-Hole</th>
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<th>Total</th>
<th>% Infested</th>
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<tbody>
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<td>HL1</td>
<td>30710.9</td>
<td>30710.9</td>
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<td></td>
<td></td>
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<td>9.7</td>
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<td>-</td>
<td>1805.7</td>
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<td>896.1</td>
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</table>
Persistence: Honaunau Low, 2015

HL1, HL2: Monthly sprays
HL3: Spray as needed

All strip picked
Efficacy: Destructive method, Honaunau Low, 2015

% AB

HL1, HL2: Monthly sprays
HL3: Spray as needed

All strip picked
Efficacy: Destructive method, Honaunau Low, 2015

% CD

HL1, HL2: Monthly sprays
HL3: Spray as needed

All strip picked
### Data: Stripped, 2014

**Honaunau Low 3**  
Stripped 2/20/14

14,619 sq ft (0.3 acres); 13 people, 2 hours

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<td>-</td>
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6683.3g  
14.7lb

- HL1-HL3: 3 sprays total (no suppression sprays)  
- HL3: strip picked  
- Mid-year: 20-30% AB; 10-30% CD  
- Start of harvest: 30-50% AB; 20-40% CD  
- End of harvest: >50% AB; 60% CD
### Data: Stripped, Honaunau High, 2015

22,080 sq ft (0.5 acres); 10 people, 6 hours

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<table>
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<td>232</td>
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</table>
HH1, HH2: Monthly sprays
HH3: Spray as needed
All strip picked
Efficacy: Destructive method, Honaunau High, 2015

% AB

HL1, HL2: Monthly sprays
HL3: Spray as needed

All strip picked
Efficacy: Destructive method, Honaunau High, 2015

% CD
HL1, HL2: Monthly sprays
HL3: Spray as needed

All strip picked
Data: Honaunau High, 2014

Honaunau High 3
Stripped 3/7/14

8,404 sq ft (0.2 acres); 8 people, 6 hours

<table>
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<tr>
<th>weight (g)</th>
<th>Hole</th>
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<tr>
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<td>-</td>
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<td>7858.3</td>
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12213.4g
26.9 lb

- Suppression sprays
- HL1: 1 spray/month; HL2: 2 sprays/month; HL3: strip picked + 1 spray/month
- Harvest: 5-20% AB; 5-10% CD
Data: Prediction Model
Rate of Infestation
Persistence (2015), influenced by unique microclimates
**Bb GHA Persistence in the Field**

- All 2014 and 2015 data
- A strong relationship between the number of days since Bb spray and the number of active spores in the fields. Horizontal transmission: recycling of the product
Significant Factors on Persistence

Field averages by year (2014, 2015)

Mean interval between sprays
Colony forming units/mL
Factors Affecting Persistence

Response: log(spores)

<table>
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<tr>
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<th>Estimate</th>
<th>SE</th>
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<th>p</th>
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<tr>
<td>(Intercept)</td>
<td>1.795</td>
<td>4.237</td>
<td>0.4</td>
<td>0.6723</td>
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<tr>
<td>log(days since spray)</td>
<td>-0.770</td>
<td>0.147</td>
<td>-5.3</td>
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<td>Cum. Rain</td>
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<td>0.042</td>
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<tr>
<td>Mean RH</td>
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<td>0.015</td>
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<td>Mean Temp</td>
<td>-0.009</td>
<td>0.054</td>
<td>-0.2</td>
<td>0.8662</td>
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<tr>
<td>Field</td>
<td>0.800</td>
<td>0.430</td>
<td>1.9</td>
<td>0.0647</td>
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</table>

* Significant effects of days since spray, RH
* This model allows us to make predictions of active *Bb* in the field given weather and time since spraying
Strip Picking: Effect on CBB Spread
Honaunau Low, 2014

*Non-destructive sampling: rates of infestation (start of increase; max level observed)
Conclusions/Observations

• Good CBB control can be achieved
• Difficult to give a precise recipe for success; each location is unique
• Location specific; seasons vary
• Only Beauveria: Not the silver bullet
• Only stripping: Not the silver bullet
• Timing versus number of applications
• Data for CBB Prediction Model
What Does The Data Tell Us?

• Knock back the existing CBB population early (strip; *Beauveria* suppression sprays)

• Increased infestation during the harvest months (strip pick sanitation)

• *Beauveria* sprays: monitor visually; spray when necessary

• “% infested” doesn’t necessarily mean you have a high % of damaged beans
Thank You Field Cooperators!

(Thanks to Nicholle, John and Glenn for excellent technical help)

Questions?