

# Apple Scab Models & Suggestions for Scab Control in 2015



70th NORTH JERSEY COMMERCIAL FRUIT  
GROWERS MEETING

Flemington, NJ

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# Critical Issues for Scab Control in 2015

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1. Sprayer calibration
2. Apple scab biology & benefits of sanitation
3. Scheduling fungicides for optimal control—  
can computer models help?
4. Optimizing fungicide selection
5. Avoid burning leaves/fruit

# Critical Issue #1: Sprayer Calibration

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- Most important item for improving pest control.
- Use Surround or water-sensitive paper to check for even distribution throughout trees.
- If you will be spraying against a 10 mph wind, then run at least one spray distribution check with a 10 mph wind.
- If investing in super-spindle orchards and/or buying a new sprayer, get a tower sprayer.
  - Less drift
  - Better coverage
  - Quieter ??

# Critical Issue #2 – Scab Biology & Sanitation

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- Many orchards have more over-wintering scab than they did 20 years ago.
  - Because of DMI-resistance? Or poor calibrat'n?
  - May result in pin-point scab and/or under-leaf scab, both of which develop in late summer.



# Critical Issue #2 – Scab Biology & Sanitation

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- Many orchards have more over-wintering scab than they did 20 years ago.
  - Because of DMI-resistance? Or poor calibrat'n?
  - May result in pin-point scab and/or under-leaf scab, both of which develop in late summer.
- In orchards with scab last year, inoculum reduction can lessen risks of scab in 2015.
  - Option 1: Apply 40 lb/A of urea before/at green tip.
  - Option 2: Brush-rake leaves to row middles and chop with a flail mower before bud-break.
  - Option 3: Apply 2.5 T/A of dolomitic lime over fallen lvs. in spring or fall

# Critical Issue #2 – Scab Biology & Sanitation

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## The five curses of high inoculum:

1. More ascospores.
2. More ascospores early in the season.
3. Marginal infection periods become economically important.
4. Conidia may over-winter in buds if >40% leaves infected.
5. Fungicides will seem less effective:

Results from 99.9% control with fungicides in orchards where 1% of the spores are released at green-tip can cause infections if no fungicides are present —

High-inoculum vs low inoculum orchards:

20% scab last yr = 1,220 spores/A escape the fungicide.

<1% scab last yr = 0.18 spores/A escape.



# Critical Issue #3 – Scheduling Fungicides

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Start early: Don't miss the first scab infection period or you will be back to the high-inoculum scenario just as trees are at peak scab susceptibility at PF.

Can scab models assist with fungicide timing?

- Models can predict high-risk infection periods.
- Models are sometimes used to decide if the GT spray can be omitted, but this is risky in the era of fungicide resistance.

# Apple Scab Models/Predictors

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## NEWA scab maturity model (<http://newa.cornell.edu>)

Estimates scab maturity based on degree days.

Did not compensate adequately for the fact that scab spores cannot develop in dry leaves

Dry pre-bloom weather in 2012 caused the model to get ahead of reality: Spores were still left several weeks after Petal Fall.

## RIMpro scab model: (<http://www.rimpro.eu>)

European model that uses a totally different model that predicts how cohorts of spores from various rains will progress through the season.

Available for purchase at \$200 euros/yr.

Accessing weather data is currently a problem for this model.



# NEWA scab maturity model

## NEWA Apple Disease Models

Select a disease:

Apple Scab

Weather Station:

Highland HVL

Date of Interest:

5/20/2014

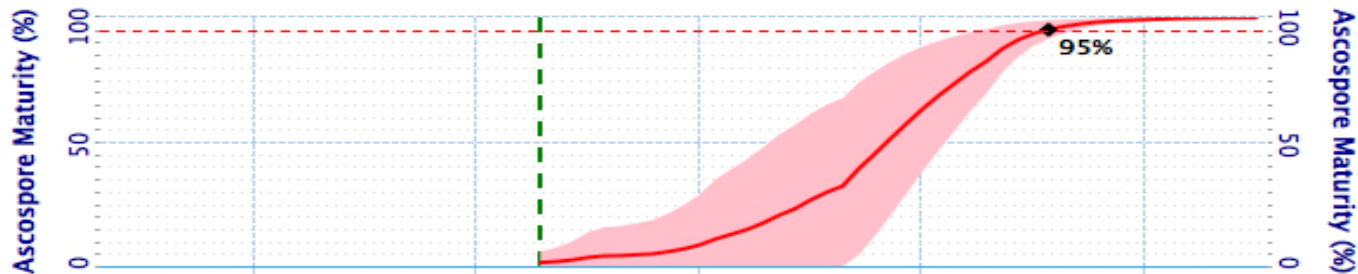
Calculate

Apple Scab Summary for Highland HVL								
	Past	Past	Current	5-Day Forecast			Forecast Details	
	May 18	May 19	May 20	May 21	May 22	May 23	May 24	May 25
Ascospore Maturity	99%	99%	99%	99%	100%	100%	100%	100%
<u>Infection Events</u>	-	-	No					
Days to Symptoms	-	-	NA					
Wetness Events								
Rain Amount	0.03	0.04	0.03	NA	NA	NA	NA	NA
Rain Prob (%) Night Day ?			- -	- -	- -	- -	- -	- -
Dew ?	Yes	No	Yes	NA	NA	NA	NA	NA
Leaf Wetness (hours)	0	4	0	NA	NA	NA	NA	NA
NA - not applicable			Ascospore Maturity Graphs			Download Time: 5/20/2014 23:00		

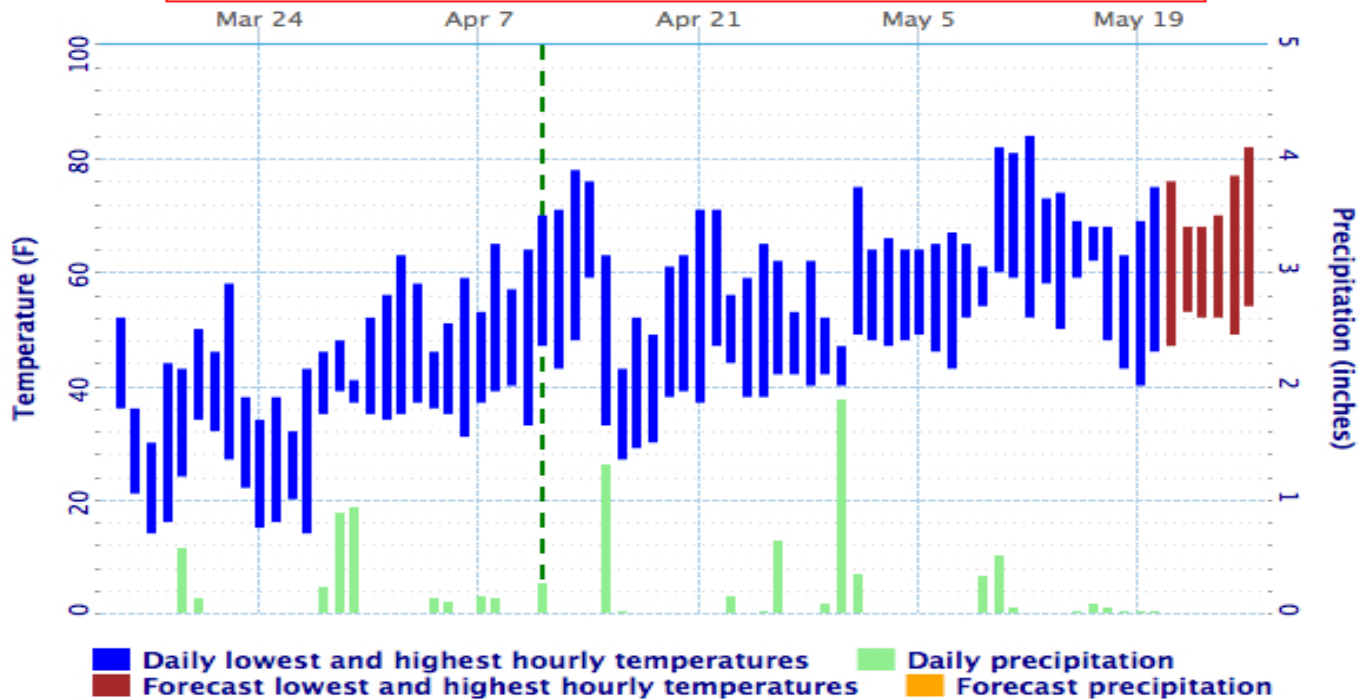
# NEWA scab maturity model

## Ascospore Maturity and Weather Summary for Highland HVL

Greentip date (4/11) is indicated by a dashed green line



The Ascospore Maturity model predicts that 95% of the spores are matured. At this point, essentially all ascospores will be released after a daytime rain of greater than 0.10 inch with temperatures above 50 deg F.



