SIMPLY SUSTAINABLE. ALWAYS EFFECTIVE.

Crop Protection Product Update(s)
BioSafe Systems

IR-4 Food Use/Integrated Solutions/Biopesticide Workshop
Sept. 19-21, 2018

Manuel Campos, Ph.D
Entomologist & Technical Representative-US and Mexico

SIMPLY SUSTAINABLE. ALWAYS EFFECTIVE.

CELEBRATING 20 YEARS 20th ANNIVERSARY OF SUSTAINABILITY

BioSafe Systems

- *A family-owned manufacturer of biodegradable and reduced risk crop protection products.*
- *Headquartered in East Hartford, CT, USA*
- *Biochemical (Peracetic Acid Based) and Microbial based Biopesticides for organic and conventional Agriculture and Horticulture markets.*
- *Products registered in US, Canada and Mexico.*

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BioSafe Systems

Crop Protection Product Update(s)

PVent®

TerraStart®

PerCarb®

BioCeres® WP

SIMPLY SUSTAINABLE. ALWAYS EFFECTIVE.

PVent®

BioSafe Systems

BIOLOGICAL FUNGICIDE

Active Ingredient: ***Gliocladium catenulatum*** strain J1446…..93.0%

Contains a minimum of 1 X 10^9 CFU/g

Formulation Type: Wettable Granule (WG)

- Originally registered with EPA in 1998 as “PrimaStop” Wettable Powder formulation.
- Later marketed as “PreStop”
- Pending registration in California.

OMRI LISTED
For Organic Use

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Gliocladium catenulatum Strain J1446

- Naturally occurring Saprophytic Fungus
- J1446 strain isolated from a field soil in Finland
- Optimal growth conditions for the fungus:
- Temperature of 25- 28°C;
- pH of 5-6, with a range of pH 3-8.2.
- Non-Toxic. The risk to non-target organisms, including fish, birds, and insects, is expected to be minimal. Not harmful to beneficial insects, nematodes or pollinators

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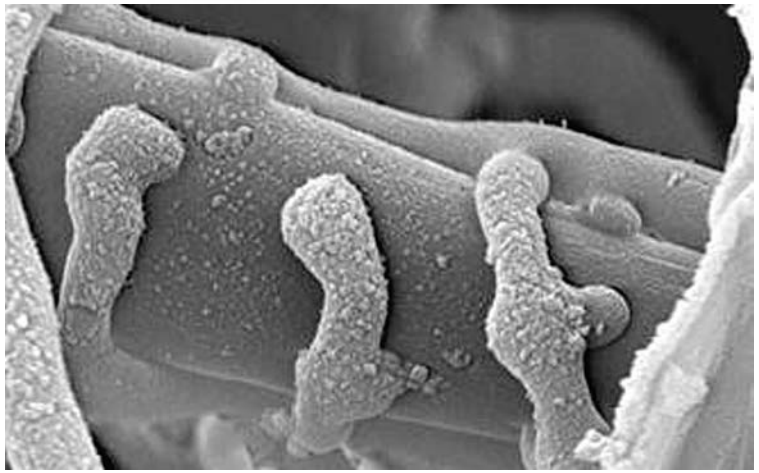
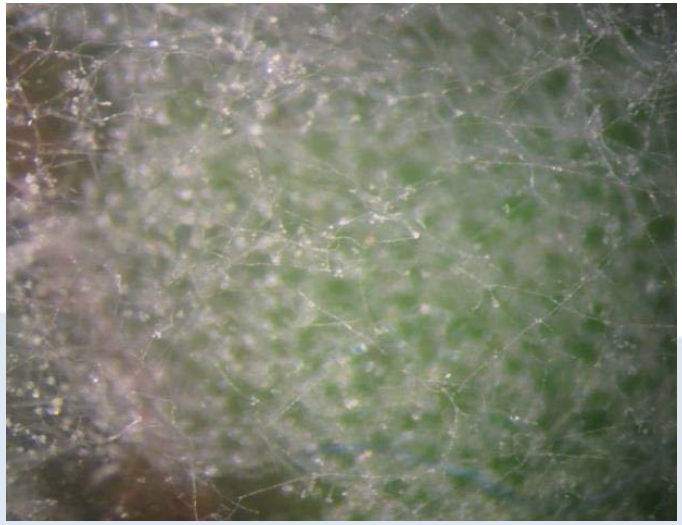
Modes of Action

