

# BioControl in the Greenhouse

## January 30, 2015

BioControl in the Greenhouse

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2:30 to 2:55 Eastern

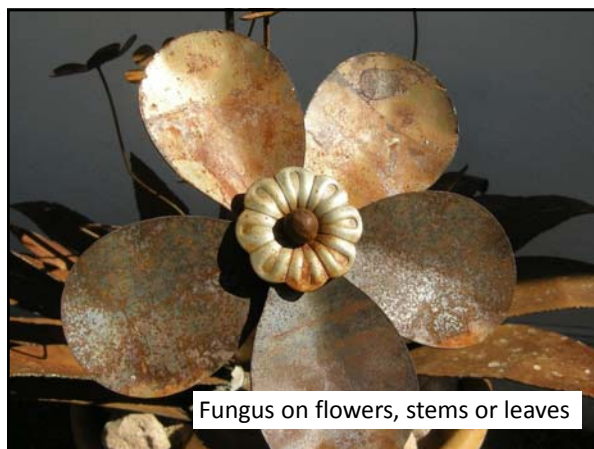
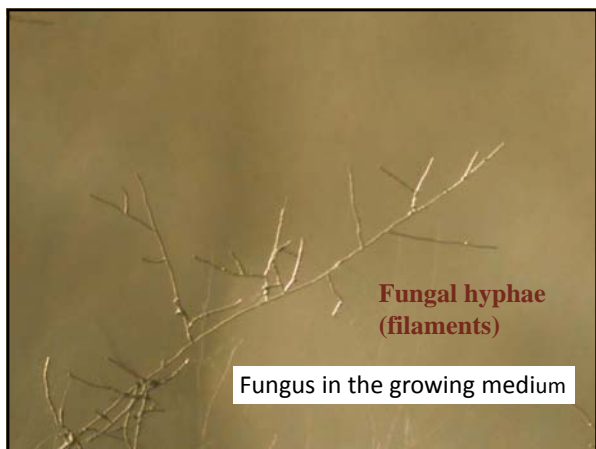
### THE FUNDAMENTALS OF BIOCONTROL OF FUNGAL AND BACTERIAL DISEASES



Margery Daugherty  
Cornell University  
mdd4@cornell.edu

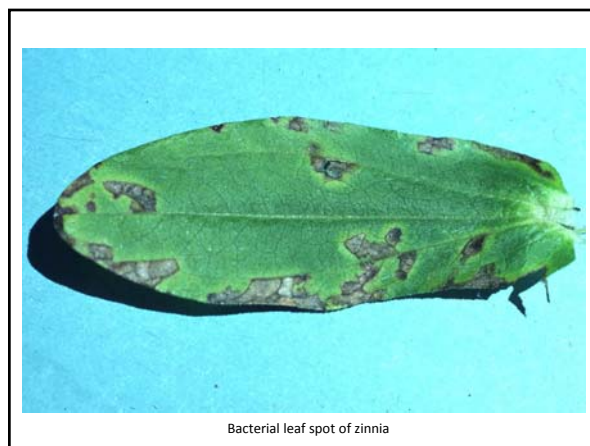
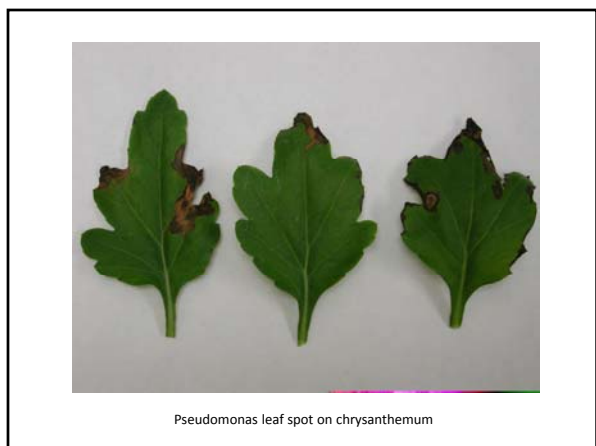
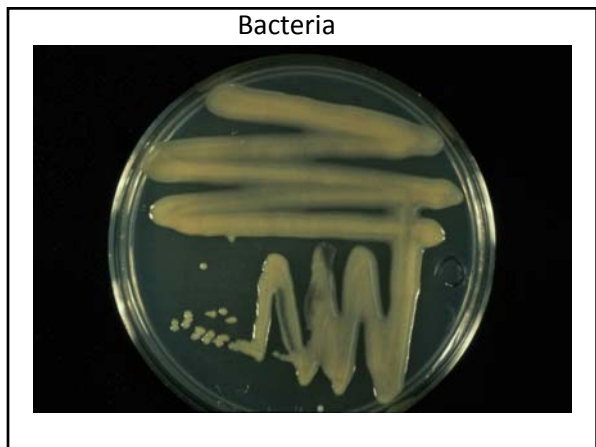
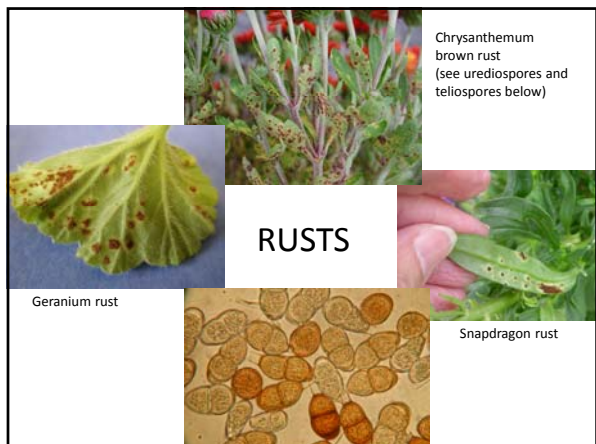


