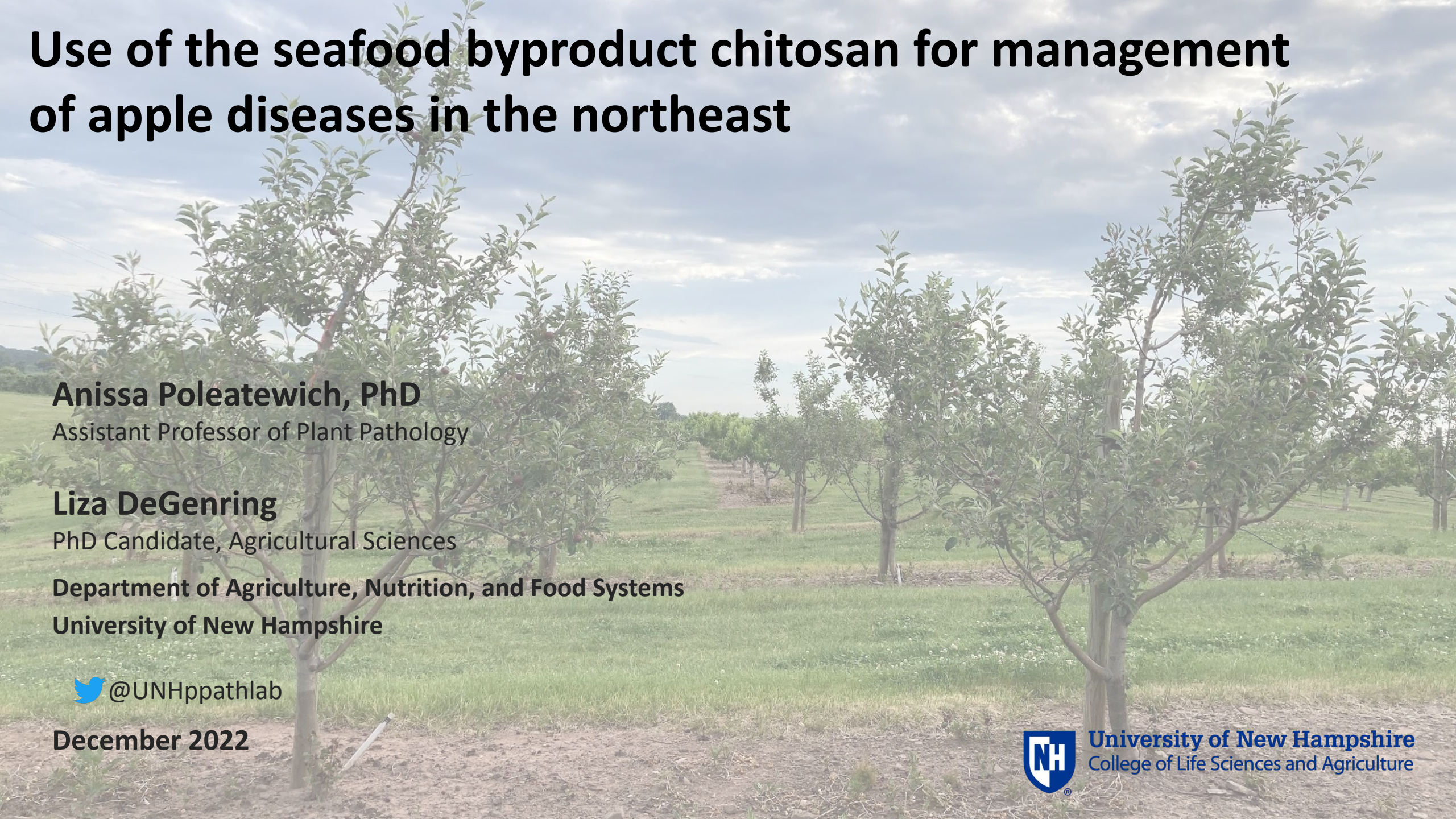
Use of the seafood byproduct chitosan for management of apple diseases in the northeast



Anissa Poleatewich, PhD
Assistant Professor of Plant Pathology

Liza DeGenring
PhD Candidate, Agricultural Sciences

Department of Agriculture, Nutrition, and Food Systems
University of New Hampshire

@UNHppathlab

December 2022

University of New Hampshire
College of Life Sciences and Agriculture

The Integrated Pest Management Approach for Plant Health

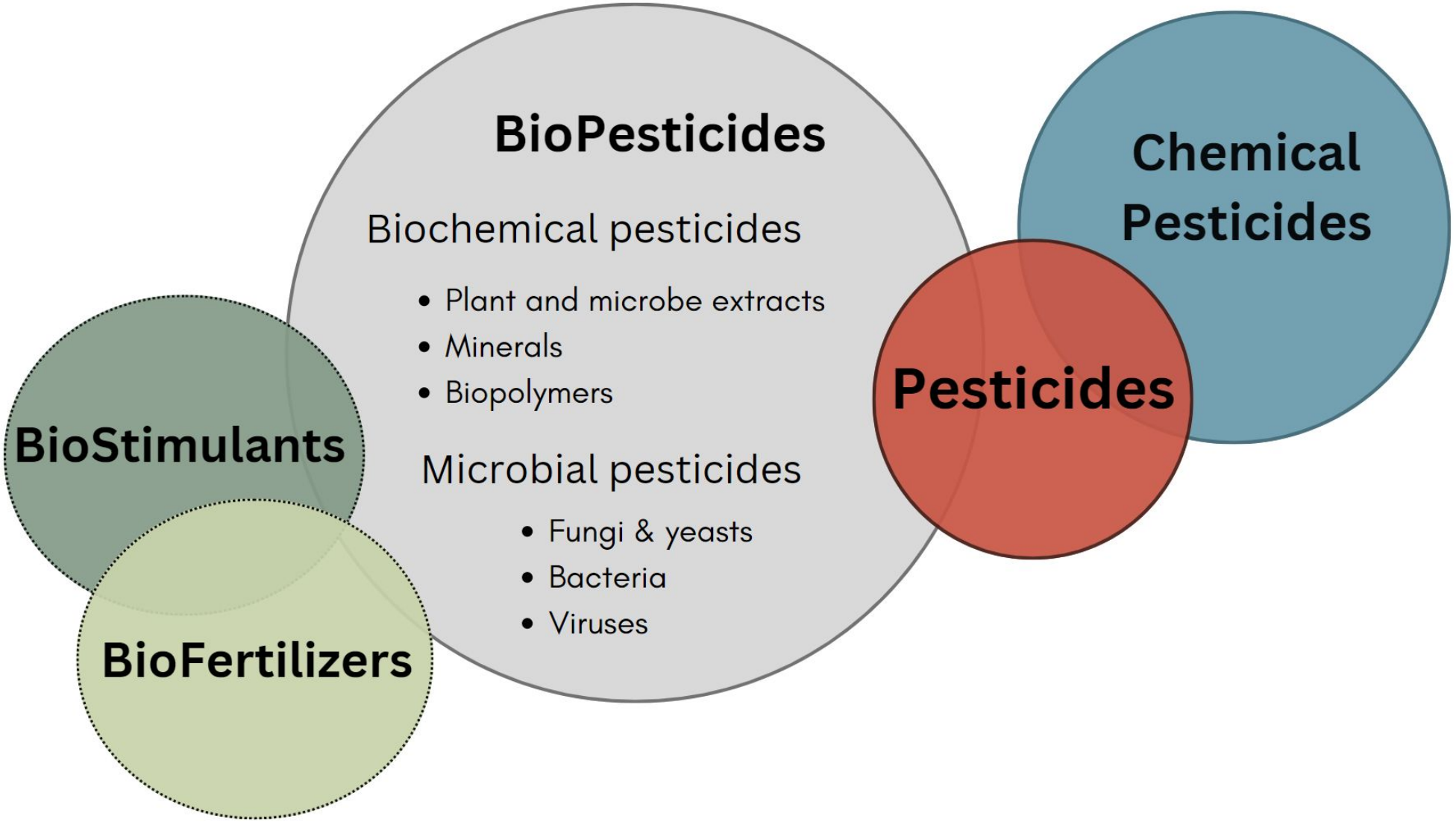
IPM is a science-based decision-making process that combines several tools…

