



How does plant cultivar effect biopesticide efficacy?



Ryan Spelman

Advisor: Anissa Poleatewich

UNH Plant Pathology Lab



**University of
New Hampshire**

NH Agricultural
Experiment Station



What are biopesticides?

Biopesticides: “A type of pesticide derived from such natural materials as animals, plants, bacteria, and certain minerals”

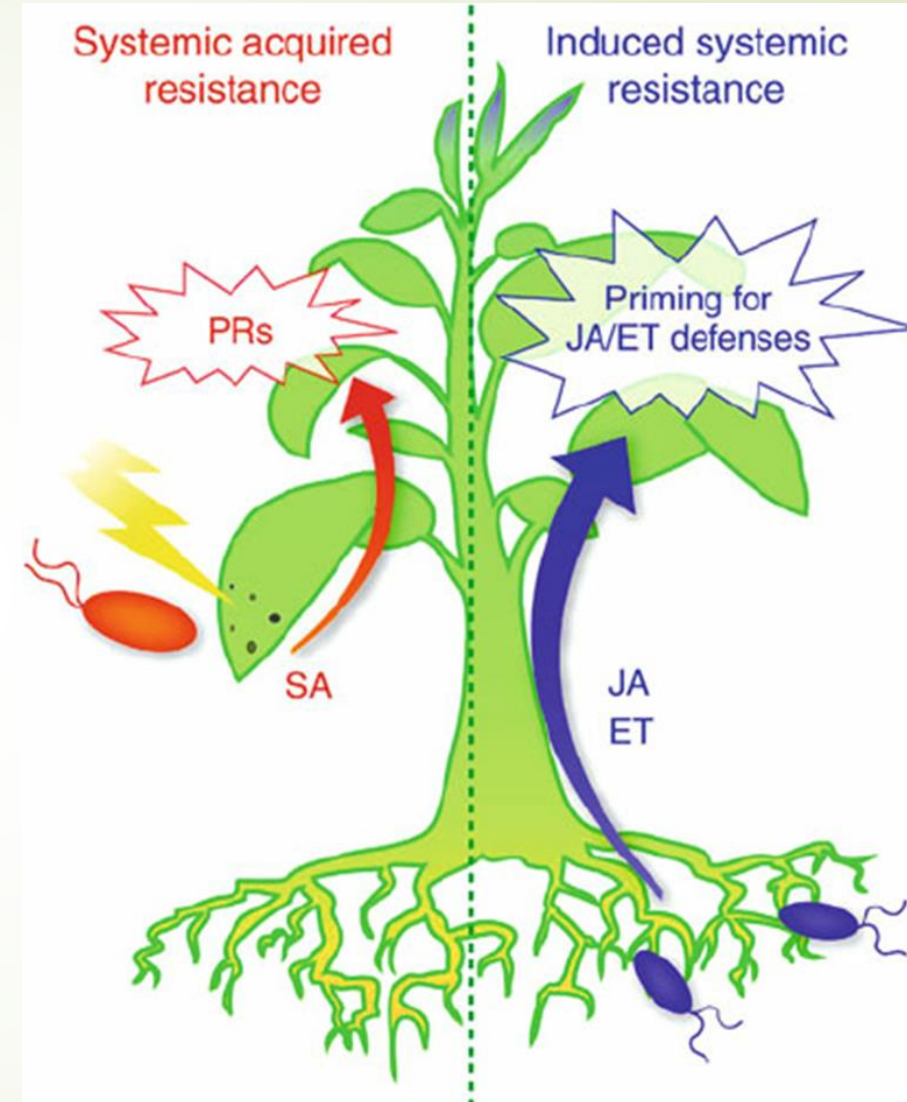
- Most effective at low/moderate disease pressure
- Often used preventatively

There are two major types of Biopesticides:

- **Biochemical pesticides** are naturally occurring substances which control pests typically through induction of systemic acquired resistance (SAR).
- **Microbial biopesticides** are derived from living microbes which suppress disease through several modes of action including activation of Induced Systemic Resistance (ISR).