**Biologicals=**  
**microbe vs.**  
**microbe**

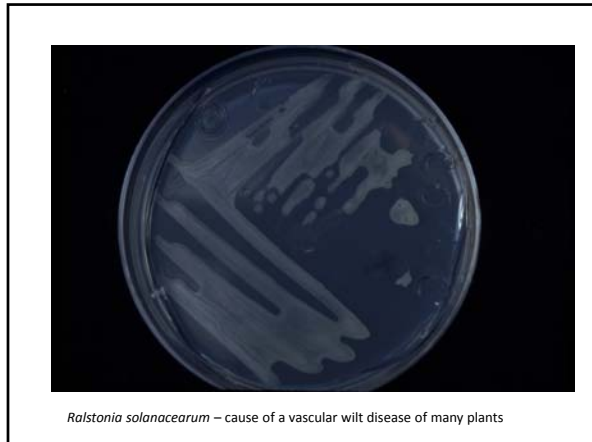


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**BioControl in the Greenhouse**  
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Biological control is sending your team in to protect against fungi and bacteria that cause disease



**Biologicals= Microbe vs Microbe**

Unlike biocontrol of insects, Biocontrols for disease mgt are regulated by EPA

Biopesticides – derived from natural materials: animals, plants, fungi, bacteria + certain minerals

- EPA Biopesticide Categories:**
1. Microbial – [beneficial bacteria and fungi](#) included here
  2. PIPs – plant incorporated bioprotectants (e.g. Bt)
  3. Biochemical pesticides (like pheromones) – no such tricks for disease management



## BioControl in the Greenhouse January 30, 2015

### Biologicals for Disease Management

- ✧ Use preventively
- ✧ Using them is NOT like using a chemical
- ✧ Different from using insect parasites and parasitoids

How do they work?

#### Different Modes of Action:

- *Competitive exclusion*  
"First come, first served"
- *Predation*
- *Antagonistic metabolites*
- *Nutrient competition*
- *Stimulate plant defense*

*Thus not prone to triggering resistance!*

### Common Biocontrol Organisms

#### Fungi

*Trichoderma* species

#### Bacteria

*Bacillus* species

*Streptomyces* species

Microbe  
Vs  
Microbe

Fortés of Bioantagonists:

*Trichoderma* vs. fungi

*Streptomyces* vs. fungi

*Bacillus* vs bacteria and fungi

Prey for the Biocontrols . . .

(the diseases you want to prevent!)