biological | cultural | physical | chemical

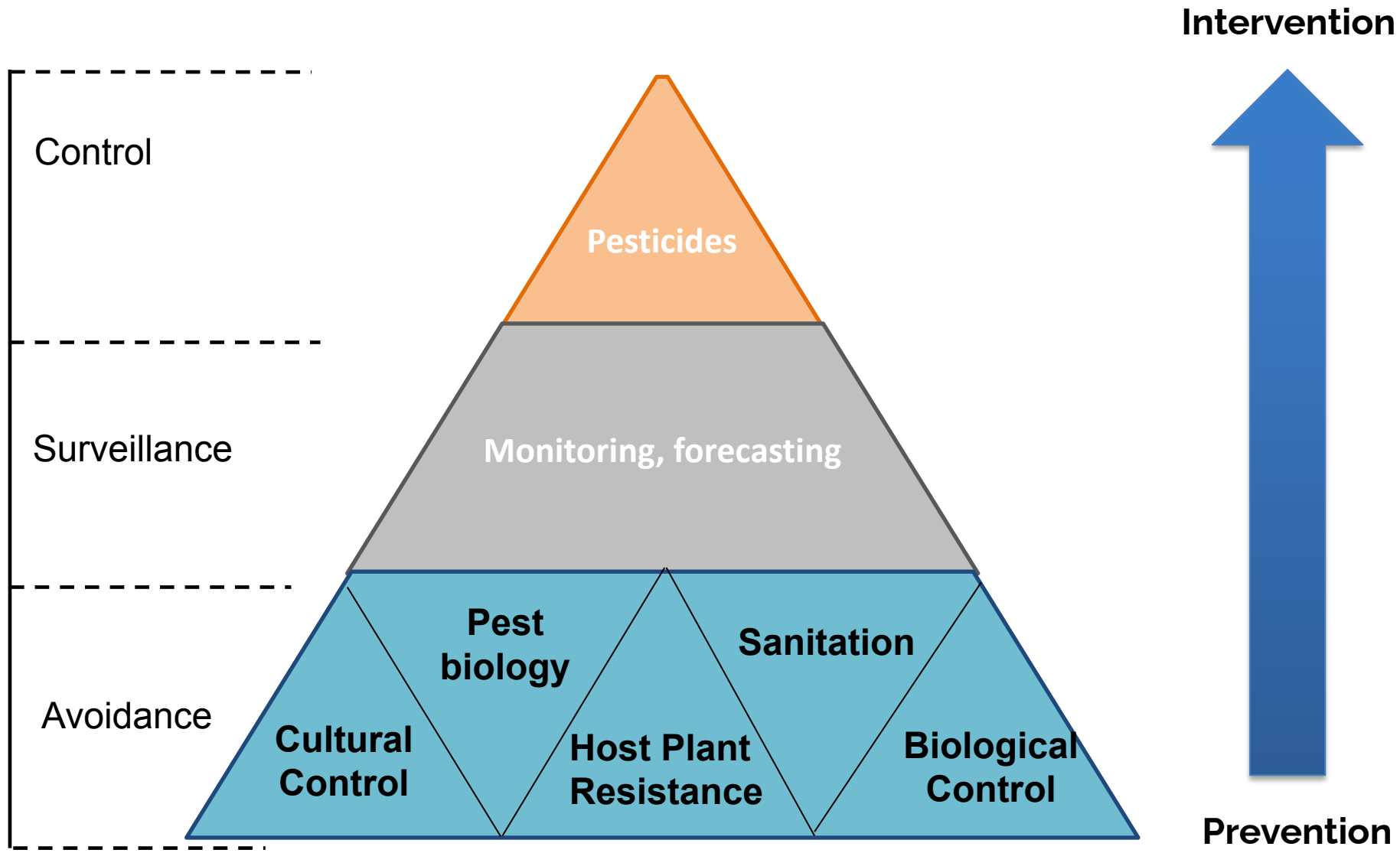
to manage and reduce risk from pests/pathogens in a way that minimizes economic, health, and environmental risk.

Minimize pesticide resistance!