Plant Defense Activators

- ▶ **Plant Defense activators** are a class of **Biopesticide**
 - ▶ Activate natural occurring defenses in the plant... "immune system"
 - ▶ Act preventatively to reduce disease pressure on plant, thus must be applied before pathogen attack
 - ▶ The cultivar of the plant may effect the efficacy of these products





Research question: Does cultivar affect plant defense activator efficacy?

6 biopesticides

- ▶ **LifeGard™** (*Bacillus mycooides*)
 - ▶ Applied as a 0.374 g/L **Foliar Spray**
- ▶ **Actigard®** (*Acibenzolar-S-methyl*)
 - ▶ Applied as 0.063 g/L **Drench**
- ▶ **Regalia®** (*Extract of Giant Knotweed*)
 - ▶ Applied as a 5 mL/L **Foliar Spray**
- ▶ **Hexanoic Acid**
 - ▶ Applied as a 0.12 g/L **Drench**
- ▶ **Pipecolic Acid**
 - ▶ Applied as a 0.13 g/L **Foliar Spray**

4 cucumber cultivars

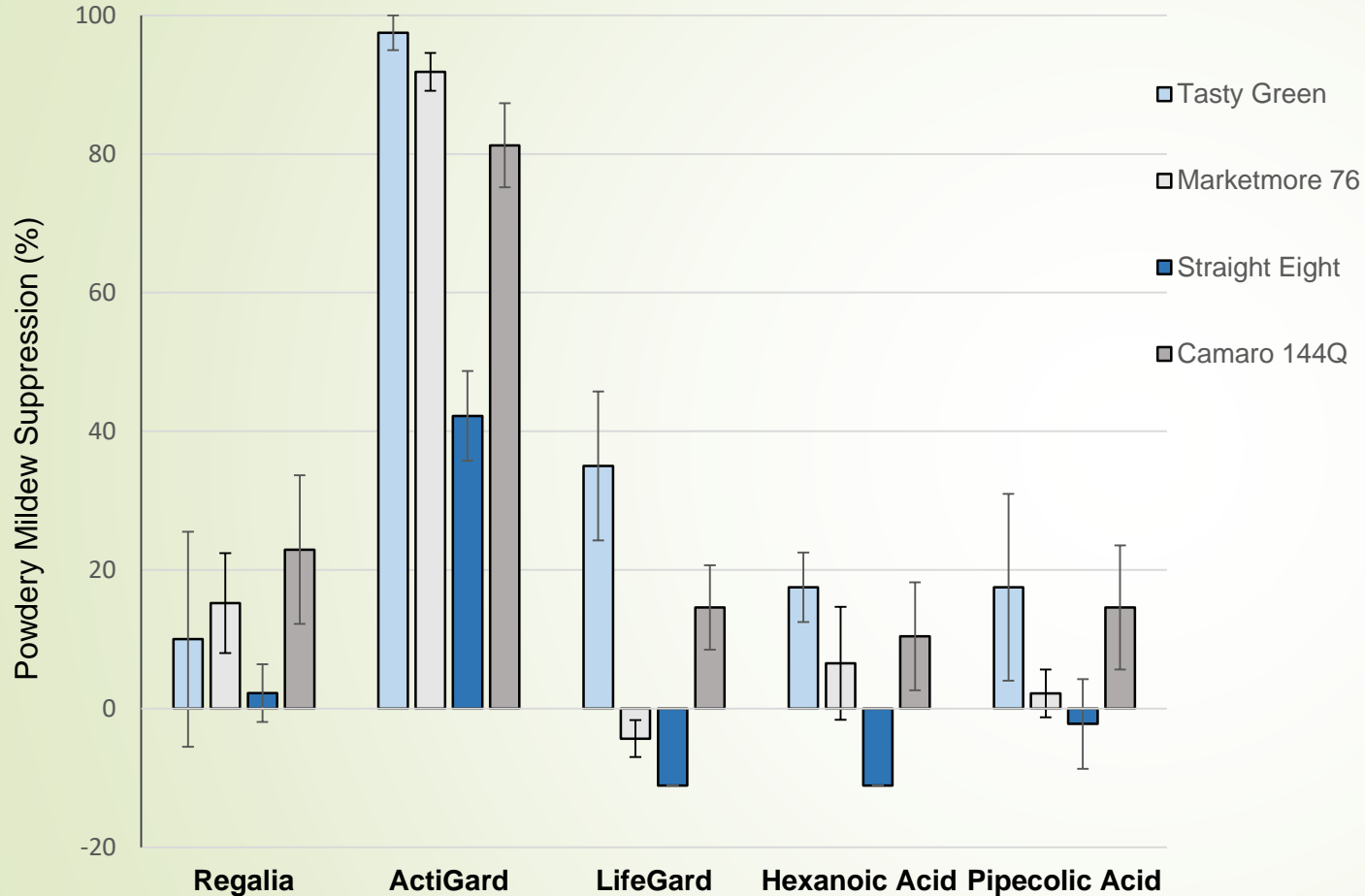
- ▶ Camaro (DeRuitter)
- ▶ Straight eight
- ▶ Marketmore (Cornell)
- ▶ Tasty Green (Sakata)

