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Optimizing Peach Disease Management

David Ritchie, Department of Plant Pathology

2015
North Carolina
Peach and Nectarine Disease and Pest Management Guide

http://peaches.ces.ncsu.edu

Information = data, facts, news,

Example: tree growth stages, disease, when does infection occur, weather conditions such as rainfall and temperature.

.

Understanding and using information determines how efficiently you manage diseases (ie, optimization)

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Approaches to Optimizing Peach Disease Management

1. Know the different peach tree and fruit growth stages.

2. Know what diseases may occur in your orchard.

3. Know what conditions are necessary for each of these diseases to occur (infection & development).

4. Know methods for preventing or reducing infections and ultimately the disease.

5. Know what and when to spray.

6. Know how to apply the sprays.

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2015 North Carolina Peach and Nectarine Disease and Pest Management Guide

http://peaches.ces.ncsu.edu/

NOT meant to be a “cookbook” for disease and pest management

Recommendations of specific chemicals are based on information on the manufacturer’s label and performance for some chemicals in a limited number of trials. Because environmental conditions and methods of application by growers may vary widely, performance of the chemical may not always conform to the safety and pest control standards indicated by experimental data.

Recommendations for the use of agricultural chemicals are included in this publication as a convenience to the reader. The use of brand names and any mention or listing of commercial products or services in this publication does not imply endorsement by North Carolina State University nor discrimination against similar products or services not mentioned. Individuals who use agricultural chemicals are responsible for ensuring that the intended use complies with current regulations and conforms to the product label. Be sure to obtain current information about usage regulations and examine a current product label before applying any chemical. For assistance, contact your county North Carolina Cooperative Extension Service.

You can locate your county center’s address and phone number from web site http:/www.ces.ncsu.edu

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Additional information on peach culture and production and disease and pest management also may be found in

"The Southeastern Peach Growers' Handbook", the electronic version is located at http://www.ent.uga.edu/peach/peachhbk/toc.htm
Provides information about the biology of the pathogen and conditions for infection and disease development.

"2014 (2015 will update soon) Southeastern Peach, Nectarine and Plum Pest Management and Culture Guide"
http://www.ent.uga.edu/peach/PeachGuide.pdf

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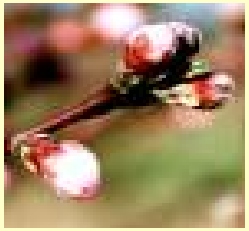
1. Peach Tree and Fruit Stages of Growth

Dormant bud

Bud swell (bud break)

Pink bud



Full bloom

Petal fall/off

Shuck split

Just before shucks off

2 weeks after shuck off

Fruit color break

Possibly Most Important Fruit Stages for Controlling Common Fruit Diseases

2. Know what diseases may occur in your orchard

Most common foliar and fruit diseases in North Carolina:

1. **Peach scab (every year) – caused by a fungus**
2. **Brown rot (weather dependent) – caused by a fungus**
3. **Blossom blight (sporadic or uncommon, weather dependent) – caused by the fungus that causes brown rot**
4. **Bacterial spot (variety, location, and weather dependent) – caused by a bacterium**
5. **Leaf curl (sporadic or uncommon) – caused by a fungus**
6. **Rhizopus rot (weather dependent, overripe fruit – caused by a fungus**
7. **Anthracnose (uncommon in NC) – caused by a fungus**

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All peaches and nectarines grown in North Carolina are at risk to major losses from three fungal diseases caused by two fungi

Peach Scab
(*Fusicladiosporium carpophilium*)

Blossom Blight
(*Monilinia fructicola*)

Brown Rot
(*Monilinia fructicola*)

Other fruit and foliar diseases also occur, but the incidence and severity of these varies depending upon orchard location, the variety, management style, and the year's environment

Leaf curl

Bacterial spot

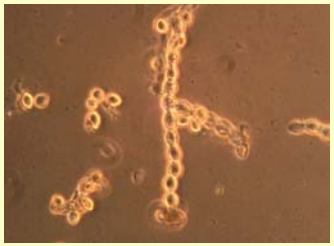
Anthracnose (ripe rot)

Postharvest rots

3. Know what conditions are necessary for each of these diseases to occur (infection)

brown rot "mummies"

Pathogen



fungal spores

temperature

AND

moisture

DISEASE

Environment

Susceptible Host

3. Know what conditions are necessary for each of these diseases to occur (infection)

PEACH LEAF CURL

Observed about time of shuck split

Time of infection

Conditions for infection:

-- budswell

-- extended cool (45-60F), and wet

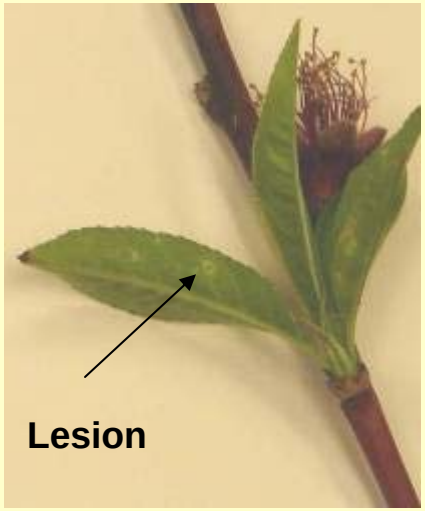
Once infection occurs (after buds swell and rainfall) and the disease is observed, fungicide applications will be of little to no value. Captan and possibly other fungicides cover sprays used the previous growing season may reduce leaf curl the following spring.

3. Know what conditions are necessary for each of these diseases to occur (infection)

BACTERIAL SPOT

16 March

23 March



Conditions for infection:

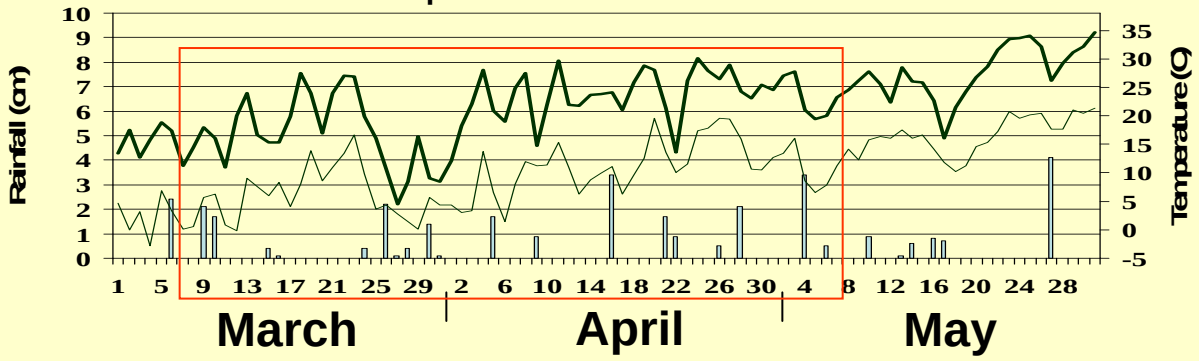
-- susceptible varieties

-- new leaves/fruit emerged

-- extended wet

12 May

Rainfall & Temperatures 2011

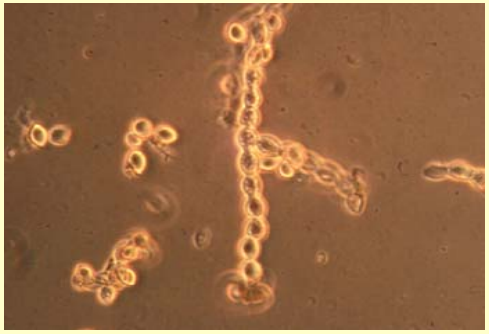


3. Know what conditions are necessary for each of these diseases to occur (infection)

BLOSSOM BLIGHT

“mummies” from previous season

weather conditions

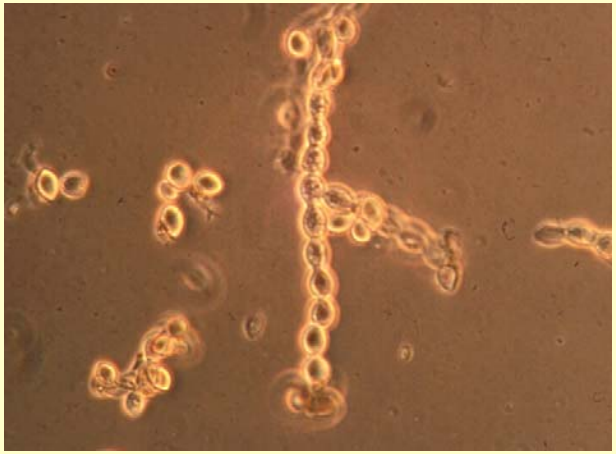


fungal spores

susceptible blossoms

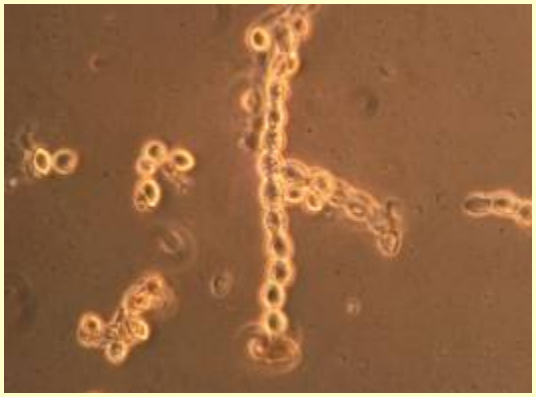
Fungal Sporulation

Conditions must become favorable for the fungus to produce spores ("sporulate").