# NEWA scab maturity model

## Apple Scab Infection Events (March 1 - May 20)

Start Date & Time	End Date & Time	Wet Hours	Temp Avg. (F)	Rain (in.)	Days to Symptoms	Combined Event
May 15 7:01 AM	May 17 5:00 AM	38	63	0.14	9-10	<u>Yes</u>
May 8 6:01 AM	May 11 3:00 AM	40	58	0.93	12-13	<u>Yes</u>
April 29 4:01 PM	May 2 3:00 AM	48	46	2.35	17	<u>Yes</u>
April 25 10:01 PM	April 26 10:00 PM	16	45	0.68	17	<u>Yes</u>
April 15 5:01 AM	April 16 3:00 PM	26	47	1.36	17	<u>Yes</u>
April 11 2:01 PM	April 12 10:00 AM	20	48	0.28	17	
April 7 5:01 PM	April 8 2:00 PM	21	46	0.32	17	
March 28 9:01 AM	March 31 7:00 AM	56	41	2.12	-	<u>Yes</u>
Dry conditions last 24 hours at download		Download Time: 5/20/2014 23:00				

# NEWA scab maturity model

## Highland HVL

## Apple Wet and Dry Log 2014

Download Time: 10/31/2014 0:00

When calculating the length of a wetting period use the following rule: two successive wetting periods, the first started by rain, should be considered a single, uninterrupted wet period if the intervening dry period is less than 24 hours, regardless of weather. Refer to [Mills Chart](#) for additional information.

Wet Starting Date Time	Wet Ending Date Time	Hours LW	Avg Temp F	Total Rain	Dry Starting Date Time	Dry Ending Date Time	Hours Dry
5/19/2014 8:01 PM	5/19/2014 11:00 PM	3	55	0.01	5/17/2014 5:01 AM	5/19/2014 8:00 PM	63
5/16/2014 1:01 AM	5/17/2014 5:00 AM	28	63	0.10	5/15/2014 5:01 PM	5/16/2014 1:00 AM	8
5/15/2014 7:01 AM	5/15/2014 5:00 PM	10	65	0.04	5/11/2014 3:01 AM	5/15/2014 7:00 AM	100
5/11/2014 12:01 AM	5/11/2014 3:00 AM	3	63	0.06	5/10/2014 7:01 PM	5/11/2014 12:00 AM	5
5/10/2014 4:01 PM	5/10/2014 7:00 PM	3	66	0.51	5/10/2014 10:01 AM	5/10/2014 4:00 PM	6
5/9/2014 7:01 PM	5/10/2014 10:00 AM	15	61	0.03	5/9/2014 12:01 PM	5/9/2014 7:00 PM	7
5/9/2014 12:01 AM	5/9/2014 12:00 PM	12	56	0.32	5/8/2014 1:01 PM	5/9/2014 12:00 AM	11
5/8/2014 6:01 AM	5/8/2014 1:00 PM	7	53	0.01	5/4/2014 5:01 AM	5/8/2014 6:00 AM	97
5/3/2014 11:01 PM	5/4/2014 5:00 AM	6	50	0.02	5/2/2014 3:01 AM	5/3/2014 11:00 PM	44
5/1/2014 8:01 PM	5/2/2014 3:00 AM	7	56	0.03	5/1/2014 10:01 AM	5/1/2014 8:00 PM	10
4/30/2014 7:01 AM	5/1/2014 10:00 AM	27	46	1.88	4/30/2014 6:01 AM	4/30/2014 7:00 AM	1
4/29/2014 4:01 PM	4/30/2014 6:00 AM	14	42	0.44	4/26/2014 10:01 PM	4/29/2014 4:00 PM	66
4/26/2014 5:01 PM	4/26/2014 10:00 PM	5	52	0.09	4/26/2014 9:01 AM	4/26/2014 5:00 PM	8
4/25/2014 10:01 PM	4/26/2014 9:00 AM	11	43	0.59	4/23/2014 2:01 PM	4/25/2014 10:00 PM	56
4/23/2014 9:01 AM	4/23/2014 2:00 PM	5	49	0.05	4/23/2014 7:01 AM	4/23/2014 9:00 AM	2
4/23/2014 1:01 AM	4/23/2014 7:00 AM	6	49	0.11	4/16/2014 3:01 PM	4/23/2014 1:00 AM	154
4/16/2014 10:01 AM	4/16/2014 3:00 PM	5	39	0.04	4/16/2014 2:01 AM	4/16/2014 10:00 AM	8
4/15/2014 5:01 AM	4/16/2014 2:00 AM	21	50	1.32	4/12/2014 10:01 AM	4/15/2014 5:00 AM	67
4/11/2014 2:01 PM	4/12/2014 10:00 AM	20	48	0.28	4/8/2014 2:01 PM	4/11/2014 2:00 PM	72