**ESPECIALLY GOOD against PM**



Gerbera leaf coated with powdery mildew fungus

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### FOLIAR BIOCONTROL PRODUCTS

**Mycostop** - *Streptomyces griseoviridis* K61 – AgBio OMRI  
**Actinovate** – *S. lydicus* – Nat’l Industries OMRI

**Cease** - *Bacillus subtilis* QST713 – Bioworks OMRI  
**Companion Biological Fungicide** (2-3-2 L)– *B. subtilis* GB03 - Growth Products ISR, antibiotic + auxin-like metabolites 0-4 hr REI Growth Products (not OMRI)

**DoubleNickel 55** Biofungicide (*B. amyloliquefaciens* D747) Certis OMRI

### BIOCONTROL PRODUCTS For DRENCH/MIX

**RootShield G, WP** – *Trichoderma harzianum* T-22 and  
**RootShield Plus** – *T. harzianum* + *T. virens* – Bioworks OMRI  
**BIO-TAM** – *T. asperellum* + *T. gamsii* – AgraQuest (not OMRI)

**Mycostop** - *Streptomyces griseoviridis* K61 – AgBio OMRI  
**Actinovate, Actino-Iron** – *S. lydicus* – Nat’l Industries OMRI

**Cease** - *Bacillus subtilis* QST713 – Bioworks OMRI  
**Companion Biological Fungicide** – *B. subtilis* GB03 - Growth Products (not OMRI)

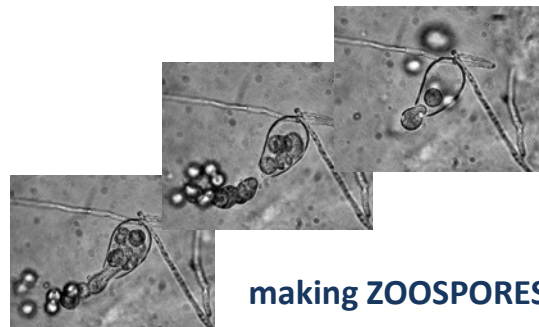
**DoubleNickel 55** Biofungicide (*B. amyloliquefaciens* D747) Certis OMRI