Model system for greenhouse experimentation

- ▶ Cucurbit Powdery Mildew
 - ▶ Oomycete (fungal like) pathogen with wind blown spores.
 - ▶ Superficial pathogen that infects leaf surfaces and can lead to chlorosis and reduced crop yield.
 - ▶ Chosen for experimentation due to fast colonization time and visible pathogen signs; easy to score disease.



Experiment 1: **One application** of biopesticide was made **48 hours** before pathogen challenge



How does cucumber cultivar effect biopesticide efficacy?

- Actigard® was the most effective plant defense activator

- Overall, there was an effect of cultivar on the efficacy of biopesticides



-Biopesticides were least effective in Straight eight, which is a susceptible variety to powdery mildew

Camaro

Marketmore

Straight Eight

Tasty Green

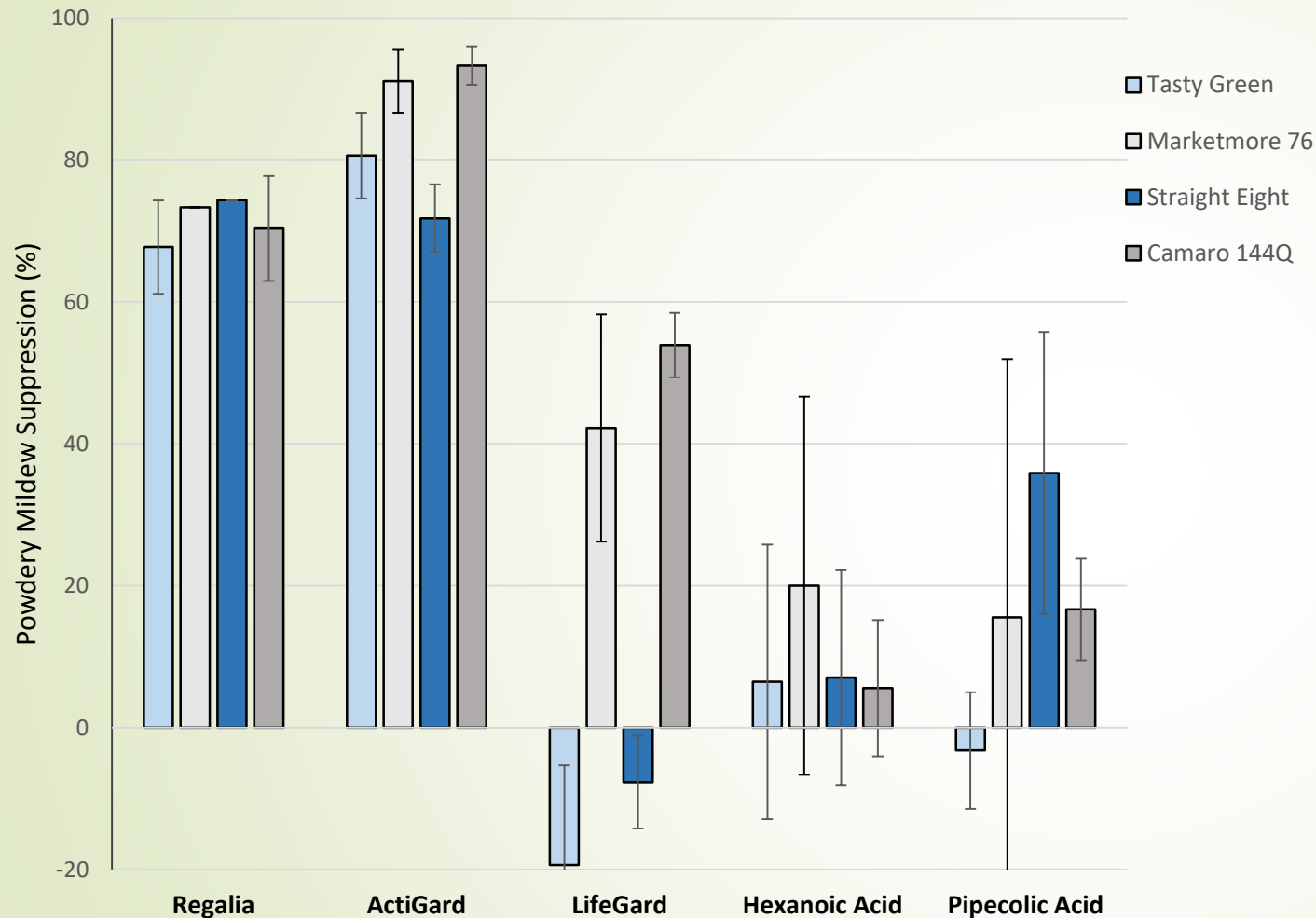
Actigard®

Water Control



In Actigard treatments, lower disease suppression occurred in Straight Eight versus Camaro, Marketmore, or Tasty Green

Experiment 2: **One application** of Actigard, **Three applications** of Regalia, LifeGard, Hexanoic acid and Pipecolinic Acid were applied.



3 applications: 9 days and 48 hrs before pathogen, and 3 days after challenge
1 application: 48 hrs before pathogen

- Cultivar effect was product dependent

- Observed enhanced efficacy of regalia applied 3x compared to exp experiment 1.