# RIMpro scab model

RIMpro Web Service for user: David Rosenberger Location: hig (Highland-HVL)

Info

Scab Primary

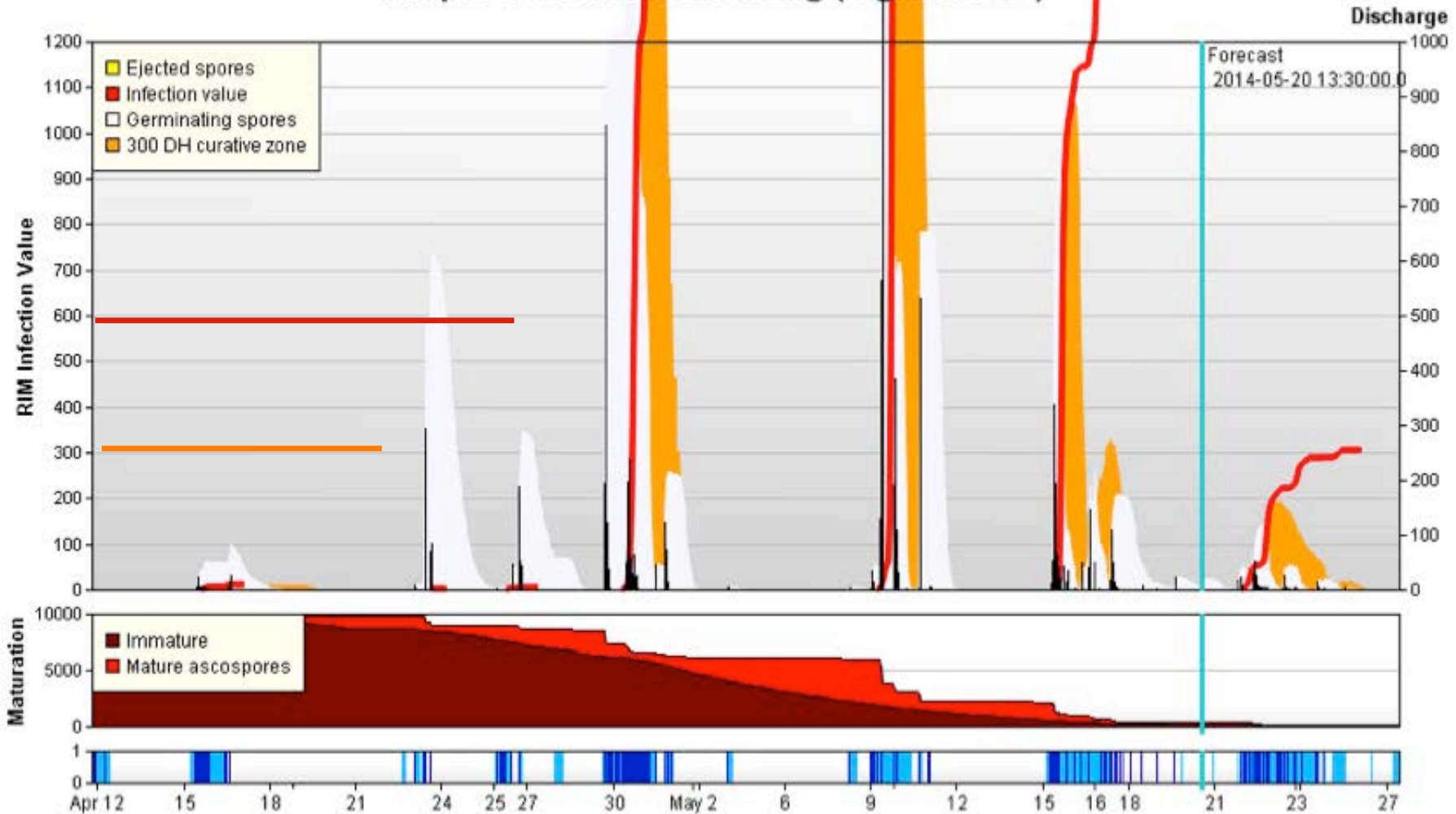
Scab Secondary

Weather data

My Breakpoints

My Treatments

## RIMpro-Venturia location hig (Highland-HVL)



# Critical Issue #4 – Selecting Fungicides

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1. **Start early:** don't miss the first scab infection period or you will be back to the high-inoculum scenario just as trees are at peak scab susceptibility at PF.
  - Copper at green-tip can help with blight and may help to suppress DMI-resistant scab.
  - If orchards are blight free, then mancozeb can be used in place of copper in the first spray.

# Background on Copper Sprays



- Effectiveness of copper sprays is highly correlated with the amount of elemental copper that is applied.
- Elemental (metallic) copper content varies by product !!

<b>ACTIVE INGREDIENT:</b>	
Copper Octanoate.....	10.0%
<b>OTHER INGREDIENTS:</b> .....	<u>90.0%</u>
<b>TOTAL</b> .....	100.0%
metallic copper equivalent	1.8%

<b>ACTIVE INGREDIENT:</b>	
Cuprous Oxide (Cu <sub>2</sub> O)* .....	83.9%
<b>OTHER INGREDIENTS:</b> .....	<u>16.1%</u>
<b>TOTAL</b> .....	100.0%
*Metallic copper equivalent: 75%	

- **Copper products with low copper content will not work for silver-tip or green-tip sprays to suppress fire blight.**  
Cueva, Mastercop, Phytan 27AG are low-copper formulations.
- Adjust copper rates so as to apply about 1 lb of elemental copper per 100 gal: perhaps slightly more in a slow-developing year and less if rapid bud development is expected.



# Critical Issue #4 – Selecting Fungicides

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## Objectives of an optimal scab program:

- Start early to prevent all primary infections and keep inoculum low.
- Include either mancozeb or captan in every spray after green-tip to slow resistance development.
- Use three different chemistry groups to mix with mancozeb or captan between HIG and 1st cover;  
For example:

- HIG & TC: Syllit + mancozeb
- Pink & Bloom: Mancozeb plus either a QoI or SDHI