The IPM toolbox – hammers and nails



Biologically based strategies are important IPM tools

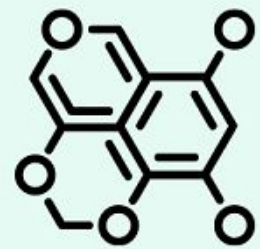


Biopesticides

Microbial metabolites

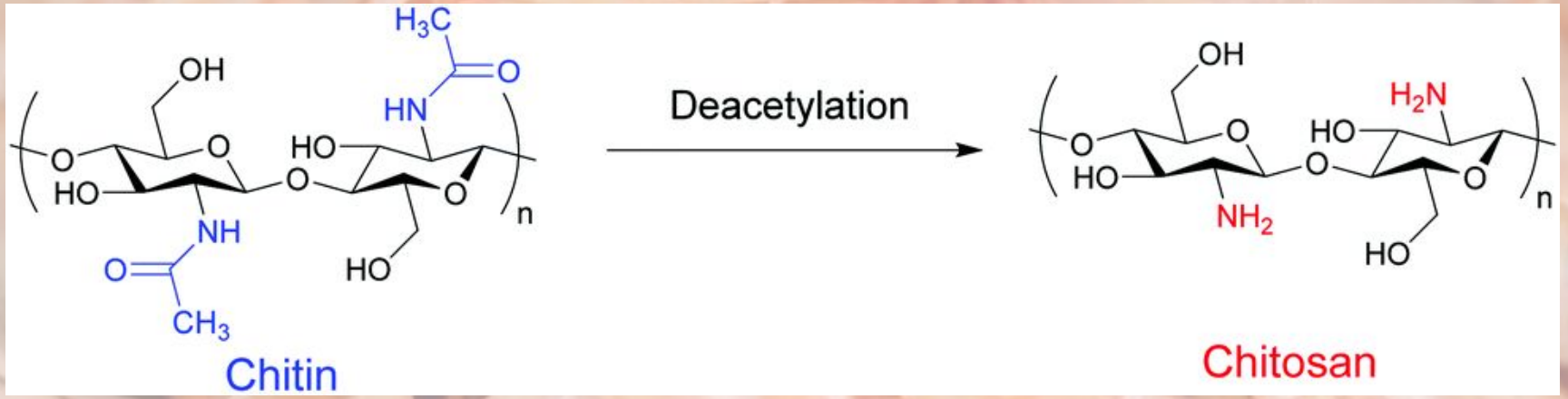
Microbes

Plant extracts



Natural compounds

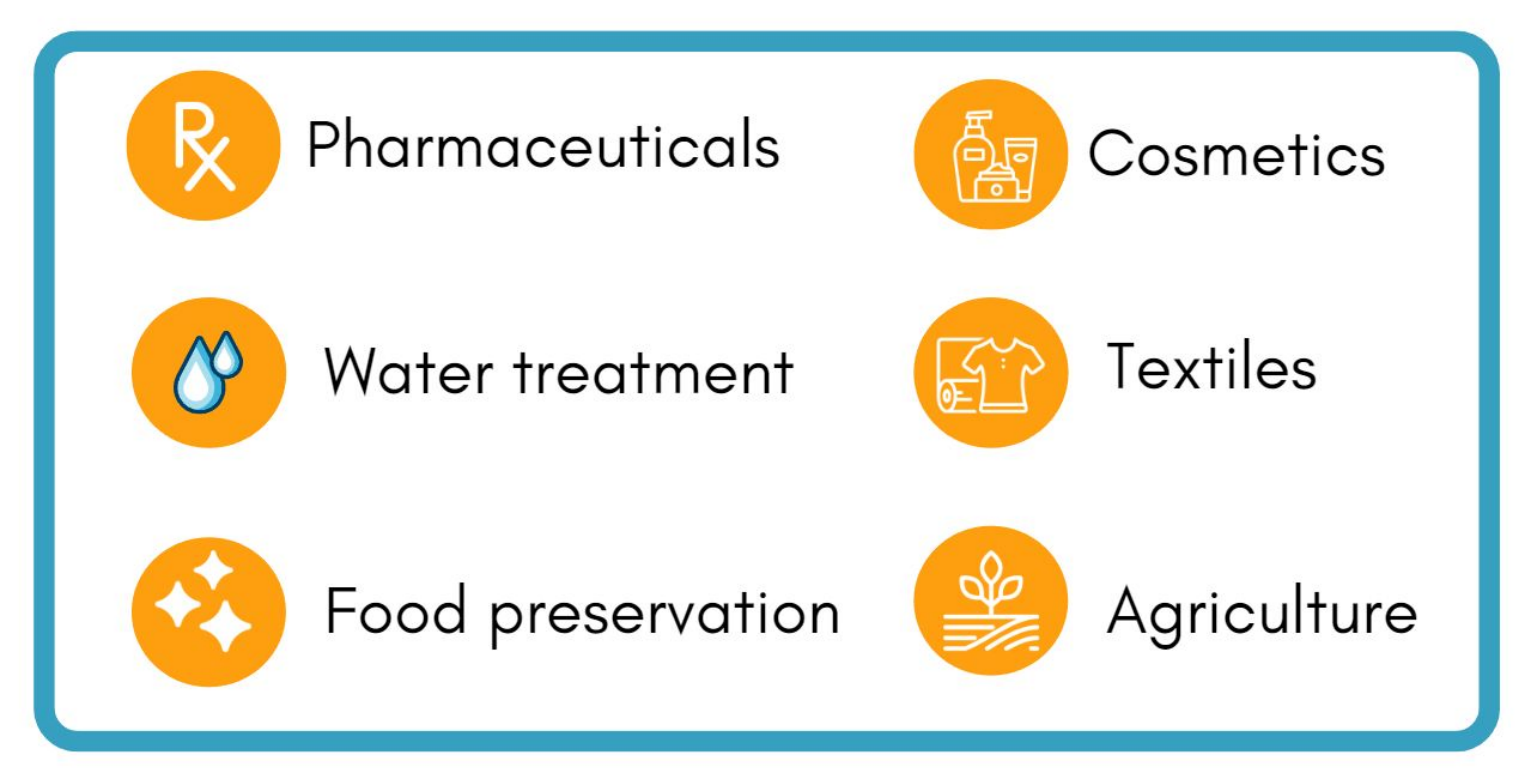
Chitin is one of the most abundant polymers on earth



Chitosan is synthetically made from chitin

Jin et al. 10.1039/D0NH00696C

Chitosan is used for many industrial applications

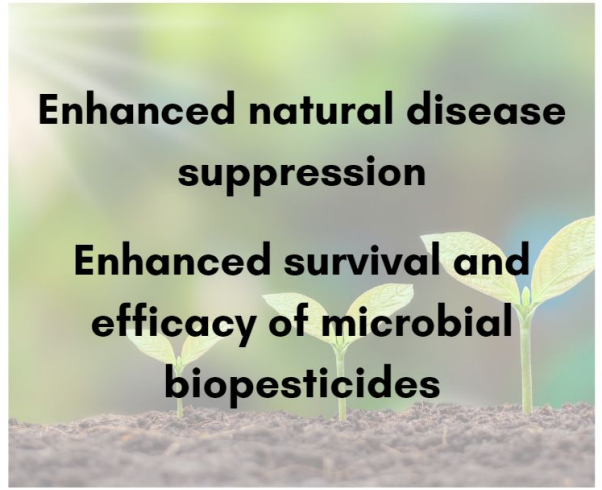


Use of chitosan in crop protection

Chitosan is component of all insect & crustacean exoskeletons and the cell walls of fungi

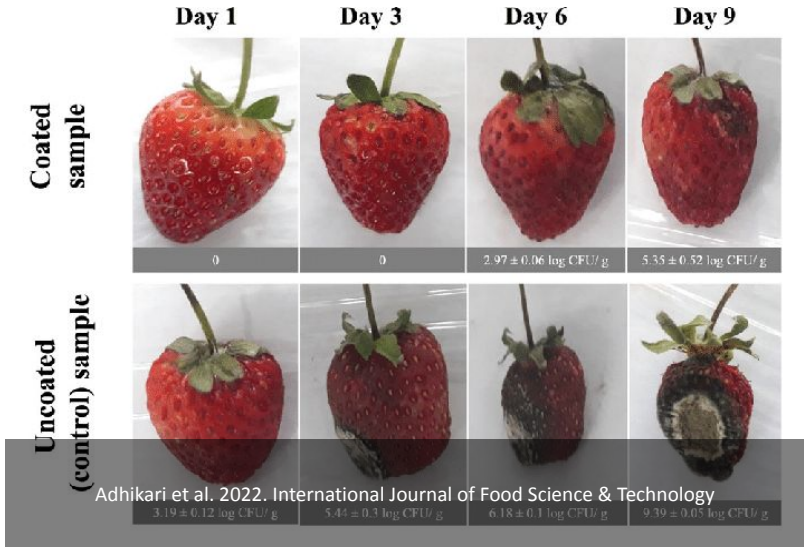
- Induces plant defense responses
- Direct inhibition of fungal growth
- Stimulates production of anti-microbial enzymes by microbes
- Food source for biocontrol microbes

Benefits of using chitosan



Infographic by A. Poleatewich via Canva

Živković et al. 2018. Pestic. Phytomed



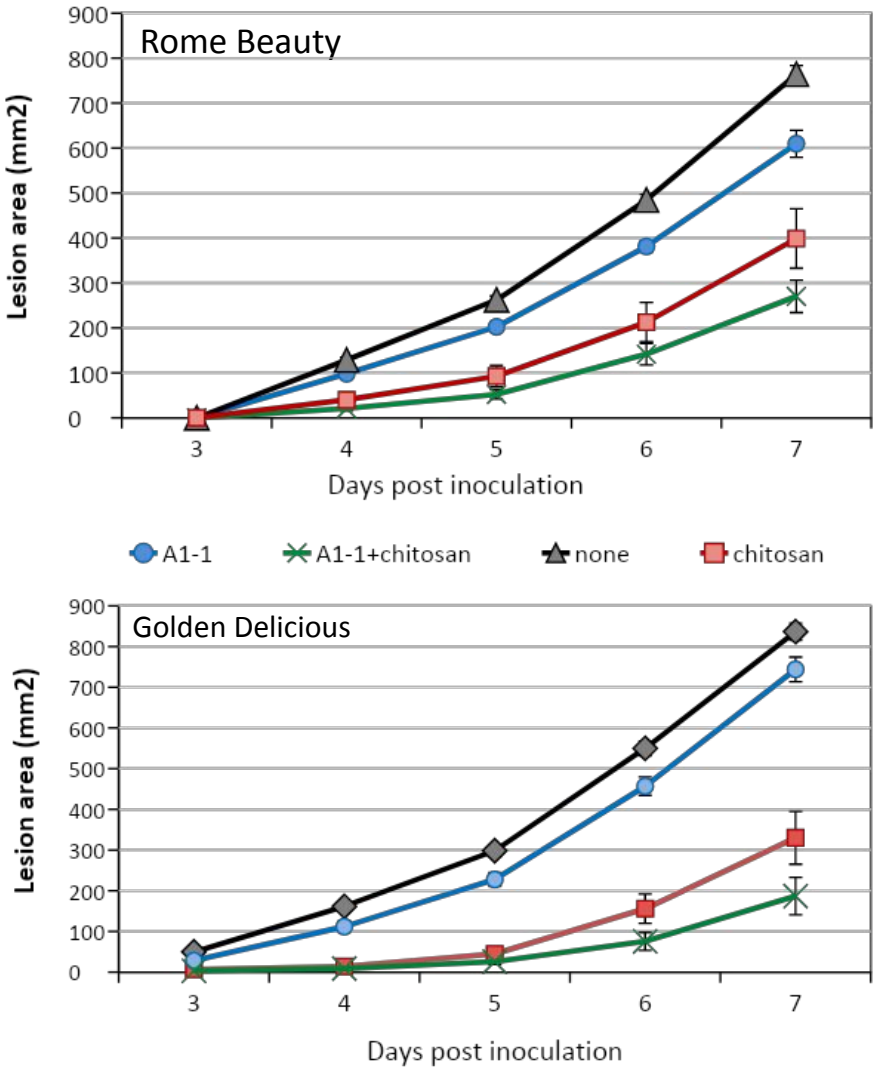
Adhikari et al. 2022. International Journal of Food Science & Technology