BioSafe Systems

Antagonistic against many fungal pathogens



- Hyperparasitism
- Enzyme activity on fungal structures-Chitinases and β-1,3-glucanenzymes
- Colonization of root and foliar surfaces
- Competition for nutrients and space
- Induced Resistance



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Labeled Crops and Diseases

PVent (WG) controls seed-borne and soil-borne plant diseases such as damping-off, root and stem rot, and wilt caused by *Alternaria, Bipolaris, Botrytis, Cladosporium, Colletotrichum, Fusarium, Mycosphaerella, Penicillium, Phytophthora, Plasmodiophora, Plicaria, Pyrenochaeta, Pythium, Rhizoctonia, Sclerotinia and Verticillium, certain storage diseases caused by Helminthosporium and Rhizoctonia, and foliar diseases like grapevine trunk diseases (several* pathogens) as well as diseases caused by *Alternaria, Anthracnose (Colletotrichum) Bipolaris, Botrytis, Cladosporium, Didymella, Fusarium, Monilinia, Mycosphaerella, Penicillium and Sclerotinia on greenhouse or field grown vegetables, herbs, ornamentals, berries, cereals,* legumes, pome and stone fruits, nut trees, tree and forest seedlings and turf. PVent (WG) also suppresses powdery mildew symptoms on these greenhouse or field grown crops.

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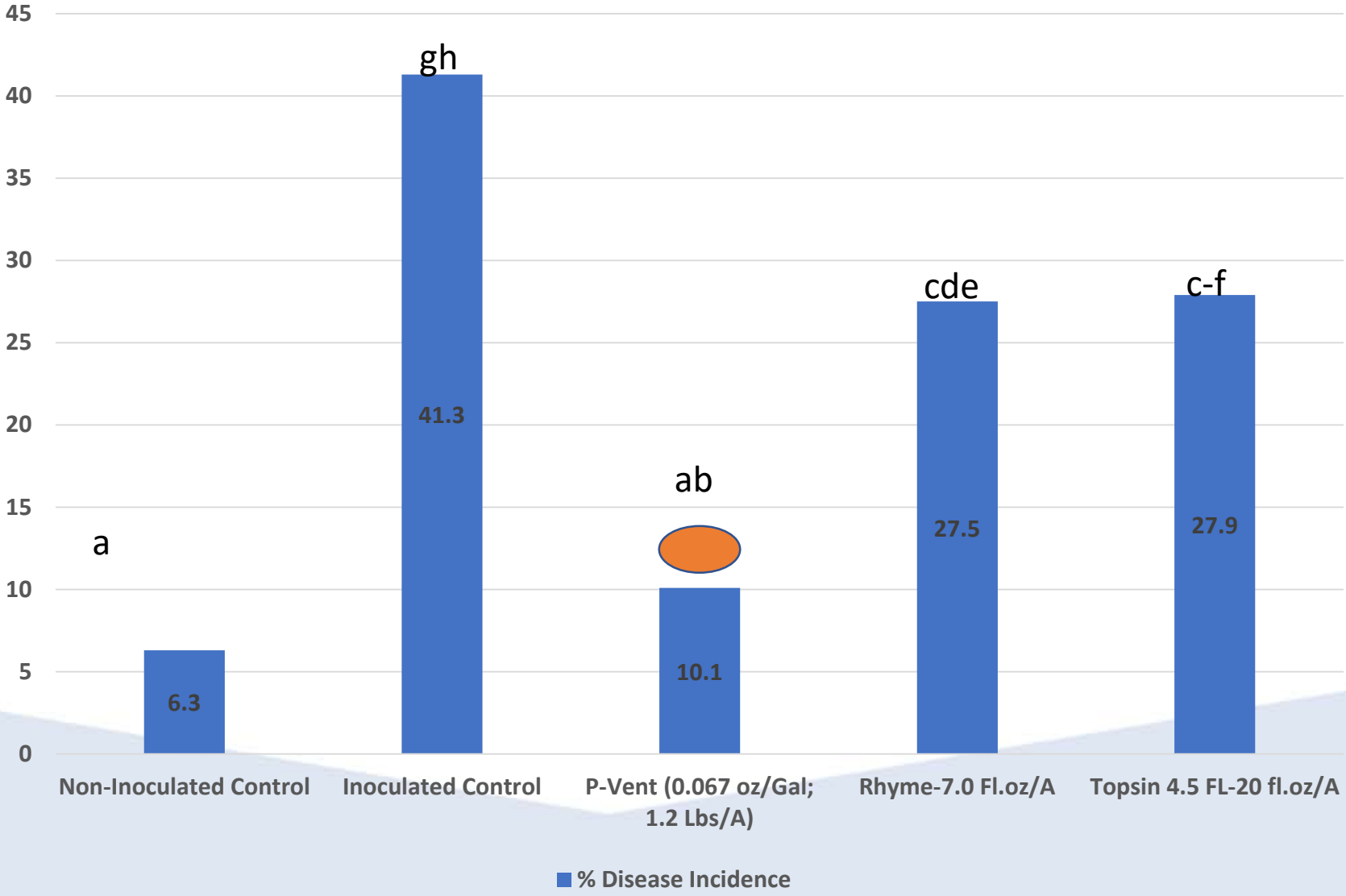
Strawberry Charcoal Rot (UFL-2017)



