

# Implications to management

1. Watch out for those rainy, warm days during bloom!
2. Watch out for warm nights even without rain (humidity is high at night, plant water potential is high at night) during bloom!

***Protect flowers with strep before 1. and 2.!***

3. Tank mix strep with your fungicide sprays (artificial wetting events) during bloom, whenever is possible.



# Water intensifies the shoot blight infection

- Compared to blossom blight, occurrence of shoot blight is more mysterious.

Why succulent shoots are always present but shoot blight only occurs sometime?

Does shoot blight require mechanical injuries (wind, hailstorm)?

What triggers shoot blight infection?





# Ea enters shoots through trichomes

Ea::GUS

Use Ea::GUS to inoculate apple shoots (no injury)

**Symptoms after 2 weeks**

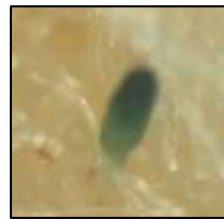


# Ea enters shoots through trichomes

- Ea::GUS (blue color) is found mostly on leaf hairs (non-glandular trichomes) and glandular trichomes.



**Glandular trichomes**



**c Leaf hairs**



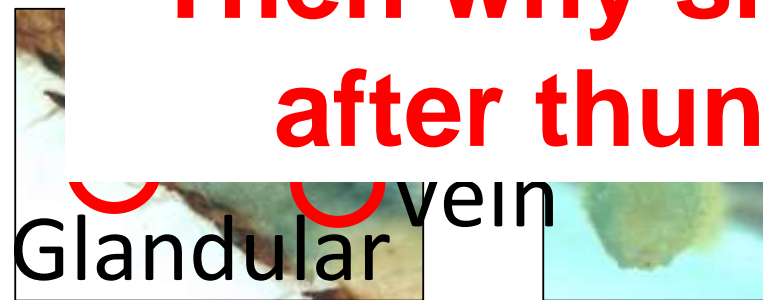
# Ea enters shoots through trichomes



- Ea::GUS (blue color) is found mostly on leaf hair (non glandular trichome) and (glandular trichome).

***Ea* enters does not require mechanical injuries (wounds created by wind, sand).**

**Then why shoot blight infections often occur after thunderstorms? Could it be water?**



Glandular  
trichomes





## Growing conditions

100% RH 25-30

***More water in shoots = More shoot blight!***

80% RH, 15-30  
soil WC

65% RH 15-25  
Soil W C

40% RH, 6-20  
soil WC

# Water intensifies the shoot blight infection

↑ More ooze production



Bacterial ooze

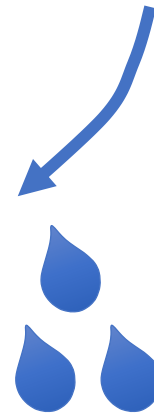


Succulent, newly expanded shoots

↑ More susceptible to shoot blight



Shoot blight infection



↑ More shoot blight

# Implications to management

1. Building windbreaks for orchard is not needed for fire blight control.
2. For newly planted, non-bearing young apple orchard (no russeting concern), apply copper before rain (low MCE, fixed copper).
3. If blossom blight already occurred in orchard (2-3 weeks after petal fall), have had lots of rain or have rain predicted, apply shoot control materials (Actigard 50WG and Apogee).





# Water intensifies the canker formation

“More live *E. amylovora* cells were detected in cankers from irrigated trees than non-irrigated trees, and in years with average rainfall than a year with drought”

On a wet year, apply Actigard 50WG or Apogee will also prevent canker formation the next season.



Srdjan Acimovic, Virginia Tech

# Summary

- Fire blight control is challenged with climate change, adoption of the high-density orchard system, and antibiotic resistance.
- No strep-resistant Ea strains were identified in New England in recent surveys.