Chitosan can reduce postharvest rots and extend shelf life

Chitosan research at UNH…a long time in the making

Chitosan reduced postharvest disease in preliminary experiments conducted in 2010 and showed potential to enhance biocontrol agent efficacy

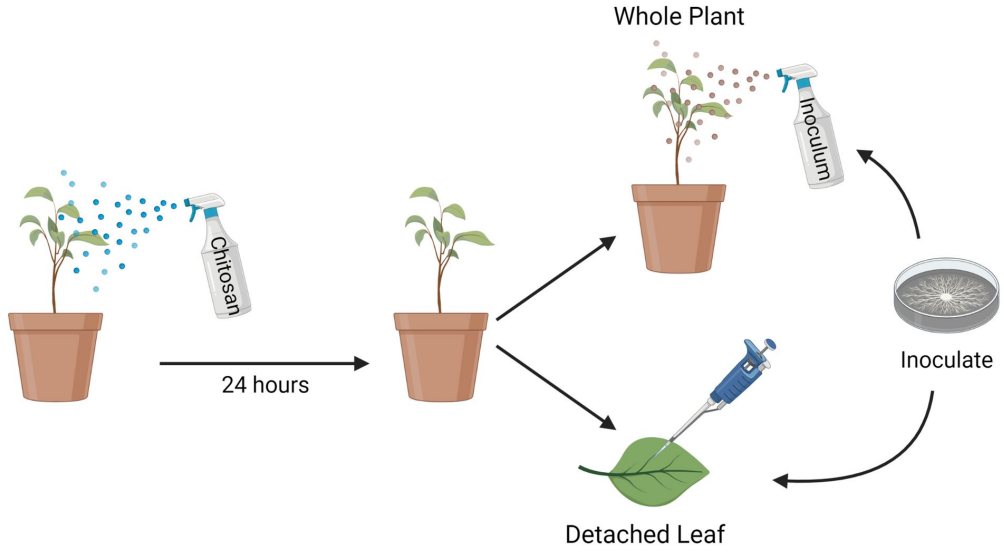
Why the gap from 2010 to 2020?

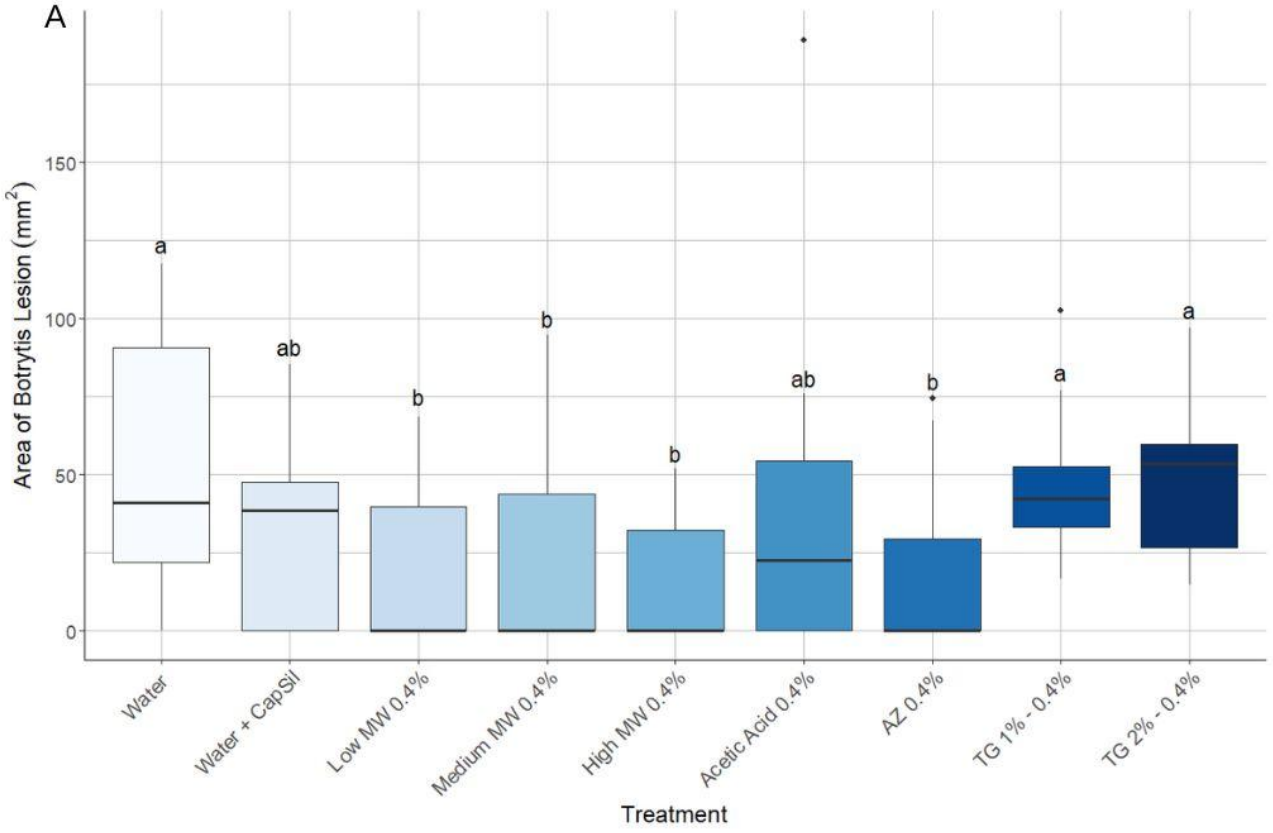


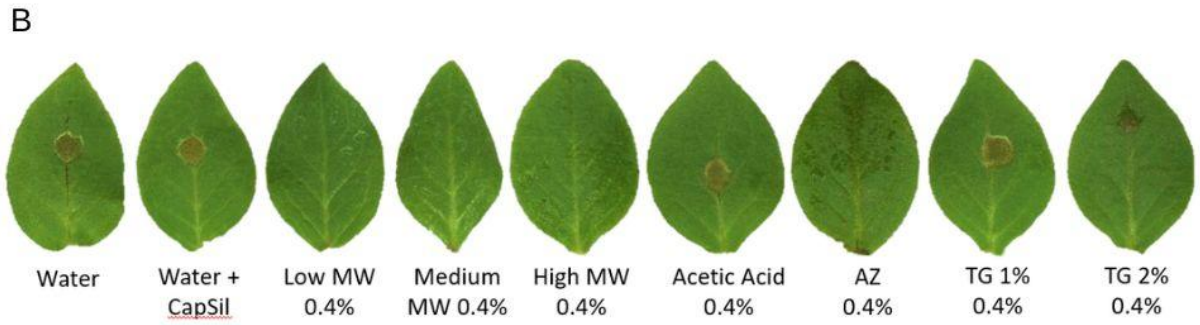
Poleatewich. 2010. Doctoral thesis.

