



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% *Cylindrocarpum*
 - 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...

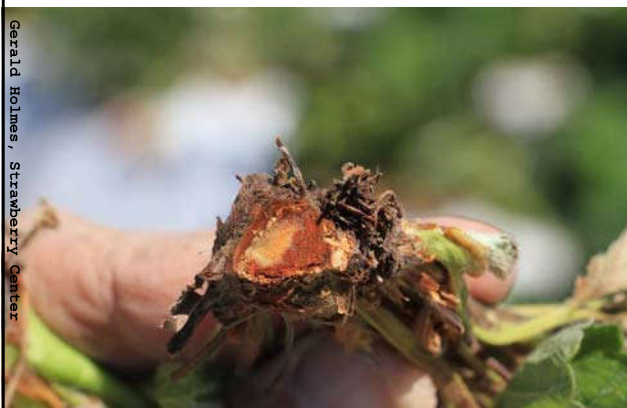


root rot
caused by
Colletotrichum
acutatum



Natalia Peres, UFV

Crown rot caused by *C. acutatum*



Gerald Holmes, Strawberry Center

Fruit rot caused by *C. acutatum*



Dan Legard, CSC

Flower blight caused by *C. acutatum*



Dan Legard, CSC

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



ALMOND PEAR
 APPLE PISTACHIO
 APRICOT PLUM
 CHERRY POMEGRANATE
 GRAPE PRUNE
 KIWIFRUIT STRAWBERRY
 PEACH/NECTARINE WALNUT

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STRAWBERRY: TREATMENT TIMING

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

Disease	At Planting				Preharvest ¹	
	Preplant fumigation ²	Clean nursery stock	Dips or water washing	Before overhead irrigations	Foliar	Fruit
Anthracnose ³	+++	+++	+++	+	++	+++
Botrytis fruit rot ³	----	----	----	+	++	+++
Mucor fruit rot	----	----	----	+	+	+++
Rhizopus rot	----	----	----	+	+	+++
Angular leaf spot	+	+++	+	+++	+	+
Common leaf spot ³	+	+++	+++	+++	+++	+
Powdery mildew ³	----	+++	----	----	+++	+
Leather rot ⁴	+++	----	----	++	----	++
Phytophthora crown rot ⁴	+++	+	----	++	+	----
Red stele ⁴	++	++	----	+	++	----
Verticillium wilt	++	++	----	----	----	----

Rating: +++ = most effective, ++ = moderately effective, + = less effective, and ---- = ineffective.

¹ Preharvest treatments include applications of fungicides before heavy fog, dew, or rain.

² Preplant fumigation includes methyl bromide-chloropicrin, 1,3-dichloropropene-chloropicrin or chloropicrin followed by metam sodium or metam potassium or solitary applications of 1,3-dichloropropene-chloropicrin or chloropicrin.

³ Integrated programs required for management including rotation of fungicides of different classes.

⁴ In-season foliar treatments include phosphite or fosetyl-aluminum products or soil applications.





TECHNICAL RECOMMENDATION

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% fludioxinil.

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.

JEH 04/16



Fungicide efficacy summary guide

By Natalia Peres, Jim Mertely and Achour Amiri

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

Fungicide	Active ingredient	Fungicide group	Target disease						Resistance status
			AFR	BFR	PM	ALS	CCR	PCR	
Topsin	thiophanate-methyl	1	-	-	-	-	++	-	***
Rovral	iprodione	2	-	++	-	-	-	-	*
Orbit	propiconazole	3	++	-	+	-	?	-	nd
Mettle	tetraconazole	3	+	-	+	-	?	-	nd
Rally	myclobutanil	3	-	-	+	-	-	-	nd
Procure	triflumizole	3	-	-	+	-	-	-	nd
Ridomil	mefenoxam	4	-	-	-	-	-	+++	nd
Fontelis	penthiopyrad	7	++	++	++	-	?	-	**
Scala	pyrimethanil	9	-	+	-	-	-	-	***
Abound	azoxystrobin	11	++	+	+	-	++	-	***
Cabrio	pyraclostrobin	11	++	+	+	-	++	-	***
Flint	trifloxystrobin	11	++	+	+	-	++	-	nd
Evito	fluoxastrobin	11	++	+	+	-	++	-	nd
Quintec	quinoxifen	13	-	-	+++	-	-	-	nd
Elevate	fenhexamid	17	-	++	-	-	-	-	**
Aliette	fosetyl-Al	33	-	-	-	-	-	+	nd
many brands	phosphites	33	-	-	-	-	-	++	nd
Quilt Xcel	azoxystrobin + propiconazole	3 + 11	++	-	++	-	?	-	nd
Merivon	fluxapyroxad + pyraclostrobin	7 + 11	++	++	+++	-	?	-	**
Pristine	boscalid + pyraclostrobin	7 + 11	++	+	+	-	?	-	***
Switch	cyprodinil + fludioxonil	9 + 12	++	+++	-	-	++	-	*
many brands	copper	M1	-	-	-	+	-	-	nd
many brands	sulfur	M2	-	-	+	-	-	-	nd
Thiram	thiram	M3	++	++	-	-	+	-	nd
Captan	captan	M4	++	+	-	-	++	-	nd
Captevate	captan + fenhexamid	M4 + 17	+	++	-	-	+	-	**
Actigard	acibenzolar-s-methyl	P1	-	-	-	++	?	-	nd
Torino	cyflufenamid	U6	-	-	+++	-	-	-	nd

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.

Source: FRAC Code List 2013; <http://www.frac.info/> (FRAC = Fungicide Resistance Action Committee).

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

