



# Effect of Rate and Rotation on Fungicide Resistance in Stemphylium Leaf Blight

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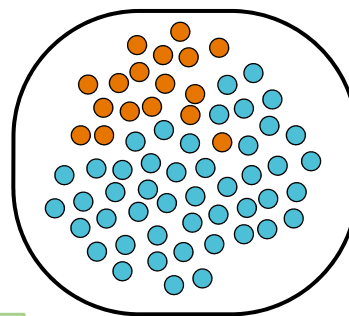
<sup>2</sup>CCE Cornell Vegetable Program

Onion SLB Fungicide Resistance Workshop  
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**Cornell AgriTech**  
New York State Agricultural Experiment Station

## Phases of Resistance Development

1. Emergence\*
2. Selection
3. Establishment



\*Fungicides are not inherently mutagenic, mutations are **pre-existing**

\*Advantageous mutations occur **infrequently**

**Pathogen Population**

● Sensitive Isolate

● Resistant Isolate

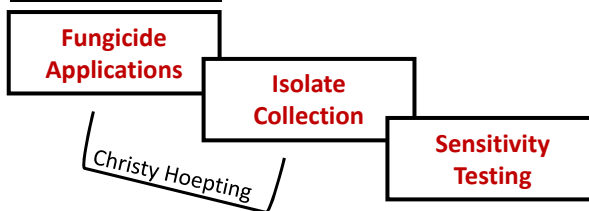
Application of a fungicide does not cause emergence, rather will select for further establishment

(adapted from van den Bosch et al 2011)

## How can we delay development of fungicide resistance?

**Goal: Identify fungicide application practices that slow down selection for establishment of fungicide resistance**

### General Work Flow



### I. Application Rate

- High, medium, or low

### II. Product Rotation

- Every other week or every two weeks

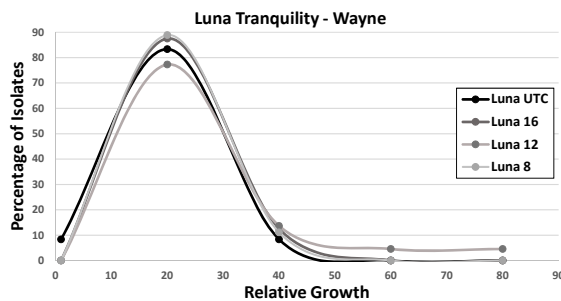
### III. Application Number

- 0, 6, or 9 applications

## Fungicide Applications-Application Rate

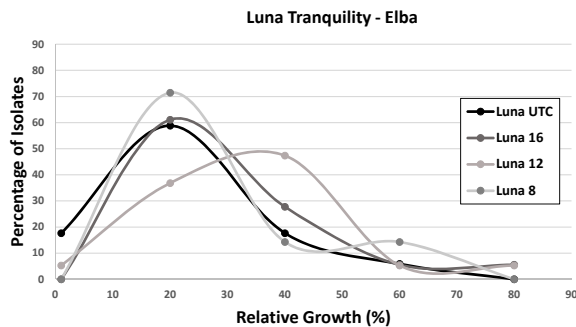
Treatment		Application Frequency
Elba	Untreated	0
	Luna Tranquility 8 fl oz	4
	Luna Tranquility 12 fl oz	4
	Luna Tranquility 16 fl oz	4
	Merivon 5.5 fl oz	4
	Merivon 9 fl oz	4
	Tilt 4 fl oz	4
	Tilt 8 fl oz	4
Wayne	Untreated	0
	Luna Tranquility 8 fl oz	5
	Luna Tranquility 12 fl oz	5
	Luna Tranquility 16 fl oz	5