SIMPLY SUSTAINABLE. ALWAYS EFFECTIVE.

Efficacy on Pathogens Causing Root Diseases

Damping Off
(*Pythium and Rhizoctonia*)
6 weeks after sowing

Control **J-1446 (10g/m2) as a Drench**

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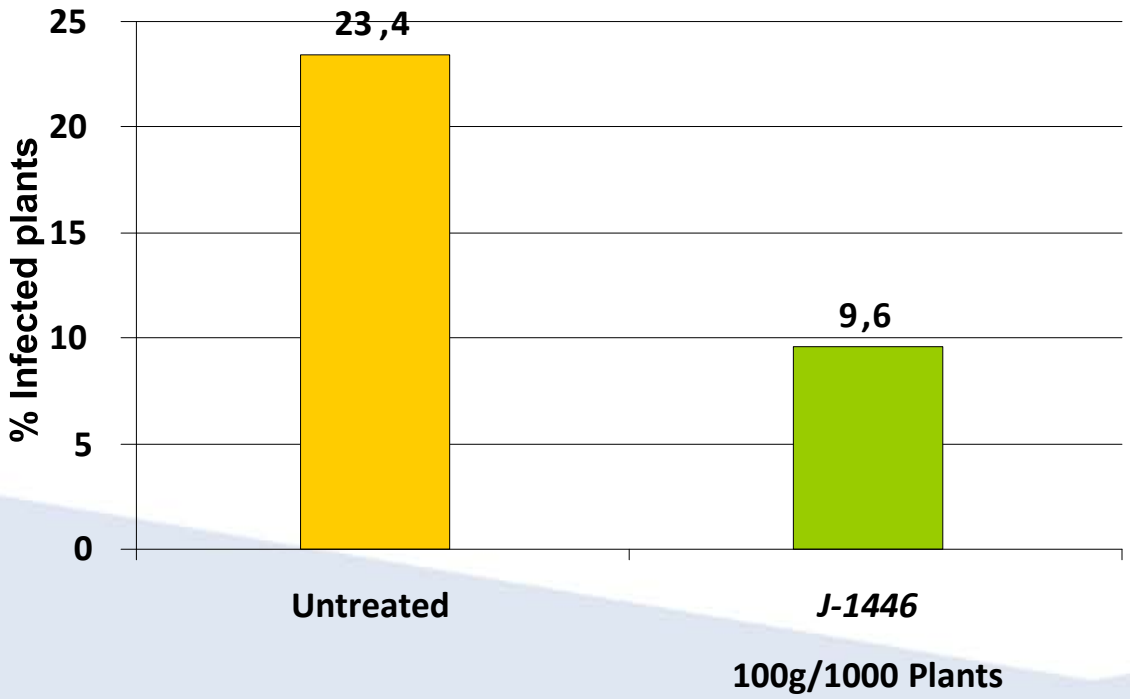
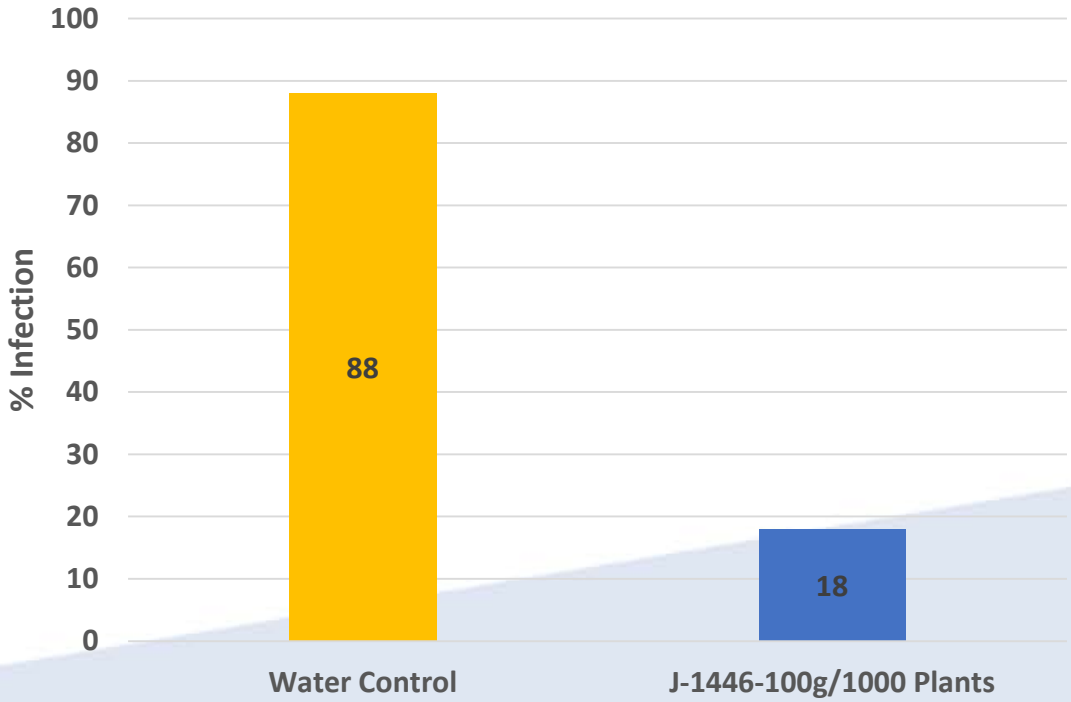
Efficacy on Pathogens Causing Stem/Foliar Diseases

