Disease Diagnostics

Year 1 (Mar 26 – Dec 31, 2014)
76 plant samples processed
- 40% Fusarium oxysporum
- 12% Macrophomina phaseolina
- 6% Fusarium + Macrophomina
- 42% Abiotic

All 3 major production regions
Limited number of samples from Watsonville / Salinas area

Disease Diagnostics

Year 2 (Jan 1 – Dec 31, 2015)
118 plant samples processed
- 21% Colletotrichum acutatum
- 15% Macrophomina phaseolina
- 8% Fusarium oxysporum
- 8% Verticillium dahliae
- 2% Phytophthora cactorum
- 46% Abiotic

All 3 major production regions
Limited number of samples from Watsonville / Salinas area

Disease Diagnostics

Year 3 (Jan 1 – NOW 2016)
55 plant samples processed
- 45% Colletotrichum acutatum
- 9% Macrophomina phaseolina
- 9% Fusarium oxysporum
- 3% Phytophthora cactorum
- 2% Cylindrocarpon
- 29% Abiotic

All 3 major production regions
Limited number of samples from Watsonville / Salinas area
Disease Diagnostics

- Colletotrichum appears to be a major concern for growers this season in Santa Maria and Oxnard growing region
- Slight increase in Phytophthora crown rot incidence
- Now is the time we start to detect more Macrophomina and Fusarium in samples due to warmer temperatures

Anthracnose...

- Anthracnose on strawberries is caused by multiple species of Colletotrichum (a fungus);
- In early Sept 2015, we started detecting and isolating C. acutatum from field plantings and nursery material
- Historically a serious problem on strawberries in FL and the southeastern U.S.

Anthracnose...

- These fungi can cause root rot, crown rot, fruit rot, flower blight, and lesions on stolons, petioles, and leaves;
- Crown rot and fruit rot are the most important in California (and Florida)
- In 2000, an epidemic of anthracnose occurred in California

summer Portola planting in Santa Maria (Sept 2015)
Anthracnose...

Root rot caused by *Colletotrichum acutatum*

Crown rot caused by *C. acutatum*

Fruit rot caused by *C. acutatum*
How this fungus spreads...

- Spores are produced in sticky masses on affected tissues.
- Spores are dispersed by water (overhead irrigation or rain); OR by adhering to harvesters, farm equipment and insects.
- Extensive research has shown that rain can ONLY move spores up to 30 cm.

Fungicides, Bactericides, and Biologicals for Deciduous Tree Fruit, Nut, Strawberry, and Vine Crops 2015

Strawberry: Treatment Timing

Note: Not all indicated timings may be necessary for disease control.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Preplant fungicide*</th>
<th>Clean-up sprays</th>
<th>Dip or water washing</th>
<th>Before overhead irrigation</th>
<th>Foliar</th>
<th>Fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracnose*</td>
<td>++</td>
<td>++</td>
<td>++</td>
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<td>Red stem*</td>
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<tr>
<td>Verticillium wilting</td>
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</tr>
</tbody>
</table>

*Fungicides include: chlorothalonil, thiophanate methyl, and chlorpyrifos. Integrated programs require management including rotations of fungicides of different classes.

2Chemical treatments include: thiram, mancozeb, and lime sulfur. Integrated programs require management including rotations of fungicides of different classes.
Best Use Practices for using Switch™ as a pre-plant dip on Strawberries for Anthracnose control