Chitosan research at UNH

When applied to leaves chitosan can reduce severity of Botrytis gray mold on petunia

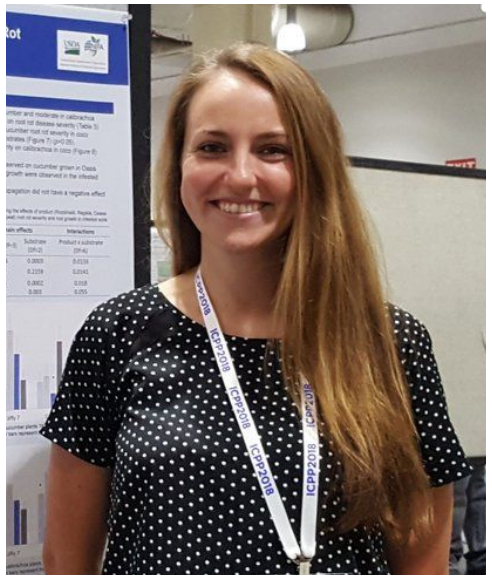






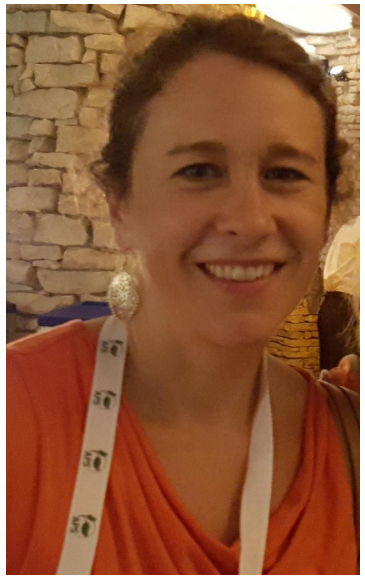
DeGenring et al. 2022. Plant Disease.

Can the seafood byproduct chitosan help suppress disease in the orchard?



Liza DeGenring
UNH PhD student

Kari Peter
Penn State Tree Pathologist



Anissa Poleatewich
UNH Plant Pathologist

Can the seafood byproduct chitosan help suppress disease in the orchard?

1. Examine the efficacy of foliar application of chitosan to reduce severity of apple scab and summer rot diseases

2. Investigate the potential to improve biopesticide efficacy in reducing apples diseases through co-application with chitosan

Chitosan products evaluated

ARMOUR-Zen
PROVEN NATURAL SCIENCE

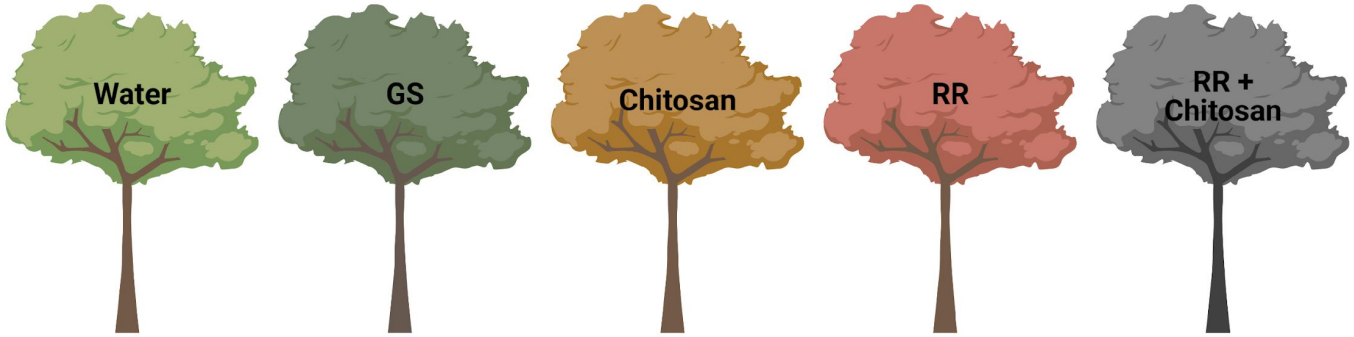
BOTRYZEN 2010 LTD
proven natural science

Tidal Grow®
AgriScience

Tidal Vision
From the Ocean,
For the Ocean.

UNH-Penn State Research Project

Research was conducted at the Penn State Fruit Research and Extension Center 2020-2022



Treatment	Trade Name (*Active Ingredient*)	Rate (per acre)	Timing[1]
Water Control	Water	--	TC-10C
Grower Standard	Manzate Pro-Stick (*Mancozeb*) Captan Gold (*Captan*) Luna Sensation (*Fluopyram and Trifloxystrobin)* Inspire Super (*Difenoconazole and Cyprodinil*) LI 700 (*Penetrant*)	1361 g (3 lb) 1134 g g (2.5 lb) 184 mL (5 fl oz) 355 mL (12 fl oz) 473 mL (1 pint)	TC-1C TC, 2C-10C P, FB PF, 1C 2C-10C
Chitosan	Tidal Grow (*2% Chitosan*)	473 mL	TC-10C
Reduced Risk	Microthiol Disperss (*Sulfur 80%*) Serenade ASO (*Bacillus subtilis* strain QST 713)	4536 g (10 lb) 3785 mL (4 qt)	TC-PF 1C-10C
Reduced Risk + Chitosan	Microthiol Disperss (*Sulfur 80%*) Serenade ASO (*Bacillus subtilis* strain QST 713) Tidal Grow (*2% Chitosan*)	4536 g (10 lb) 3785 mL (4 qt) 473 mL	TC-PF 1C-10C TC-10C