Constant Temperature	Until Sporulation
41^{0}F	10 days
50^{0}F	8 days
60^{0}F	3 days
68^{0}F	2 days
77^{0}F	2 days
86^{0}F	erratic

Spore Dissemination and Germination



Spores must come in contact with susceptible plant tissue and grow ("germinate") and enter ("infect") this tissue.

Constant Temperature	Until Germination
41^0F	11 – 12 hours
50^0F	6 – 7 hours
60^0F	3 – 4 hours
68^0F	2.5 – 3 hours
77^0F	2.0 – 3 hours
86^0F	3 – 4 hours

Blossom Blight Symptom Development

Infection by the fungus to disease observed

2 – 7 days

~ 2 weeks

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Infection of Fruit

BROWN ROT

As fruit ripens susceptibility rapidly increases.

Source of spores to infect fruit.

Infection of peach fruit can occur within 12 hours at 70 - 80^{0}F.

3. Know what conditions are necessary for each of these diseases to occur (infection)

PEACH SCAB

Early June

There is a period of 4 - 6 weeks after infection before lesions are first observed.

When were the fruit infected?

Mid-July

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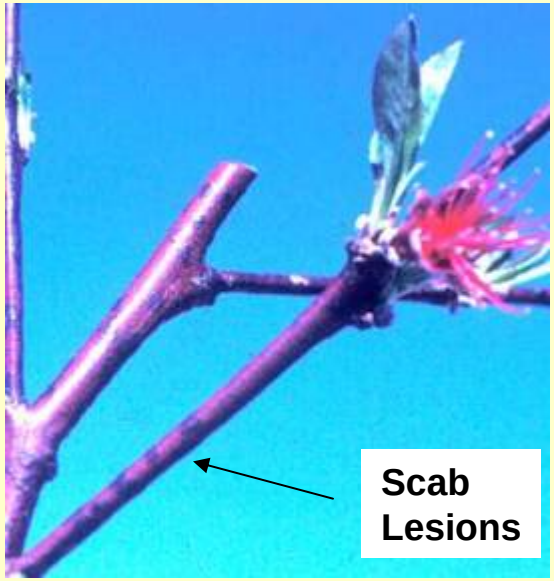
PEACH SCAB



Rain or heavy dew can splash or wash the fungal spores on the small fruit

Optimal fruit stage for infection

Shuck Split

Shucks Off

4. Know methods for preventing or reducing infections and ultimately the disease

1. Orchard location – should be a site suitable for growing peaches such as full sun light and proper soil water drainage

2. Follow cultural and other management practices such as training and pruning of trees and soil and tree fertility

3. Know and select the appropriate fungicide or bactericide for the the disease being controlled

4. Know how to safely and effectively apply the chemical spray

General Strategy for Control of Peach Diseases

FOR SUCCESSFUL DISEASE CONTROL

<u>Cannot wait</u> until the disease is observed to begin applying controls!!!

THUS – To achieve successful disease control, ACTION must be taken at some earlier time before the disease is observed.

This time is influenced by the ENVIRONMENT
the PATHOGEN, and
the HOST.

AND

Correct use of the appropriate control(s).

5. Know what and when to spray

What is done prior to pit-hardening determines the impact of diseases at harvest

Bud-break

TO

About February

About May

Pit-Hardening

OR

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Optimal Times for Applying Controls for Common Peach Fruit and Foliar Diseases in North Carolina

Growth Stage	Leaf Curl	Bacterial Spot (Fruit)	Blossom Blight	Scab	Brown Rot
Prior to budswell (dormant)	XXXX	X	---	---	---
1 to 5% budswell (bud-break)	XXX	XXX	---	---	---
Pink to full bloom	---	XXX	XXX	---	---
Petal fall	---	XXXX	---	X	X
Shuck split to shuck off	---	XXXX	---	XXX	X
1st Cover (7-10 days after SO)	---	XXXX	---	XXXX	X
2nd Cover 10-14 days after 1st cover	---	XXX	---	XXXX	X
3rd & additional covers (2 to 3 weeks)	---	XX	---	XX	X
Preharvest sprays starts about 3 weeks before harvest	---	---	---	----	XXXX

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Selecting Fungicides

From page 10 of 2015 NC Disease and Pest Management Guide

RELATIVE EFFECTIVENESS OF DISEASE CONTROL CHEMICALS FOR PEACHES AND NECTARINES

(--- = ineffective; ++++++ = superior; +++++ = very effective; n/a = does not apply)