## Effect of Application Rate on Fungicide Sensitivity- Luna Tranquility (Group 7 & 9)



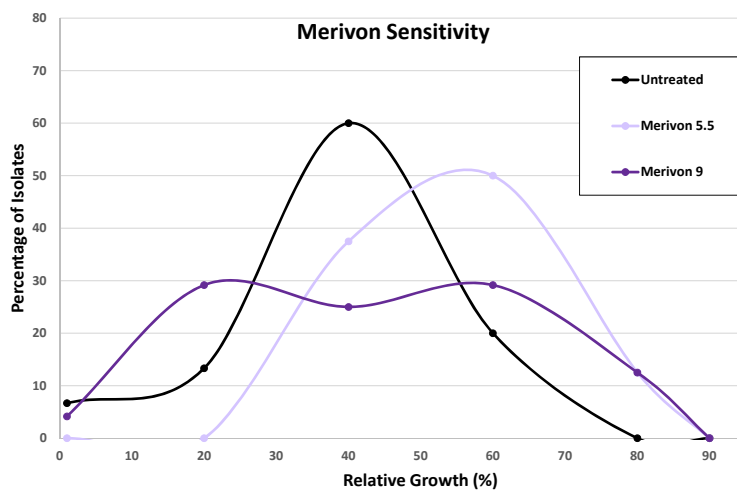
Treatment	Mean RG (%)
UTC	12.6
Luna Tranquility 16 fl. Oz	15.55
Luna Tranquility 12 fl. Oz	17.47
Luna Tranquility 8 fl. Oz	11.6

Minor (or no) shifts in sensitivity observed



Treatment	Mean RG (%)
UTC	13.75
Luna Tranquility 16 fl. Oz	19.361
Luna Tranquility 12 fl. Oz	21.39
Luna Tranquility 8 fl. Oz	13.88