**Active Ingredients:** Switch 62.5WG contains 37.5% cyprodinil and 25% fludioxonil.

**Site of Action:** FRAC groups 9 and 12

**Key Diseases Controlled:** root and crown anthracnose at planting (*Colletotrichum* spp.)

**To reduce likelihood of injury following crown treatments with Switch, the following guidelines are recommended:**

- Rates: 5-8 oz. product/100 gallons of water. Do **NOT** tank-mix with any other pesticides, adjuvants, fertilizers, or crop enhancement products.
- Strawberry crowns and roots are to be dipped for a **minimum of 2 minutes and a maximum of 5 minutes.** Dipping the crowns and roots for longer than 5 minutes may result in stunting and injury to plants.
- For best results, transplants should be planted immediately after dipping. Plants may be planted as soon as the drip solution dries on the transplant crowns and roots. Holding plants for longer than 12 hours may result in unacceptable stunting and injury.
- Inside of 12 Hour REI period, field workers planting these crowns (Handlers) must wear:
  - Long-sleeved shirt and long pants
  - Chemical-resistant gloves of any waterproof material (Viton 15ml disposable)
  - Shoes plus socks
- **Box dip method:** If the Strawberry crowns and roots are treated within the packed nursery boxes, the liner bags must be **completely** drained after the transplants are immersed for **no longer than 5 minutes.** Failure to drain the liner bags completely or allowing the plants to remain in residual dip solution for longer than 5 minutes (as solution drains to the bottom of the liner bags) will result in unacceptable stunting and injury. Crowns and roots should be removed from the liners and repacked into nursery boxes, without liners, to aid in draining.

**Other Best Use Guidelines:**

- It is best to wash transplants in clean water prior to dipping to remove excess soil, leaves, and plant debris. Failure to do so may affect efficacy of the product.
- Use of “Strawberry forks” to set transplants (so that the roots are positioned vertically in the plant hole) is encouraged. Improperly set plants that are “J” rooted may show unacceptable stunting and injury.
- Apply overhead irrigation as soon as possible after transplanting.

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Every strawberry season, experimental trials are conducted at the UF Gulf Coast Research and Education Center to evaluate the efficacy of products on controlling the most important strawberry diseases in Florida. The trials are conducted for each disease separately and cultivars that are more susceptible for each of the diseases are used and/or inoculations with the target pathogen are conducted. The list below has been assembled from our results over the years and is sorted by fungicide group. It also includes a summary of the recent fungicide resistance monitoring of Botrytis populations collected from Florida strawberry fields.

We also have results with some biorational products that have not been included in this list because data might be limited or not conclusive. We hope this information will be useful. Please feel free to call us to inquiry whether we have tested a product you are planning to use in your operations.

### SUMMARY EFFICACY GUIDE FOR STRAWBERRY FUNGICIDES

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Active ingredient</th>
<th>Fungicide group</th>
<th>AFR</th>
<th>BFR</th>
<th>PM</th>
<th>ALS</th>
<th>CCR</th>
<th>PCR</th>
<th>Resistance status</th>
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<tr>
<td>Captave</td>
<td>captan + fenhexamid</td>
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<td>+++</td>
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</tr>
</tbody>
</table>

**Fungicide group** = Numbers and letters are used to distinguish the fungicide mode of action groups. All fungicides within the same group (with same number or letter) indicate same active ingredient or similar mode of action. This information must be considered for the fungicide resistance management decisions. 

M = multi-site inhibitors; U = unknown, or a mode of action that has not been classified yet; P = host plant defense inducers.


AFR = Anthracnose Fruit Rot; BFR = Botrytis Fruit Rot; PM = Powdery Mildew; ALS = Angular Leaf Spot; CCR = Colletotrichum Crown Rot; PCR = Phytophthora Crown Rot

(+++) = good efficacy; (+++) = moderate efficacy; (+) = low efficacy; (-) = no efficacy or not registered

**Resistance status** = Fungicide resistance of Botrytis populations from Florida strawberry fields

(***) = widespread; (**) = moderate frequency; (*) = low or absent; (nd) = not determined
AZOXYSTROBIN (ABOUND) RESISTANCE

Colletotrichum and Strawberries

Stay out of infested fields until foliage dry

Make protective sprays BEFORE rain events (most important for fruit rot control)

Rotate chemical classes to limit fungicide resistance

Follow all label guidelines