[*FRAC CODE*] Fungicide or Bactericide and Product/Acre (100-125 gal water/acre)	DAYS for* PHI and HOURS (REI)		Leaf Curl	Blossom Blight	Brown Rot	Scab	Rhizopus Rot	Bacterial Spot
[*11*] azoxystrobin (Abound) 2.08F -12 fl oz	0	(4)	n/a	+++	+++	++++	n/a	n/a
[*11*] azoxystrobin+[*3*]difenoconazole (Quadris Top) -14 fl oz	0	(12)	n/a	++++	+++++	++++	n/a	n/a
[*M4*] captan (Captan, Captec) 50WP, 80WP, 4L - 5 lb, 2.5 qt	0	(24)	n/a	++	+++	++++	---	n/a
[*M5*] chlorothalonil (Bravo Weather Stik, Equus, Echo) 6F- 4.0 pt	n/a	(12)**	++++	+++	n/a	++++	n/a	n/a
[*M1*] copper (Kocide 2000, 3000, Cuprofix Ultra 40D, Nordox 75WG) - 4-8 lb***	n/a	(24)	+++	n/a	n/a	n/a	n/a	+++
[*9*] cyprodinil (Vangard) 75WG - 5.0 oz	n/a	(12)	n/a	++++	n/a	---	n/a	n/a
[*9*] cyprodinil+[*3*] difenoconazole (Inspire Super) -18 fl oz	0	(12)	n/a	++++	+++++	+++	n/a	n/a
[*14*] dicloran (Botran) 75WP - 3.0 lb	10	(12)	n/a	++	+++	---	+++	n/a
[*3*] fenbuconazole (Indar) 75WSP, 2F - 2.0 oz, 6.0 fl oz	0	(12)	n/a	++++	+++++	+++	n/a	n/a
[*M3*] ferbam (Ferbam Granuflo) 76DF - 4.5 lb	21	(24)	+++++	n/a	n/a	n/a	n/a	n/a
[*3*] flutriafol (Topguard) -14.0 fl oz	7	(12)	n/a	++++	++++	n/a		
[*2*] iprodione (Rovral) 50WP, 4L - 1.5 lb, 1.5 pt	n/a****	(24)	n/a	++++	n/a****	---	n/a	n/a
[*3*] metconazole (Quash 50) WDG - 3.5 oz	14	(12)	n/a	++++	+++++	+++	?	n/a
[*3*] myclobutanil (Rally) 40WP - 5.0 oz	0	(24)	n/a	++++	+++	---	n/a	n/a
[*41*] oxytetracycline (FireLine, Mycoshield) 17WP-- 0.75 lb	21	(12)	n/a	---	---	---	---	+++
[*7*] penthiopyrad (Fontelis) -- 20 fl oz	0	(12)	n/a	+++	++++	++	n/a	n/a
[*3*] propiconazole (Orbit, Tilt, PropiMax, Bumper) 3.6EC - 4.0 fl oz	0	(12)	n/a	++++	+++++	+	n/a	n/a
[*11*] pyraclostrobin+[*7*] boscalid (Pristine) 38WG - 14.5 oz	0	(12)	n/a	++++	+++++	++	n/a	n/a
[*11*] pyraclostrobin+[*7*] fluxapyroxad (Merivon) - 6.5 fl oz	0	(12)	n/a	++++	++++++	+++	++	n/a
[*9*] pyrimethanil (Scala SC) -18 fl oz	30	(12)	n/a	++++	n/a	---	n/a	n/a
[*M2*] sulfur (numerous formulations) - 10 lb	0	(24)	n/a	++	++	+++	---	n/a
[*3*] tebuconazole (Elite, Orius, Tebuzol) 45WP - 5.0 oz	0	(12)	n/a	++++	+++++	++	n/a	n/a
[*3*] tebuconazole + trifloxystrobin [*11*] (Adament) 50WG - 5.0 oz	1	(12)	n/a	++++	+++++	+++	?	n/a
[*1*] thiophanate-methyl (Topsin M) 70WP, WSP - 1.5 lb	1	(48)	n/a	++++	++++	+++++	n/a	n/a
[*11*] trifloxystrobin (Gem) 500SC - 3.8 fl oz	1	(12)	n/a	+++	n/a	+++++	n/a	n/a
[*M3*] ziram (Ziram) 76DF - 4.0 lb	14	(48)	++++	+	+	+	---	+

[FRAC CODE] = **F**ungicide **R**esistance **A**ction **C**ommittee. Numbers and letters distinguish the fungicides according to their cross-resistance behavior. Fungicides having the same FRAC number have a similar mode of action and are prone to cross resistance, thus not good mixing or alternating partners.

* PHI = preharvest interval (**DAYS** between last spray and harvest); REI = reentry interval (**HOURS** between last spray and reentry without using personal protective equipment (PPE). **ALWAYS CHECK/READ LABELS BEFORE USE.**

** REI is 12 hours for chlorothalonil, but see label for precautions related to risk for eye damage and required protection.