## Effect of Application Rate on Fungicide Sensitivity- Merivon (Group 7 & 11)

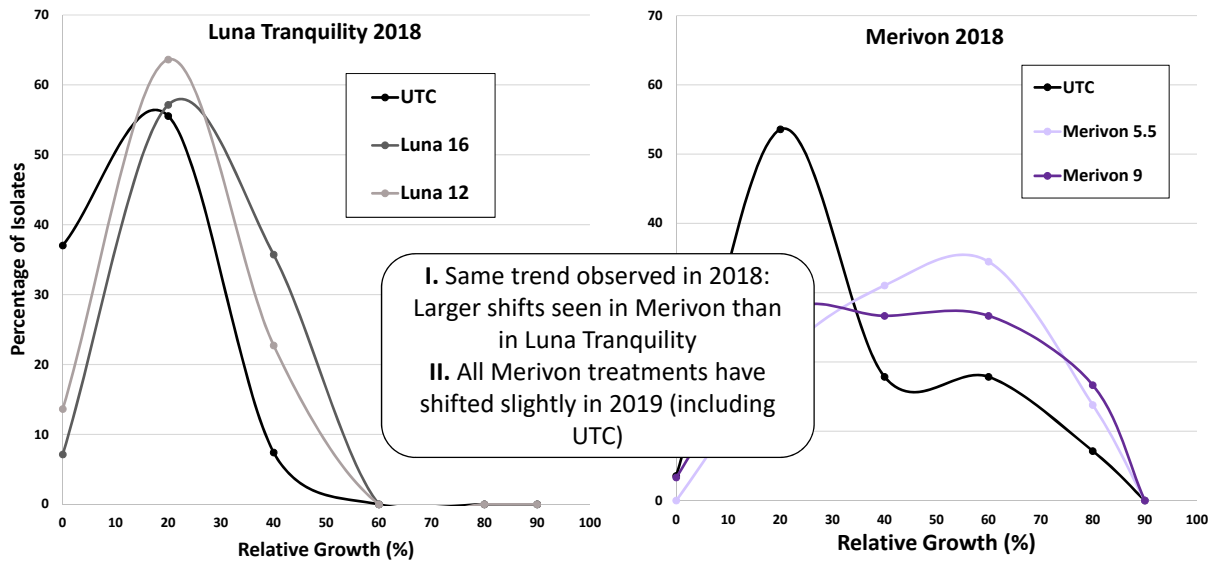


Treatment	Mean RG (%)
UTC	28.62
Merivon 5.5 fl oz	44.21
Merivon 9 fl oz	34.24

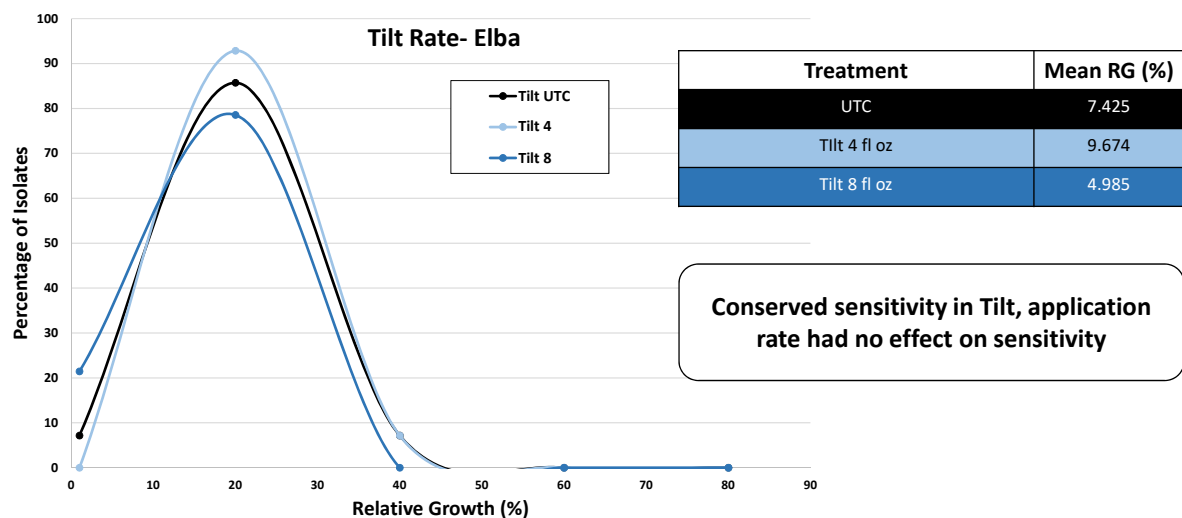
- I. Regardless of treatment, shift in population sensitivity is observed
- II. Larger shift seen in isolates treated with the low rate... translate to field efficacy differences?
- III. Larger shift is seen in the Merivon treatments; group 11 slipping, and therefore higher selection pressure from the group 7

## Effect of Application Rate on Fungicide Sensitivity-

2018



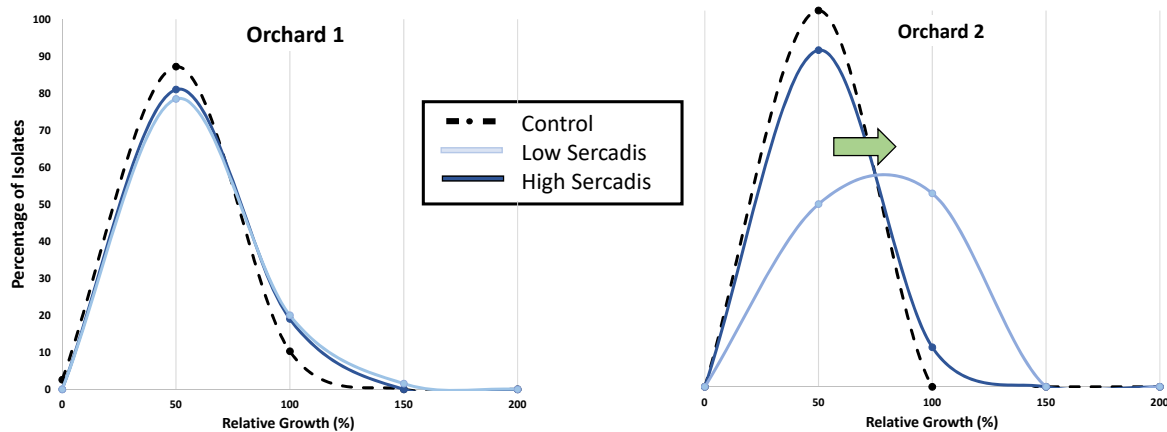
## Effect of Application Rate on Fungicide Sensitivity- Tilt (Group 3)