# Summary

- Water is a key factor that intensifies fire blight infection!
- Ea grows faster on flowers under higher humidity; water flushes Ea cells to the hypanthium (the site of infection); water dilutes nectar, making Ea easier to grow at hypanthium. **More water = More Blossom Blight!**
- Shoots with high water content are more susceptible to Ea, more ooze droplets are produced when it is wet. **More water = More Shoot Blight!**
- **More water,** faster Ea moves in xylem, **= more cankers.**



# Fire blight outbreak at CAES experimental orchard, 2020





Idared

NY1

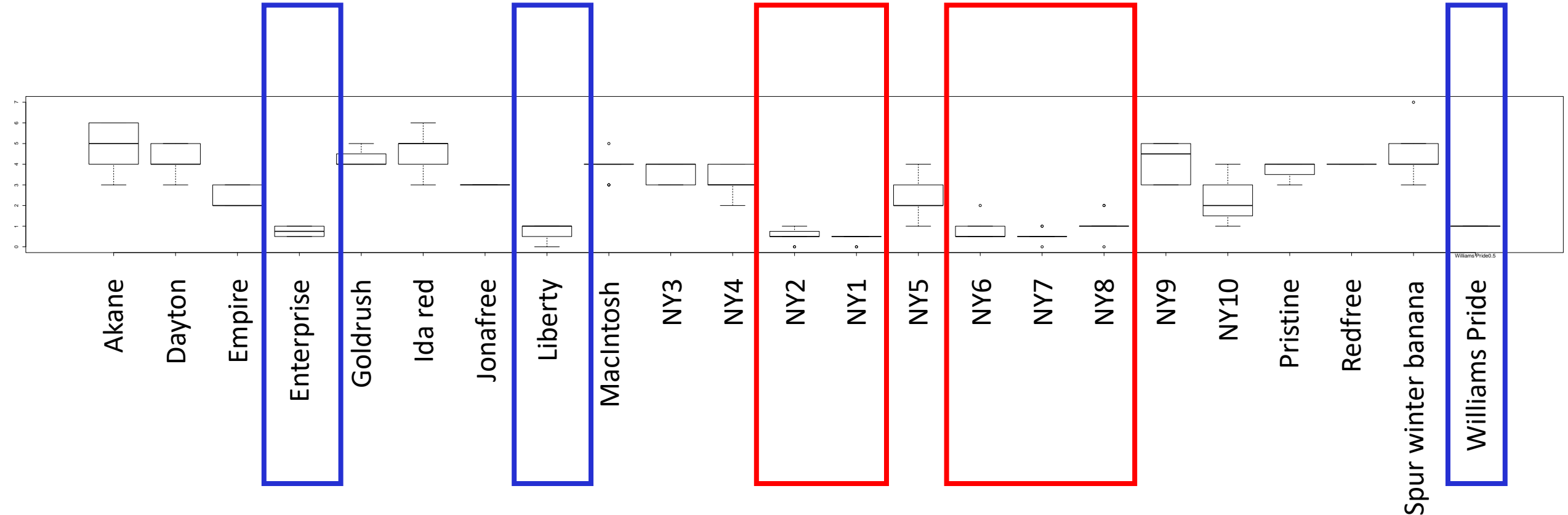
NY2

Idared





# Disease rating, Summer 2020





# NY1, heavily inoculated with FB bacteria





## NY1, heavily inoculated with FB bacteria



50% of flower clusters do not adhere (similar to non-pollinated flowers)

NY1, heavily inoculated with FB bacteria



**True resistance to fire blight!**



# NY2, heavily inoculated with FB bacteria



Fire blight infections occurs at flower clusters, but do not spread.



# NY2, heavily inoculated with FB bacteria



Fire blight infections occurs at flower clusters, but do not spread.



# Crimson crisp (FB susceptible)



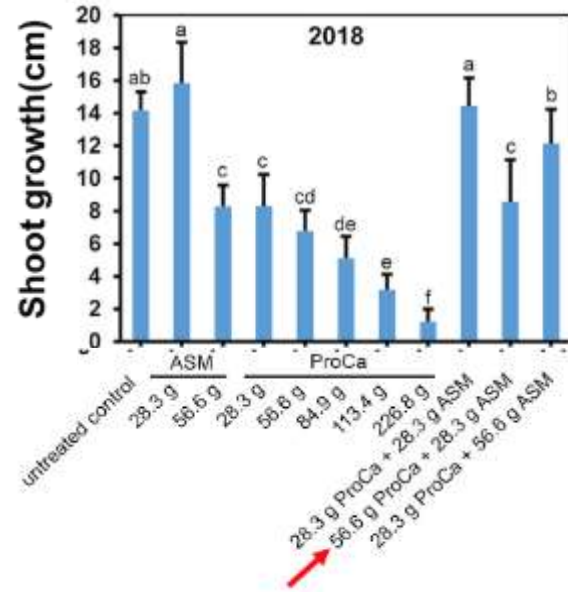


NY1 has some horticulture traits that need to be resolved before commercial adoption.