**Pro-Mix with Biofungicide** (*B. pumilis* GHA-180)– Certis (not OMRI)

### Also tackle SOILBORNE PROBLEMS:



### *Phytophthora cryptogea*



### SOILBORNE PROBLEMS: e.g. *Phytophthora* on lavender

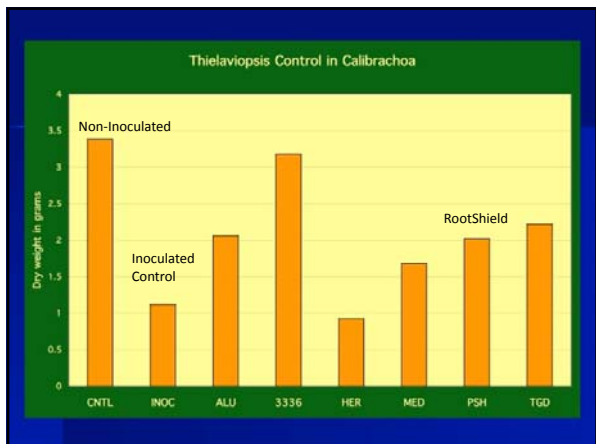


### SOILBORNE PROBLEMS: e.g. *Thielaviopsis basicola* on calibrachoa



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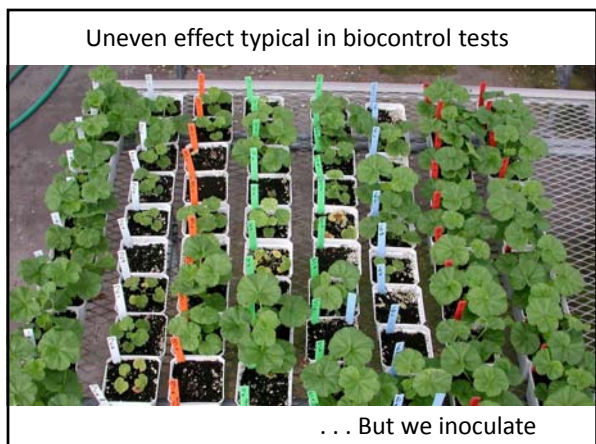
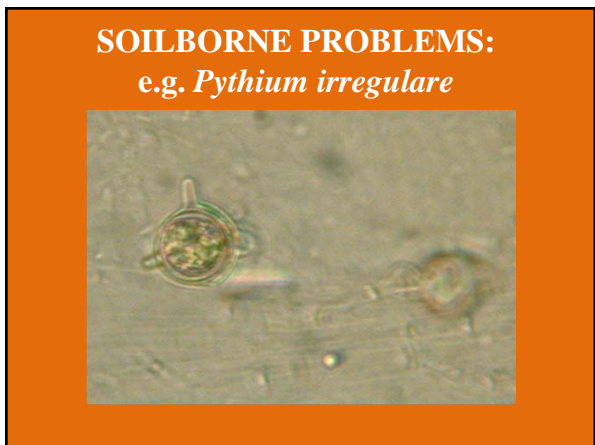
## January 30, 2015



Pro-Mix BX/HP Biofungicide +  
 Mycorrhizae [BRK, BRK20 & LP15]  
 (*B. pumilis* GHA-180  
 + *Glomus intraradices*)  
 Premier  
 (not OMRI listed)

Targets: *Pythium*, *Fusarium*, *Rhizoctonia* etc.  
 Root biostimulant & ISR generator, toxins

ISR=  
 Induced Systemic Resistance



Tools Available  
 For  
 Biological Control  
 In Greenhouses

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Harzianum  
 Hamatum,  
 Virens, Asperellum  
 and Gamai

(Trichoderma species developed as biocontrols)

*Trichoderma*  
 species

**RootShield G, WP** -root 0 hr REI **OMRI**  
*Trichoderma harzianum* T-22

**Targets:**  
*Pythium, Rhizoctonia, Fusarium,*  
*Thielaviopsis, Cyindrocladium*

**RootShield Plus+ - G & WP** **OMRI**  
*Trichoderma harzianum* T-22  
*Trichoderma virens* G-41

**Targets:**  
*Pythium, Rhizoc, Fusarium,*  
*Thielaviopsis, Cyindrocladium*  
 Suppression of *P. aphanidermatum*  
 More benefit against *Phytophthora*

REI=0 hr for G&WP; 4 hr if dip or dust WP

**BIO-TAM** – AgraQuest (not OMRI)  
*Trichoderma asperellum* ICC 012  
*Trichoderma gamsii* G-41 ICC 080

**Targets: soilborne diseases**  
*Fusarium, Phytophthora, Pythium, Rhizoc,*  
*Sclerotinia, Sclerotium rolfsii, Thielaviopsis,*  
*Verticillium, Rosellinia, Armillaria*  
 Can pre-germinate with 24-36 hr pre-trt soak  
*May pose a risk to beneficial beetles: blocked in*  
*some counties* Not OMRI certified  
 REI=1 hr

*Streptomyces*  
 species

*Sounds like something I took last week...*

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*Streptomyces  
 griseoviridis*

**Mycostop OMRI**  
*Streptomyces griseoviridis* K-61  
 Targets:  
*Fusarium, Alternaria & Phomopsis*  
 (Seed rot, root rot, stem rot & wilt)  
 Also suppression of *Botrytis,*  
*Pythium, Phytophthora & Rhizoc*  
 Use with thiophanate-methyl, metalaxyl, vinclozolin,  
 fosetyl-AI & propamocarb - same day  
 (Don't treat seeds of dusty miller or melons)  
 REI=0-4 hrs Also Mycostop Mix, larger particles