### Case Study: Apple Scab

### Effect of Application Rate – Sercadis (Group 7)

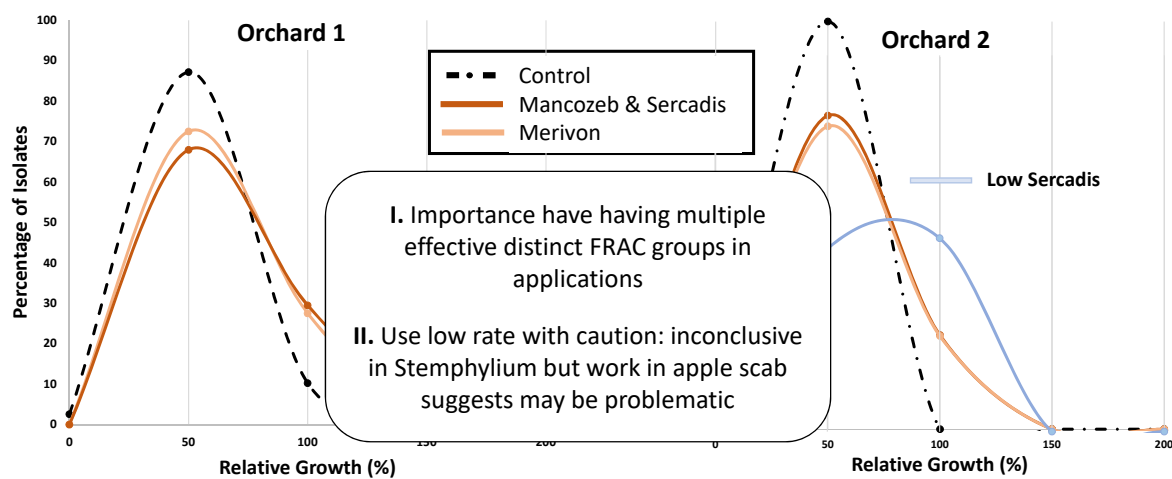
after three years



### Case Study: Apple Scab

### Effect of Mixture – Mancozeb + Sercadis (Group M3 + 7) and Merivon (Group 7 & 11)

after three years



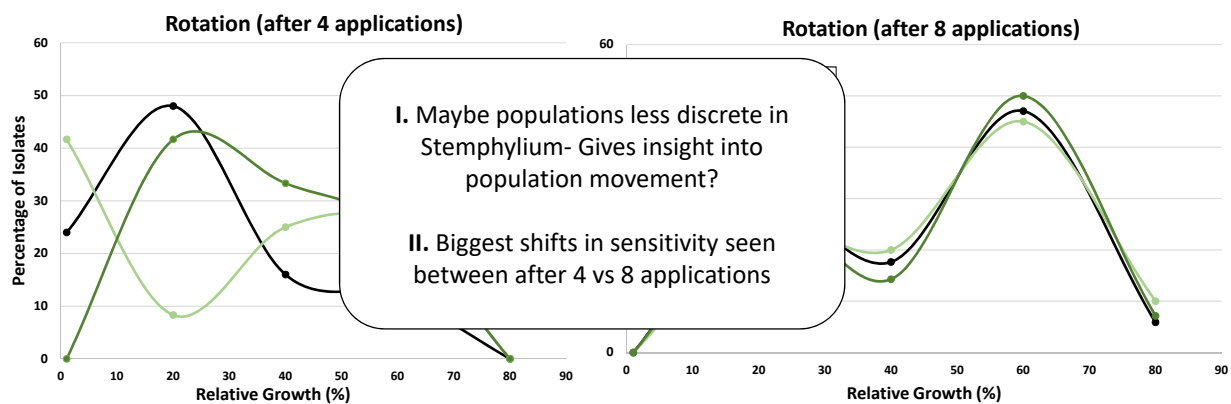
# Fungicide Applications-Application Rotation

Treatment	Spray Intervals/Frequency				Spray Intervals/Frequency			
Untreated	-	-	-	-	-	-	-	-
Sercadis 7.8 fl. oz	X	-	X	-	X	-	X	-
Tilt 8 fl. oz	-	X	-	X	-	X	-	X
Sercadis 7.8 fl. oz	X	X	-	-	X	X	-	-
Tilt 8 fl. oz	-	-	X	X	-	-	X	X