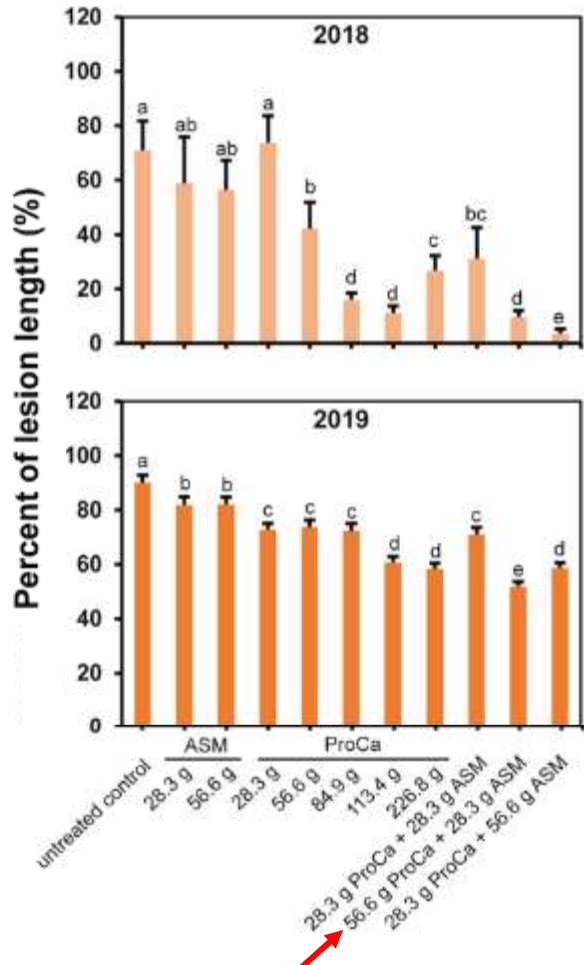
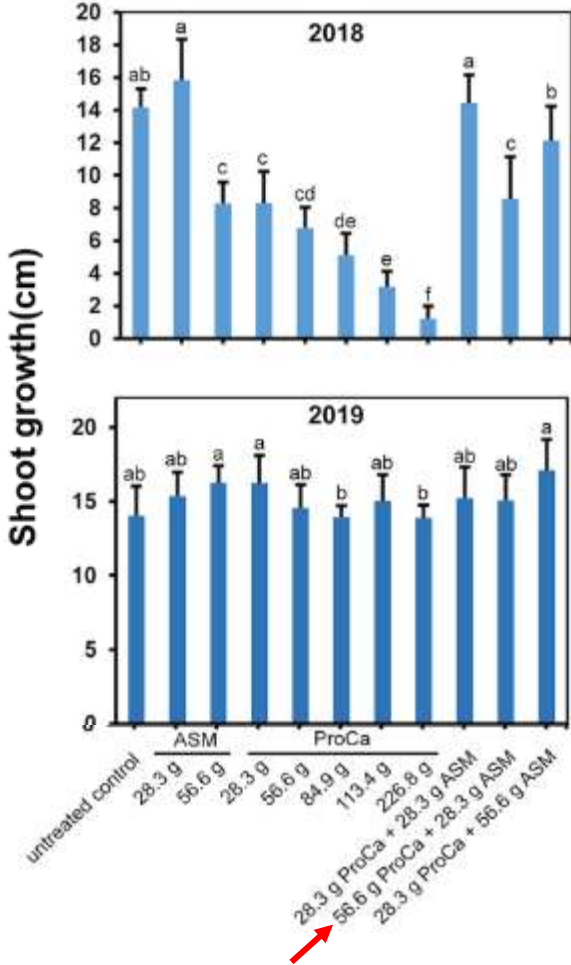


# Combinations of low rates of ProCa and ASM for shoot blight management



George Sundin, MSU

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# Post-Bloom Petal Fall:

## **Current protocol for balancing shoot growth and shoot blight suppression (for young high-density plantings):**

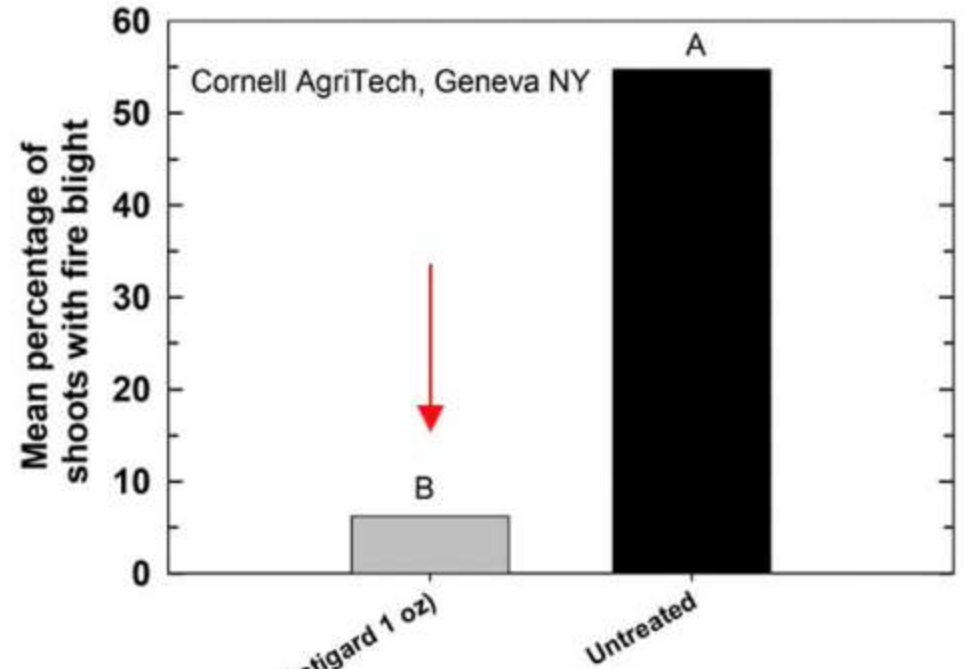
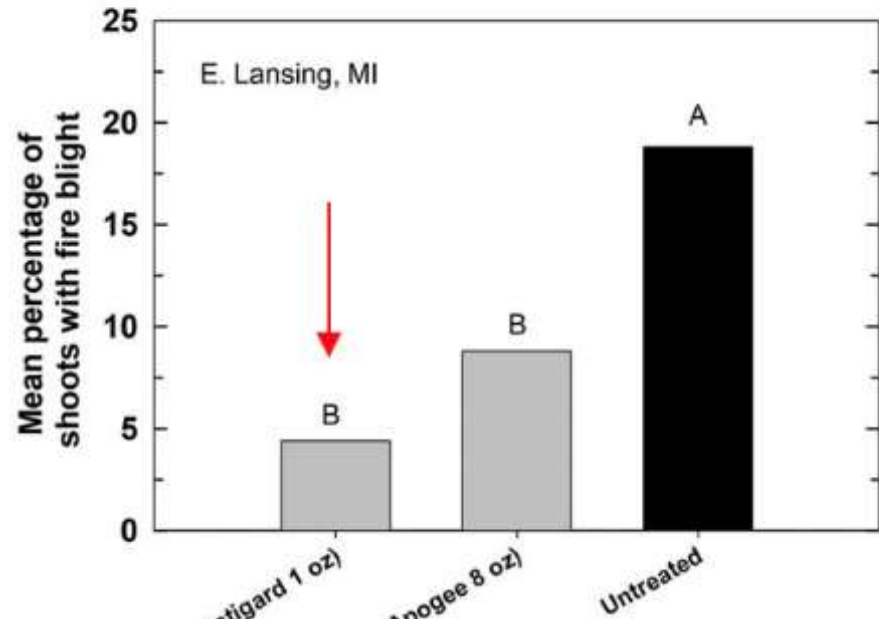
- Four weekly applications of Apogee (2 oz) + Actigard (1 oz).
- Tank mix the two products
- 1<sup>st</sup> application at king bloom petal fall.
- Widely adopted in Michigan.

George Sundin, MSU

# 2 oz Apogee + 1 oz Actigard experiments, MI and NY, 2019

George Sundin

Kerik Cox





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