*Streptomyces  
 lydicus*

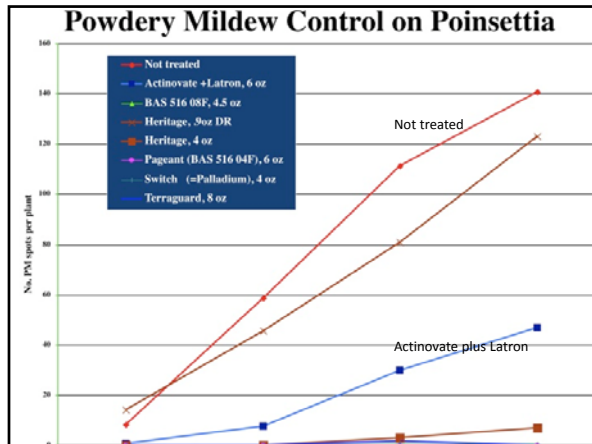
**Actinovate SP T&O OMRI**  
*Streptomyces lydicus* WYEC 108 Natl Industries  
 Targets include:  
*Pythium, Phytophthora, Rhizoctonia,*  
*Verticillium, Fusarium, Sclerotinia, Botrytis,*  
*Alternaria, Anthracnose, Erwinia,*  
*Xanthomonas, Pseudomonas,*  
 PM and DM  
 Soil and foliar treatments; 7-14 days  
 REI=0-1 hr *Ornamentals, veg & herbs* - 1 tsp/gal





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*Bacillus*  
species

*Bacillus amyloliquefaciens*

**Double Nickel 55 OMRI**  
*Bacillus amyloliquefaciens* D747  
 WDG 0-4 hr REI  
Targets include:  
 PM, DM, leaf spots, bacterial diseases, and rusts. Herbs on label.  
 Root disease treatments also.

0.25-3.0 lb/100 gal      3-28 day interval

*Bacillus subtilis*  
 Companion  
 Cease

**Companion Biological Fungicide 2-3-2L**  
*Bacillus subtilis* GBO3 Growth Products  
 (Not OMRI listed)  
Effect: ISR, antibiotic + auxin-like metabolites

Some Targets: *Rhizoctonia, Pythium, Fusarium wilt; Alternaria, Botrytis, PM, Sclerotinia, Xanthomonas campestris*

REI: 0-4 hr

- Liquid Biological Fungicide for Turf & Landscape Use
- Liquid Biological Fungicide for Ghse, Nurs & Ornam Crops

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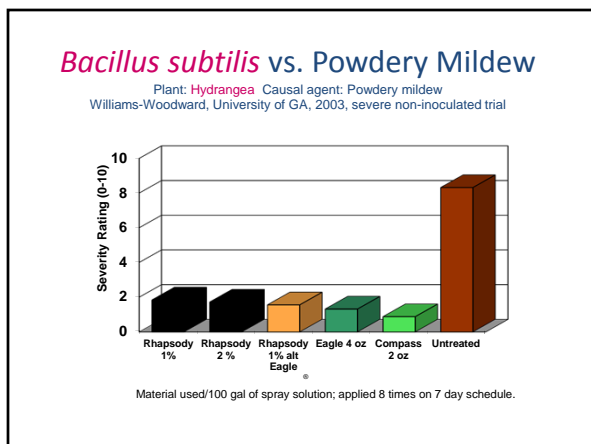
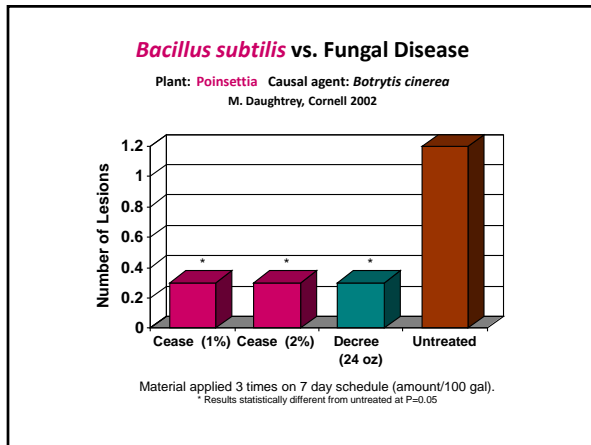
### Cease

*Bacillus subtilis* QST-713 strain – Bioworks (OMRI listed)