*** This rate of copper is for use only as a dormant spray. See information on copper (Dormant Spray) for use against bacterial spot. **** Rovral is not registered for use after petal fall.

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Things to Consider When Selecting a Fungicide

-- **Efficacy.** Is it effective against the disease targeted? If so, how effective?

-- **Physical characteristics.** Is it protective? Is it systemic/curative? Is it highly specific or broad-spectrum? How long is it effective? Does it "weather" well?

-- **Risk of resistance.** Has resistance to the fungicide occurred? If not, is there potential for resistance to develop?

-- **Label restriction**. Safety? Number of applications? Re-entry period? Time between last application and harvest?

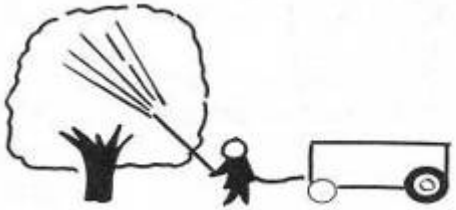
-- **Cost**. What are the costs? Price of the fungicide? Loss of crop? Lower price for poor quality? Loss of return customers?

6. Know how to apply the sprays

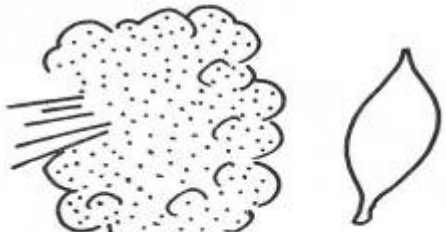
Spray-Mix Coverage – Is Your Sprayer Ready?

HIGH-PRESSURE SPRAYER

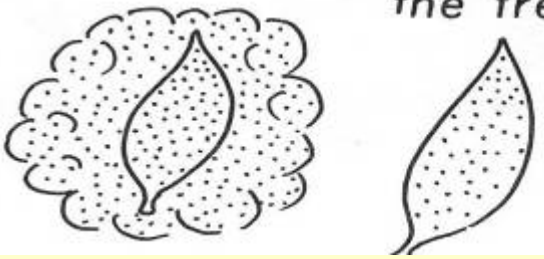
Fungicide is mixed with water and applied by hand in high-pressure stream



AIR-BLAST SPRAYER



Fungicide is mixed with water, injected into high velocity air stream which carries spray into the tree.



Three Things That Can Affect Disease Control

- **Time of fungicide application -** For optimal brown rot and scab control, the fungicide should be present prior to occurrence of conditions for infection - that is before rainfall or other moisture.

- **Application method -** For optimal results, must "hit the target". Sprayer must work properly, use correct rate of fungicide and proper amount of water per acre (100 gal/acre), conditions when fungicide is applied (wind, rain). Wind should be minimal (<5 mph) and there should be adequate drying time (>3 hours).

- **Disease pressure -** This involves two main components – pathogen inoculum and environmental conditions for infection and disease development.

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Case Study for Managing Brown Rot: Fungicide Time of Application and Spray Schedule