BioSafe Systems

Gummy Stem Blight of Cucumber
(Didymella/Mycosphaerella)
Sprays at 6 and 53 days after planting



Botrytis on Tomatoes *(Botrytis cinerea)*



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PVent®

BioSafe Systems

2019 IR-4 Biopesticide Study Request(s)

-Study requests to develop and support additional data for registration in California.

-Soilborne Diseases (Landscapes and Orchards)

-Rhizoctonia and Charcoal Rot (Strawberry)

-Botrytis (Strawberry and Raspberry)

-Botrytis (GH Tomato)

-Fusarium Wilt (Basil)

-Botrytis (Herbs)

-Phytophthora (Cucurbits, Vegetables, Peppers)

-Fungi-Post-Harvest (Sweet Potato)

Damping Off (Hemp)

-Pythium Cavity Spot (Carrots)

-Root Rot (Ginseng)

-Southern Blight (Tomato and Pepper)

-Timber Rot (Tomato)

-Verticillium Wilt (Egg Plant)

-Fusarium Root Rot (Green Beans)

SIMPLY SUSTAINABLE. ALWAYS EFFECTIVE.

PerCarb®

BioSafe Systems

US EPA Registered Broad Spectrum Plant Bactericide/Fungicide

Labeled for control of major foliar diseases on field grown crops, tree crops, berries, small fruits, vine crops and greenhouse vegetable crops.

EPA Registration No. 70299-15

Registration Pending in CA

Active Ingredient: Sodium Carbonate Peroxyhydrate*: 85.00%

Inert Ingredients: 15.0%**

Contains 27.60% Hydrogen Peroxide by weight

****Includes <10% Calcium Carbonate as a Calcium Source for the Plants and a Silicate based material as a stabilizer***

SIMPLY SUSTAINABLE. ALWAYS EFFECTIVE.

PerCarb®

BioSafe Systems

MODE OF ACTION

- ✓ Hydrogen Peroxide **works by oxidizing** Bacterial/Fungal cells/spores with which they come into contact. Damage to cellular macromolecules including lipids, proteins and nucleic acids occur upon oxidation by hydrogen peroxide.
- ✓ The sodium carbonate also play a role in **inhibiting development** of fungal mycelium and spores through changes in pH and osmotic pressure of the microbial cells.