Chitosan and overwintering ascospores

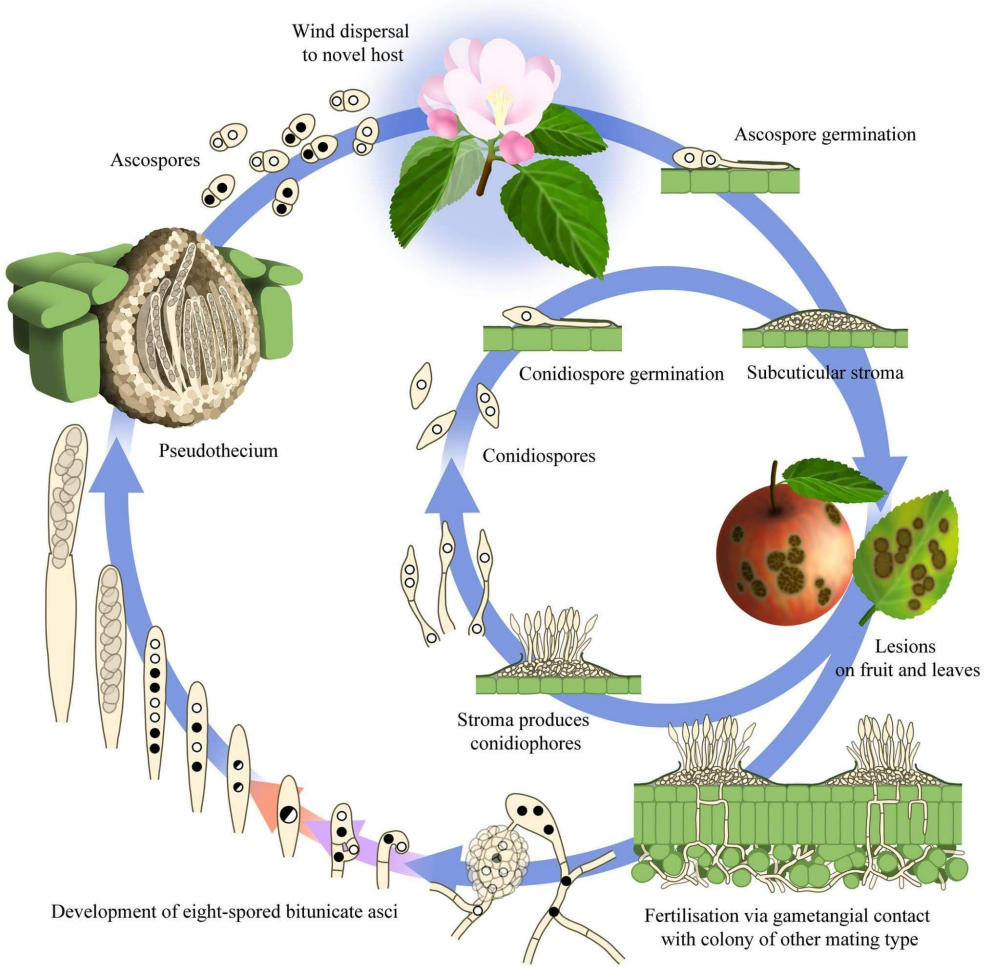
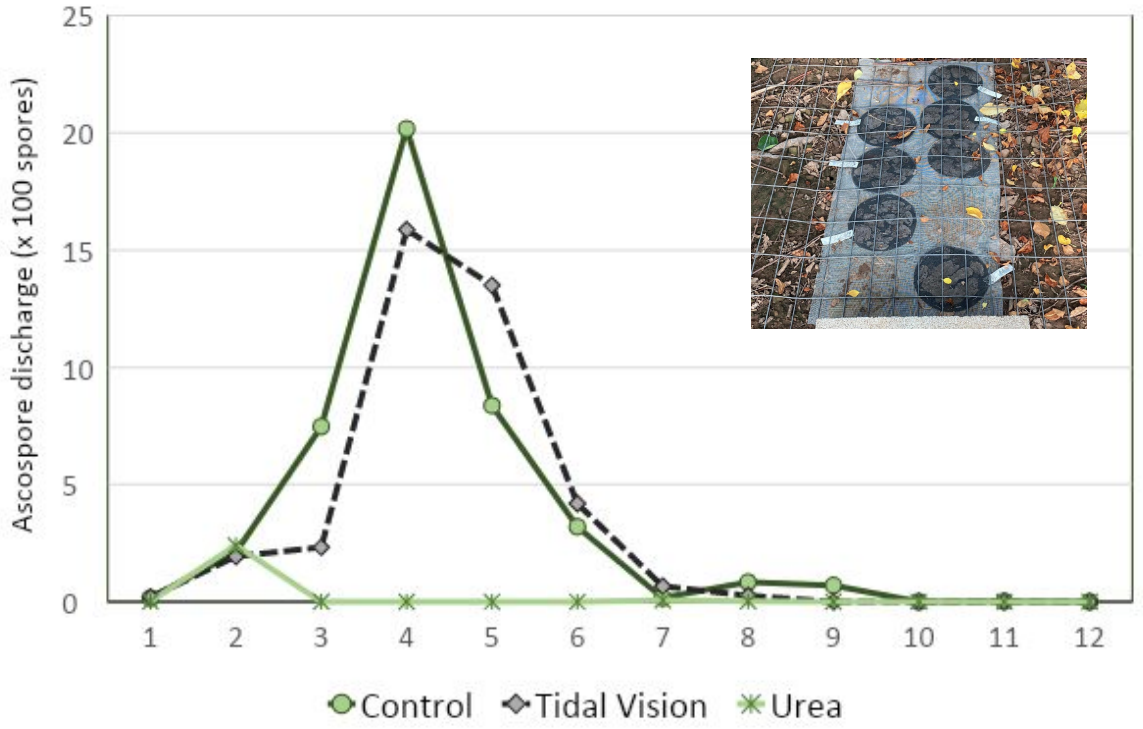
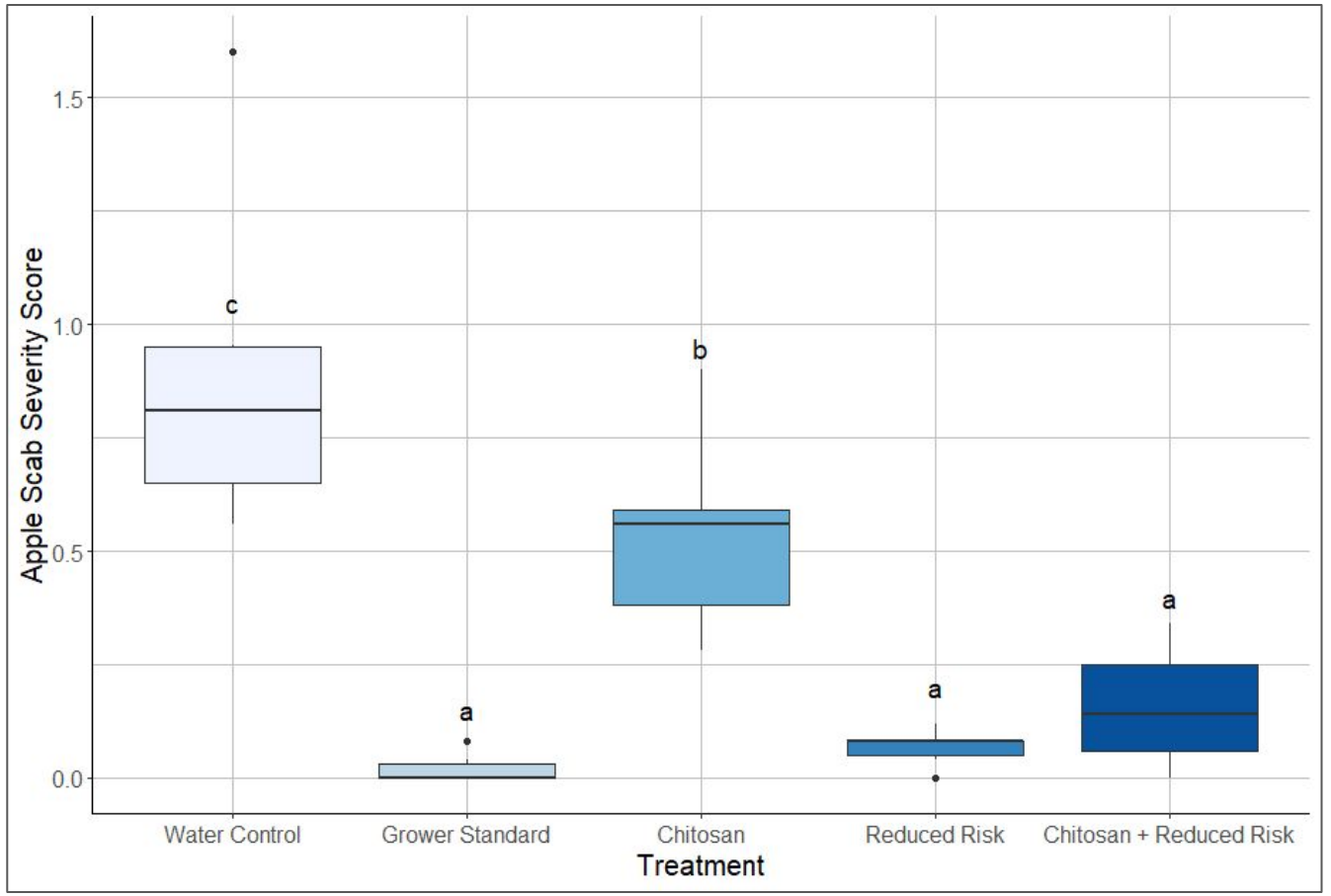