- PF & 1<sup>st</sup> Cover: Mancozeb or captan plus either a DMI or a QoI  
(if not used earlier)

# Critical Issue #4 – Selecting Fungicides

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2. At half-inch green and tight cluster, consider a tank mix of Syllit plus mancozeb:

- Historically, Syllit provided excellent scab control when used in the first two sprays of the season.
- Syllit has good redistribution, limited systemic activity.
- Syllit will be especially valuable in high-inoculum orchards.
- NOTE: The Syllit label will be changing this year: no applications are allowed on apples after bloom!

# Critical Issue #4 – Selecting Fungicides

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## 3. Best options at pink and bloom:

**Qols** (quinone outside inhibitors) or Strobilurins

Flint (trifloxystrobin)

Sovran (kresoxim-methyl)

Merivon (pyraclostrobin + fluxapyroxad [SDHI fungicide])

Luna Sensation (Flint + fluopyram [SDHI fungicide])

# Critical Issue #4 – Selecting Fungicides

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### **SDHIs**

<u>Fungicide</u>	<u>Generic name</u>	<u>Company</u>	<u>Combined with</u>
Fontelis	penthiopyrad	DuPont	(Tank mix with mancozeb)
Luna Sensation	fluopyram	Bayer	Flint (plus add mancozeb)
Luna Tranquility	fluopyram	Bayer	Scala (plus add manc'b)
Merivon	fluxapyroxad	BASF	pyraclostrobin (add manc'b)
Aprovia (??)	solatenol	Syngenta	(Tank mix with mancozeb)

# Critical Issue #4 – Selecting Fungicides

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## 4. At PF & 1C, consider DMIs

to get scab, mildew, and rust.

- DMIs = Rally, Topguard, Inspire Super
- Rally and Topguard provide excellent mildew control if mildew populations are still sensitive to DMIs.
- Inspire Super can be weak on mildew if any resistance is present: boost mildew control by adding sulfur.
- Using a DMI at petal fall can be especially important in areas with quince rust because they provide long-term post-infection activity against rust.

# Critical Issue #4 – Selecting Fungicides

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## 4. At PF & 1C, consider DMIs

to get scab, mildew, and rust.