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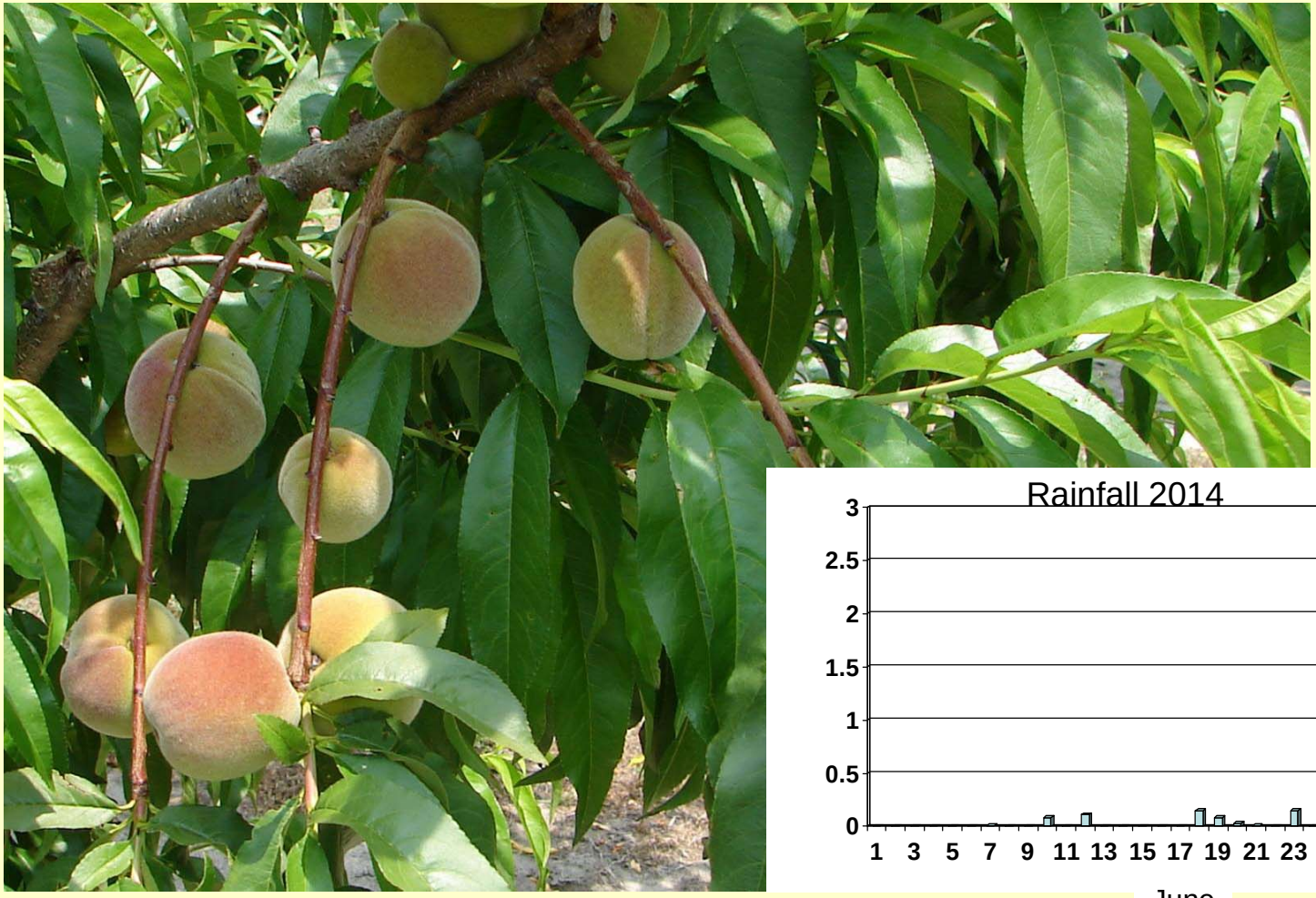
Rubyprince Fruit at Time of Inoculation – 28 May



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Inoculated Fruit on Non-Sprayed Tree at Times of the Fungicide Applications

3 fruit/tree inoculated	1st preharvest spray	2nd preharvest spray	3rd preharvest spray and Harvest
28 May	3 Jun	10 Jun	17 Jun

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Fungicide and Preharvest Spray Schedule

Fungicide & Rate/A[1/]	Spray Schedule[2/]		
	3 Jun	10 Jun	17 Jun
1 - Non-treated check			
2 - Merivon 500SC 6.0 fl oz	X		
3 - Merivon 500SC 6.0 fl oz		X	
4 - Merivon 500SC 6.0 fl oz			X
5 - Inspire Super 20 fl oz	X		
6 - Inspire Super 20 fl oz		X	
7 - Inspire Super 20 fl oz			X
8 - Merivon 500SC 4.0 fl oz Bumper 3.6EC 4.0 fl oz	X	 X	X
9 - Inspire Super 16 fl oz Bumper 3.6EC 4.0 fl oz	X	 X	X
10 - Fontelis 1.67SC 14.0 fl oz Bumper 3.6EC 4.0 fl oz	X	 X	X

1/ Based on use of 100 gal of spray mixture/acre.

2/ 28 May, 3 fruit/tree were inoculated *M. fructicola* cultured on peach fruit.

3/ Means from 4 single-tree reps.

4/ 17 Jun, 35 fruit from reps A&C and B&D were harvested 3 hr after fungicide spray and placed in storage (68-72F).