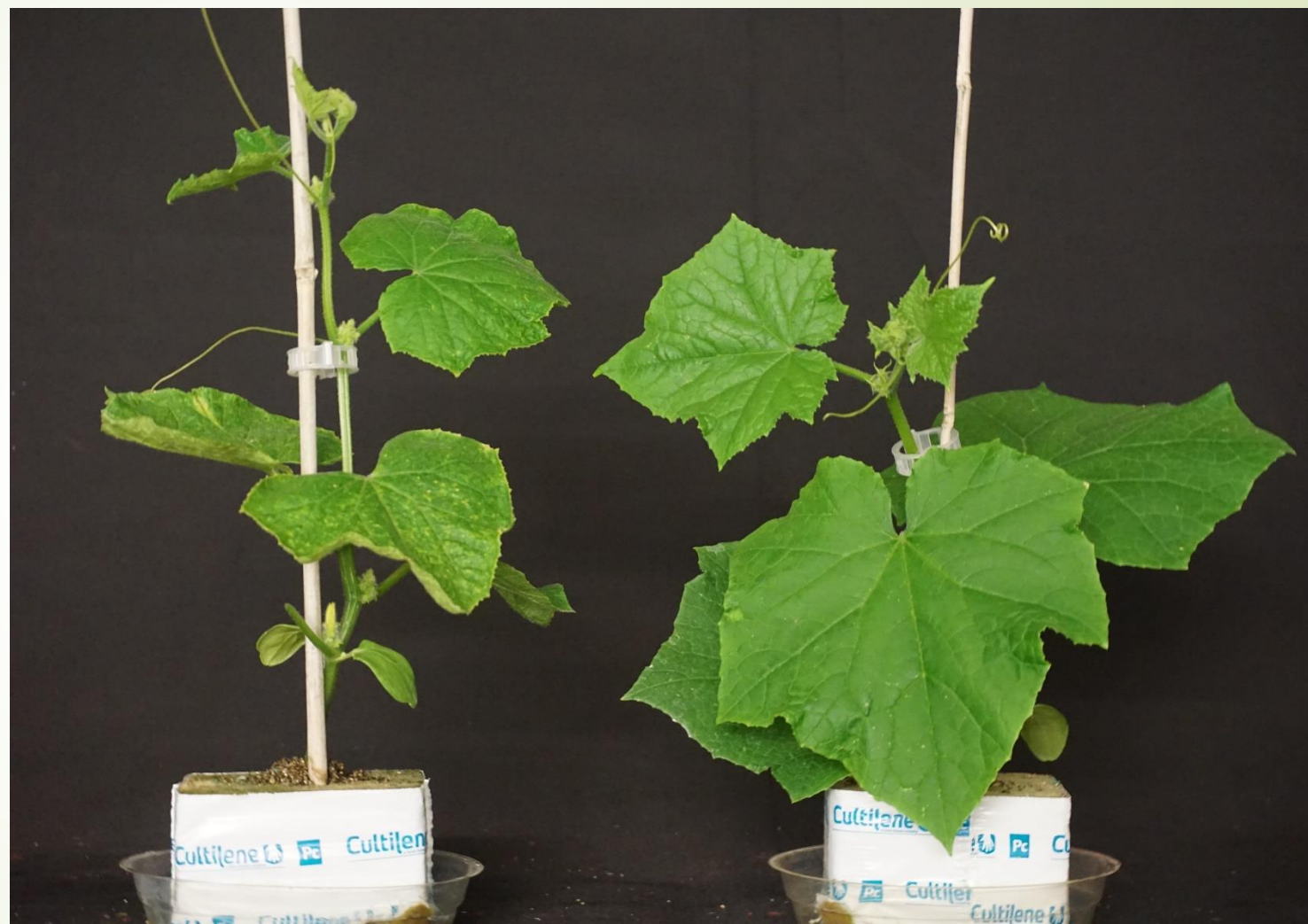
- There was an increase in the efficacy of LifeGard™ when applied over three applications in some cultivars

Biopesticide Limitations

- ▶ Some, particularly ActiGard®, exhibit phytotoxicity or growth reduction at higher rates
 - **Small amounts go a long way**
 - Consult the label!!
 - Test out before large scale use
 - **Age of the plant matters** (young plants may succumb to phytotoxicity more easily)
 - **Timing is important** – these are preventative pesticides and may require advanced application


Actigard (0.063 g/L)

Water





Take Aways

- ▶ Cultivar can impact the efficacy of plant defense activators; level of disease resistant is an important factor
 - ▶ Actigard® when applied 48 hours in advance was the most effective, however young plants were prone to stunting and phytotoxicity
 - ▶ Regalia® was another promising plant defense activator, but must be applied to plants earlier (at least a week before expected pathogen challenge)
 - ▶ Biopesticides, including plant defense activators are a promising tool to add to your IPM toolbox; they have the potential of reducing the amount of pesticides necessary during the growing season.
- 

Thank you to our supporters:

Anissa Poleatewich

Luke Hydock

David Goudreault

Amber Kittle

Liza DeGenring

Madie Hassett

This work was supported by the New Hampshire Agricultural Experiment Station project #NH00662-R and the Hubbard Fellowship



Visit us at unhppath.weebly.com



@UNHppathlab