- However, using DMIs before petal fall in orchards with DMI-resistant scab may make scab problems worse due to hormesis.
- “**Hormesis**” is a term used by toxicologists to refer to a low dose stimulation or beneficial effect from a toxicant.
- Resistant scab perceives normal rates as a low dose and may grow faster than it would in the absence of any fungicide.

# Critical Issue #5 – Avoid Burning Leaves/Fruit!





# Factors favoring captan injury

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1. Extended periods of cloudy cool weather that allow growth without the need for cuticle development, especially near petal fall.
2. Tank mixes with products containing surfactants to enhance uptake:
  - products containing oil or oil-based solvents.
  - urea, calcium chloride, other foliar nutrients
  - plant growth regulators
3. Applications under slow drying conditions:
  - spraying at night.
  - spraying trees still wet with dew.
4. Heat during or shortly after application??

# Consequences of 2013 captan injury:

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1. Recent work by Cox, Villani, and Breth in NY showed that some formulations of captan are rougher on fruit than others.
2. I suggest that captan should be avoided in sprays at PF or 1<sup>st</sup> cover.

## Rationale:

- At PF and 1<sup>st</sup> cover, fruit and leaves are at their peak susceptibility for injury due to rapid leaf growth and small fruit.
- Period of the craziest tank mixes.

# Rationale for changing Captan usage:

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Complaint: “We’ve used captan for more than 50 years, so why the sudden concern about phytotoxicity?”

Response: “Are you still spraying the way you did 50 or even 25 years ago?”

Tank mixes at petal fall and 1<sup>st</sup> cover are sometimes very complex:

Regulaid?  
streptomycin  
+ 1-2 other fungicides  
Captan  
Insecticide

# Captan label warnings:

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CAPTAN 80WDG can be combined safely and effectively at recommended dosage rates with most commonly used fungicides and insecticides with the exception of oil and strongly alkaline materials. ....

**Do not apply CAPTAN 80WDG in combination with or immediately before or closely following oil sprays.**

**The use of spreaders which cause excessive wetting is not advised.**

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Regulaid is a nonionic spreader activator for use in improving the effectiveness of foliar applied plant growth regulators or streptomycin applications. Regulaid provides **superior** wetting of the spray solution ... and improved foliar penetration.

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Tank mixes at petal fall and 1<sup>st</sup> cover are sometimes very complex:

NAA  
carbaryl  
streptomycin  
**Captan**  
+ 1-2 other fungicides  
Insecticide  
Urea  
Apogee?  
+water conditioner  
pH buffer  
Magic elixir

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**CONCLUSION: With 6 to 8 separate products in a tank mix, no one can determine when you have passed the threshold for “excessive wetting.”**

**Therefore: drop Captan out of the mix !!**

# Conclusions concerning Captan and phytotox risks

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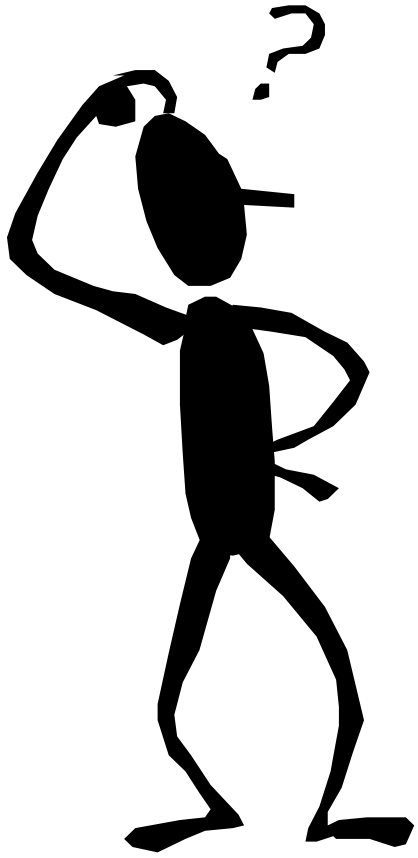
1. Captan is phytotoxic if absorbed into plant tissue; New formulations ???
2. Increasingly complex tank mixes have increased risks that mixtures will contain “excess surfactant.”
3. PF & 1<sup>st</sup> cover are high risk periods for phytotoxicity on apples.
4. Continue to use Captan at PF and 1<sup>st</sup> cover if you prefer, but at least consider the risks and avoid complex spray mixtures under high-risk weather conditions.



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Questions?