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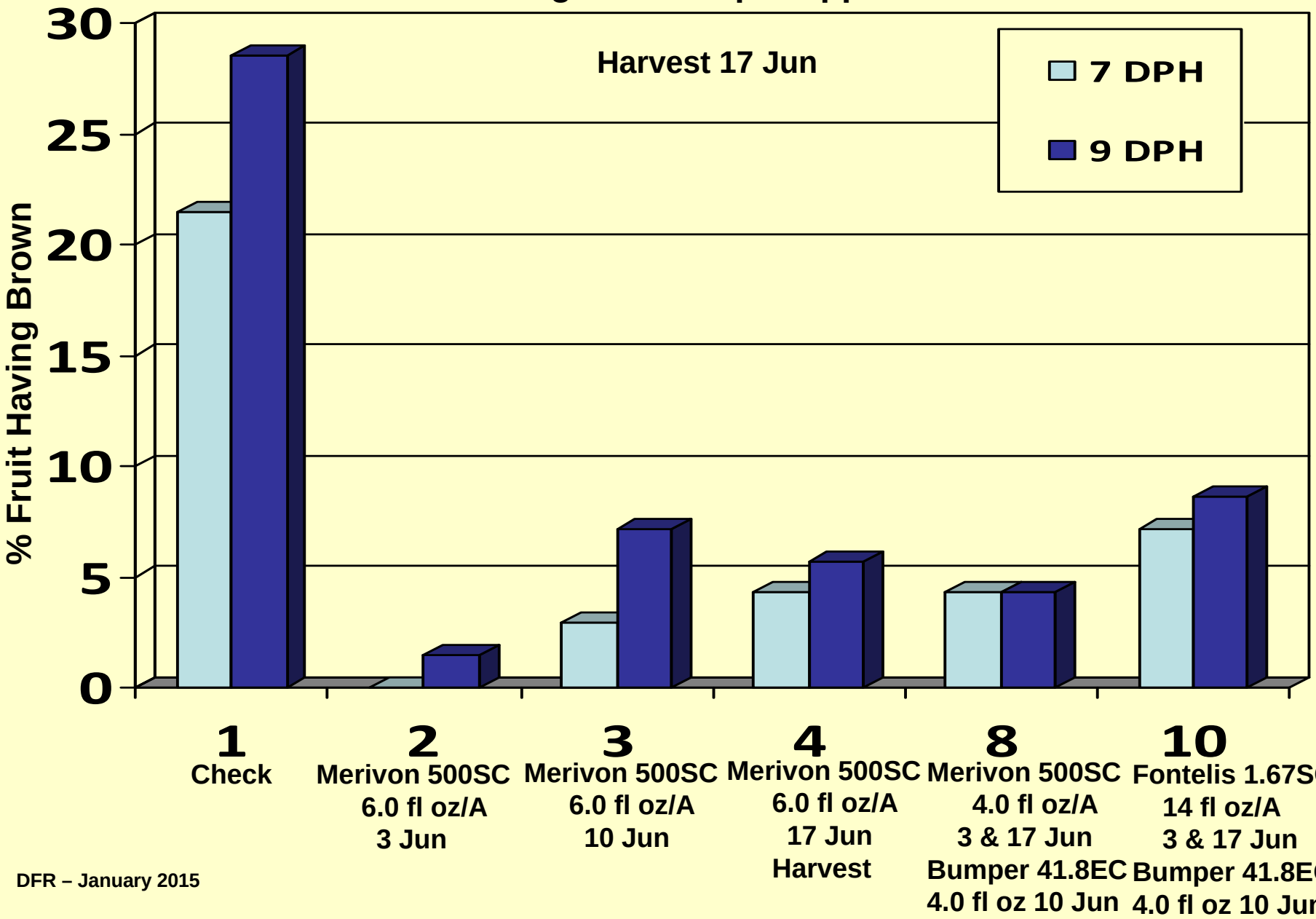
% Brown Rot at Days Post Harvest (DPH) Comparing Time of Single to Multiple Applications of Merivon 500SC