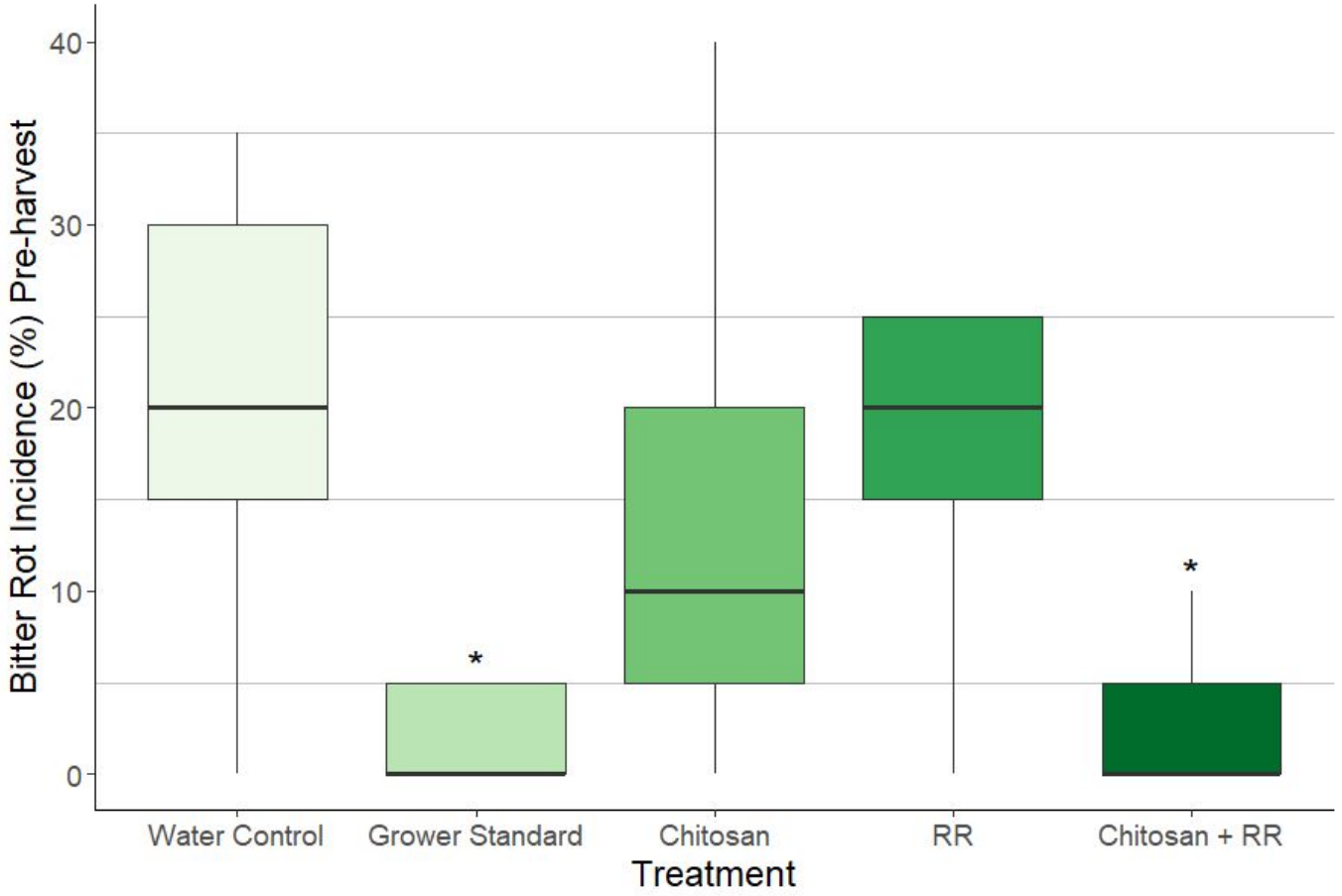
Illustration from Fungal Biodiversity edited by Crous, Verkley, Groenewald, & Houbraken



Chitosan and the chitosan + biopesticide treatments reduced severity of foliar scab and fruit scab