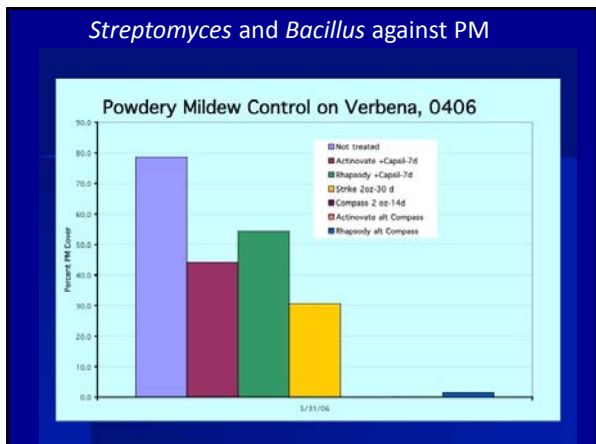
#### Some Targets:

*Rhizoc, Fusarium, Pythium, Phytophthora Alternaria, Anthracnose, Botrytis, Cercospora, Myrothecium, DM, PM, rust, Sclerotinia, Xanthomonas, Erwinia, Pseudomonas*

REI: 0-4 hr.



# BioControl in the Greenhouse January 30, 2015



You could pit a *Bacillus* species vs. *Erysiphe polygoni*

(To manage PM)

Rose Powdery Mildew

You could pit a *Streptomyces* against *Podosphaera pannosa*

Verbena PM

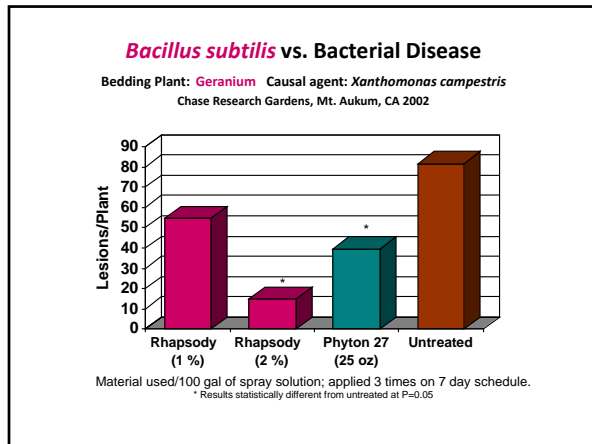
You could pit a *Bacillus* or *Streptomyces* vs. *Podosphaera xanthii*

Bacteria too???



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Nogoya Rose Kale IR-4 report, C. Becker, 2009  
*Bacillus subtilis* (Cease) reduced *Xanthomonas* leaf spots at 1% and 2% (but wasn't as good as a copper fungicide treatment)

Think Alternation

**Biorationals =**  
**Materials with natural origin,**  
**considered**  
**environmentally benign**  
**(includes botanical extracts)**

**Trilogy**  
**(Neem oil)**  
**Use at 1%**  
**7-14 day interval**  
**Landscape and nursery**  
**ornamentals**  
**Watch out for open**  
**flowers**  
**Have good**  
**evaporation conditons**

Marrone Bio Innovations production and landscape

**Regalia Biofungicide Concentrate**

Regalia PTO  
 REI 4 hrs **OMRI**  
 Made from  
 Giant knotweed,  
*Reynoutria*  
*sachalinensis*  
 Flowering plants  
 Foliage plants  
 Many herbs, veggies

Induced resistance, translaminar  
 Soil drench treatments for Fusarium, Pyth/Phytoph,  
 Rhizoctonia and Verticillium Foliar: PM forté

Marrone Bio Innovations

**Regalia Biofungicide Concentrate**

Gerbera Disease severity reduced from  
 79% in controls to 2% with Regalia 1%  
 Per Villavicencio 2011  
 PDMR 5:OT020



**BioControl in the Greenhouse**  
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ArmicarbO, MilStop & Kaligreen

Potassium bicarbonate

For foliar disease control

Especially powdery mildew

Weekly application

Good as a rotational partner

Why Use Biocontrols for Disease?

- Plant safety (but check on this each time)
- OMRI labeling (often) for organic growers
- **Help with resistance management (rotation partners)**
- Reduce chemical use
- Enjoy low REIs
- See plant health promotion side effects
- Effectiveness against pathogens



BioControl in the Greenhouse



**Coming Up Next:**  
**3:00 to 3:25 Eastern**

**Case Studies of Using Biocontrol for Disease Control in Greenhouse Crops**

Matthew Krause



Time	Topic
3:30 to 3:45	Wrap-up/Questions