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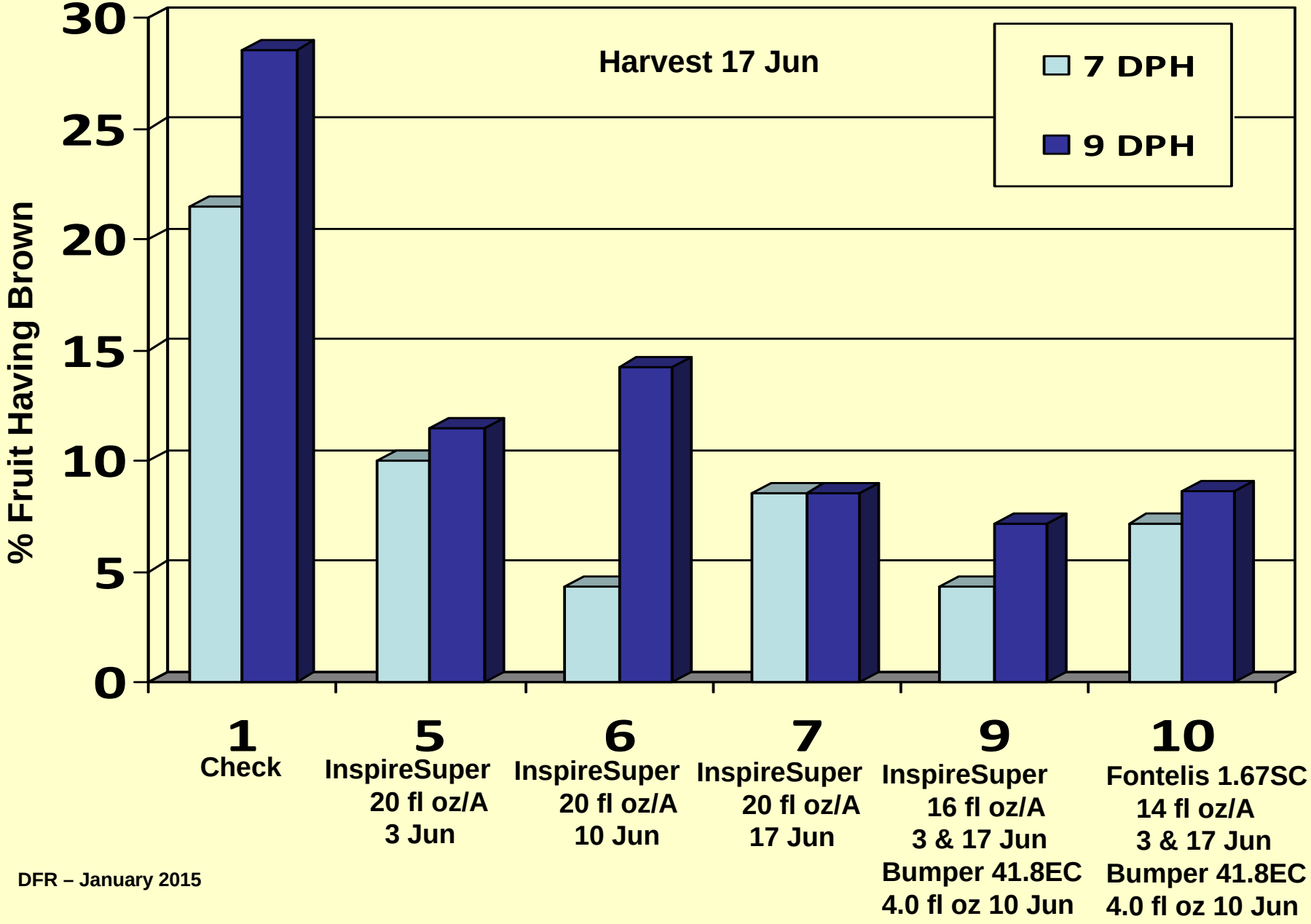
% Brown Rot Days Post Harvest (DPH) Using Single Applications of InspireSuper



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Results

Fungicide & Rate/A[1/]	Spray Schedule[2/]			Mean number brown rot diseased fruit under tree[3/]		Storage (% brown rot +/- sd) DPH[4/]	
						7 days	9 days
	3 Jun	10 Jun	17 Jun	19 Jun	24 Jun	24 Jun	26 Jun
1 - Non-treated check				2.50	4.00 a	21 (2.1)	29 (4.0)
2 - Merivon 500SC 6.0 fl oz	X			0.25	0.25 c	0.0 (0.0)	1.4 (2.1)
3 - Merivon 500SC 6.0 fl oz		X		0.25	0.25 c	2.9 (4.0)	7.1 (10.1)
4 - Merivon 500SC 6.0 fl oz			X	0.50	0.50 c	4.3 (2.0)	5.7 (0.0)
5 - Inspire Super 20 fl oz	X			1.25	1.00 b	10.0 (10)	11.4 (12.1)
6 - Inspire Super 20 fl oz		X		1.75	1.00 b	4.3 (1.9)	14.3 (4.0)
7 - Inspire Super 20 fl oz			X	0.75	0.50 c	8.6 (4.0)	8.6 (4.0)
8 - Merivon 500SC 4.0 fl oz Bumper 3.6EC 4.0 fl oz	X	X	X	0.75	0.50 c	4.3 (1.9)	4.3 (1.9)
9 - Inspire Super 16 fl oz Bumper 3.6EC 4.0 fl oz	X	X	X	0.50	1.00 b	4.3 (1.9)	7.1 (2.1)
10 - Fontelis 1.67SC 14.0 fl oz Bumper 3.6EC 4.0 fl oz	X	X	X	1.00	0.25 c	7.1 (2.1)	8.6 (0.0)
FLSD $\alpha = 0.05$				N.S.	0.43		
Probability > F				0.071	0.0001		

1/ Based on use of 100 gal of spray mixture/acre.

2/ 28 May, 3 fruit/tree were inoculated *M. fructicola* cultured on peach fruit.

3/ Means from 4 single-tree reps.

4/ 17 Jun, 35 fruit from reps A&C and B&D were harvested 3 hr after fungicide spray and placed in storage (68-72F).

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Peak Periods for Infection and Control of Blossom Blight, Scab, and Brown Rot

Blossom Blight

2-3 weeks after bloom

Pink to 5% blossoms open

Full bloom to petal fall

Scab

Start of shuck split to about 6 weeks after shuck split. Takes 5-6 weeks for lesions to become visible.

Lesions first visible early June

Brown Rot

As fruit begin to turn color (about 3 weeks before “tree ripe”) through harvest.