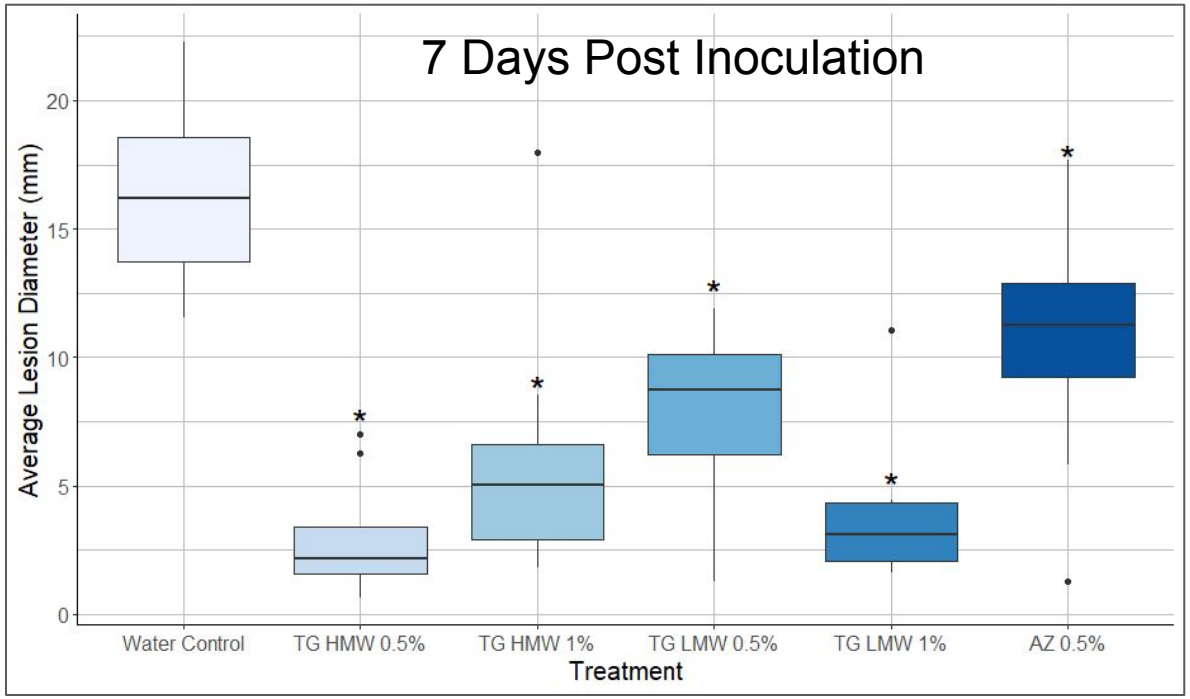


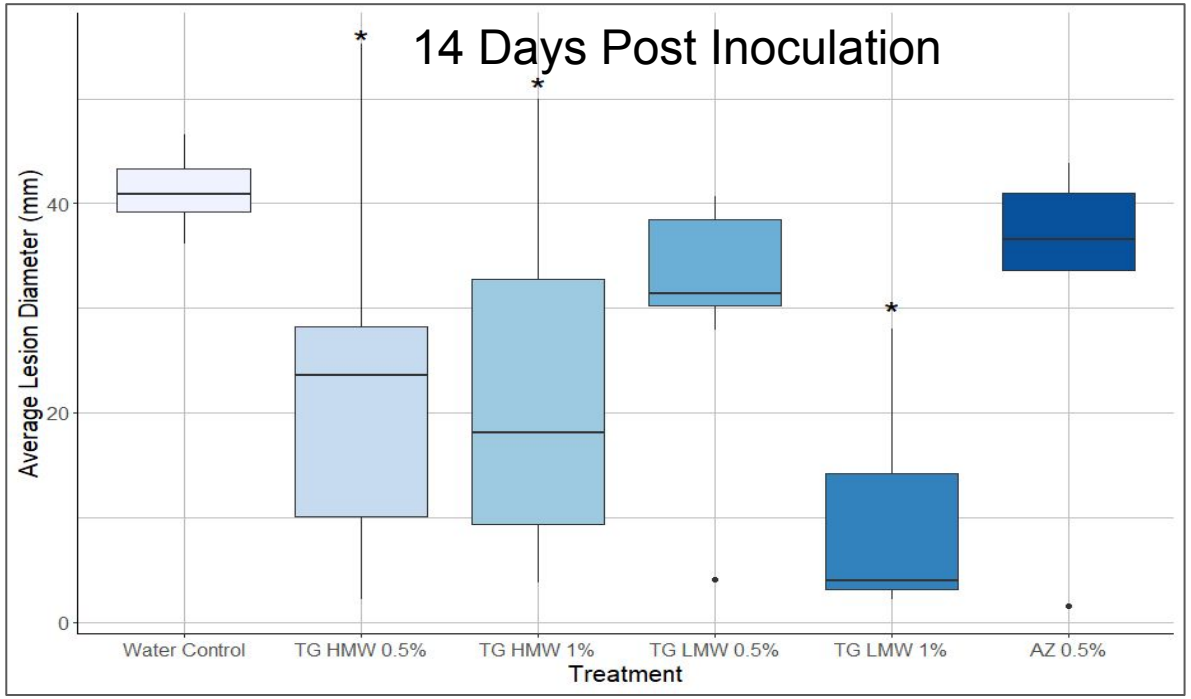
Chitosan + biopesticide reduced incidence of latent bitter rot



Chitosan reduced severity of postharvest rots

Bitter rot (*Colletotrichum fioriniae*)



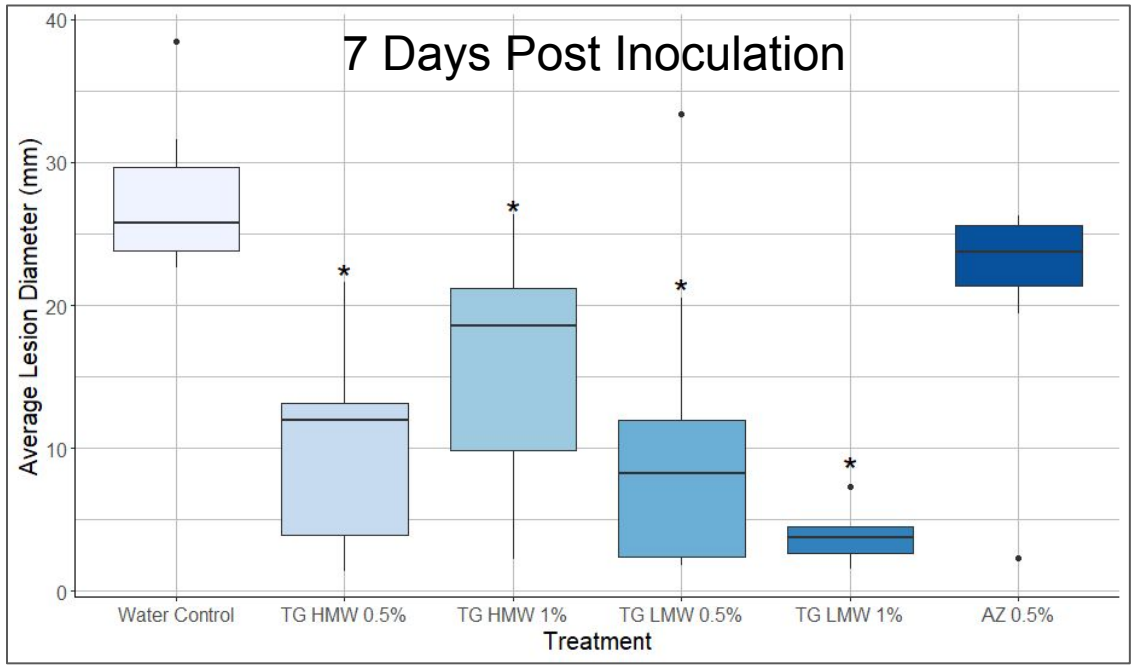


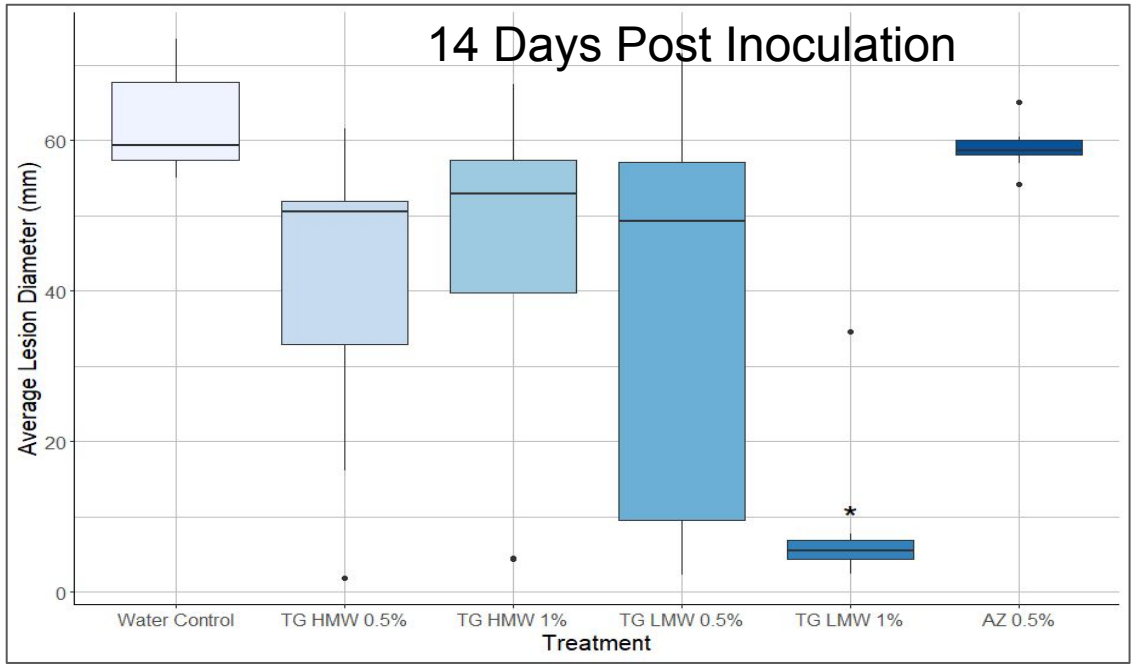
Water Control

Tidal Grow LMW 1%

Chitosan reduced severity of postharvest rots

Blue mold (*Penicillium expansum*)





Water Control

Tidal Grow LMW 0.5%

Tidal Grow LMW 1%

What to learn more?

Visit Liza DeGenring's poster on Wednesday afternoon

Acknowledgements

Collaborators:

Kari Peter, Penn State University

Tidal Vision

BotryZen

Students and technicians:

Liza DeGenring, Cameron Mehalek, Allie Wilford, Martina Florian

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Sustainable Agriculture Research & Education

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