↑  
Collect Here  
(4 Applications)

↑  
Collect Here  
(8 Applications)

## Effect of Rotation on Fungicide Sensitivity



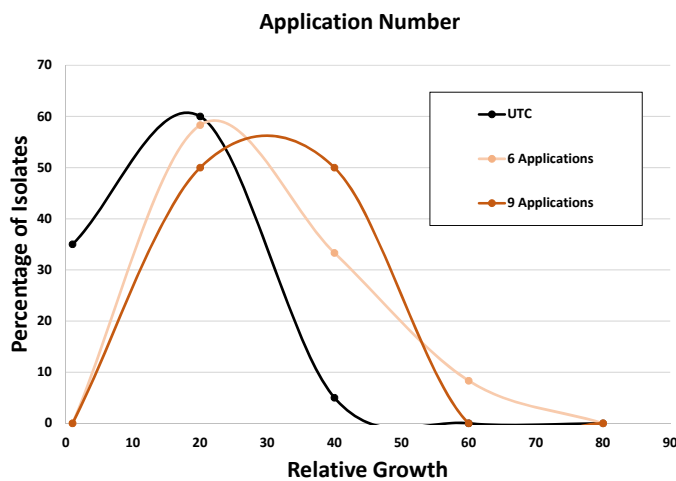
Treatment	Mean RG (%)
UTC	19.93
Every other week (after 4)	21.23
Every two weeks (after 4)	28

Treatment	Mean RG (%)
UTC	37.84
Every other week (after 8)	39.59
Every two weeks (after 8)	41.4

## Fungicide Applications-Application Number

Treatment	Application Number
Untreated Maintained	0
Luna Tranquility 16 fl oz	6
Luna Tranquility 16 fl oz	9

## Effect of Application Number on Fungicide Sensitivity



Treatment	Mean RG (%)
UTC	9.8
Luna Tranquility 16 fl oz 6 applications	19.51
Luna Tranquility 16 fl oz 9 applications	20.1

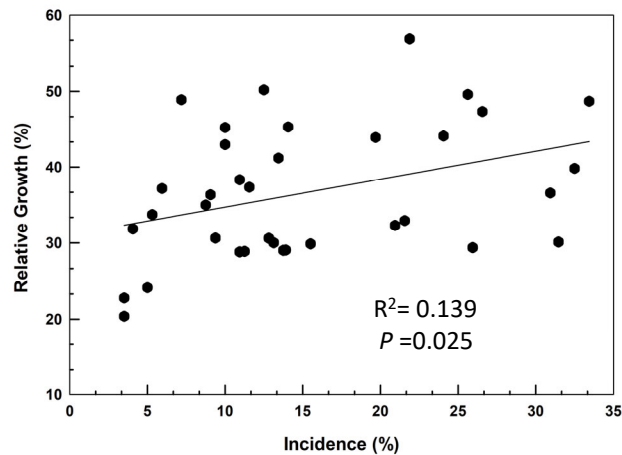
I. Shifts in sensitivity seen between 0 and both 6 and 9

II. Are we seeing smaller differences because using the two effective active ingredients in Luna Tranquility and using at high rate?

### Case Study: Apple Scab

## Correlation between incidence and relative growth

- **Exceptionally weak, but significant correlation**
- **Potential explanation:**  
The larger the pathogen population, the greater the chance of resistance development
- Manage population size to manage fungicide resistance



## Conclusions

- More questions than answers...
- **Mixing modes of action (when both FRAC groups still effective) will be best at slowing down selection for resistance**
  - Smaller trends:**
    - Low rate seems to be selecting for more reduced sensitivity isolates
    - Increased exposure to fungicides results in shifts towards reductions in sensitivity
    - Understanding trends seen in apple scab resistance may give insight towards understanding Stemphylium resistance
- Lot of unanswered questions still and a lot more to be learned...



## Acknowledgements

### Collaborators

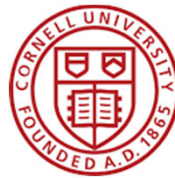
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### Questions?

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