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PerCarb®

BioSafe Systems

Crops

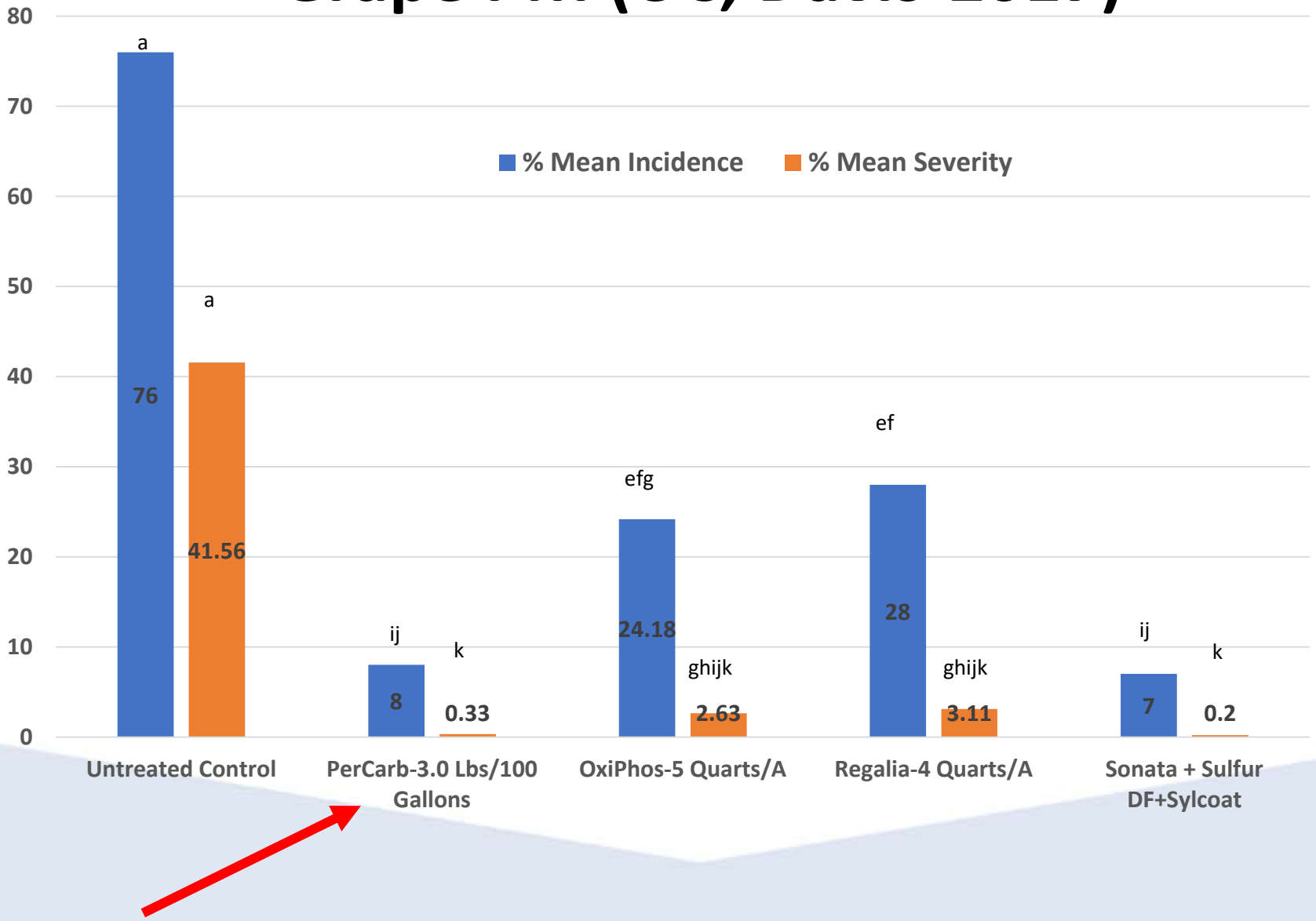
a. Berries
b. Bulb Vegetables
c. Citrus
d. Cole Crops
e. Cucurbits
f. Fruiting Vegetables
g. Grapes
h. Herbs/Spices
i. Leafy Vegetables
j. Pome Fruits
k. Root & Tuber Vegetables
l. Tree Nuts
m. Stone Fruits

Diseases

a. Powdery Mildew
b. Downy Mildew
c. Bacterial Leaf Spots/Blights
d. Fungal Leaf Spots/Blights
e. Rust
f. Scab

SIMPLY SUSTAINABLE. ALWAYS EFFECTIVE.

Grape PM (UC, Davis-2017)



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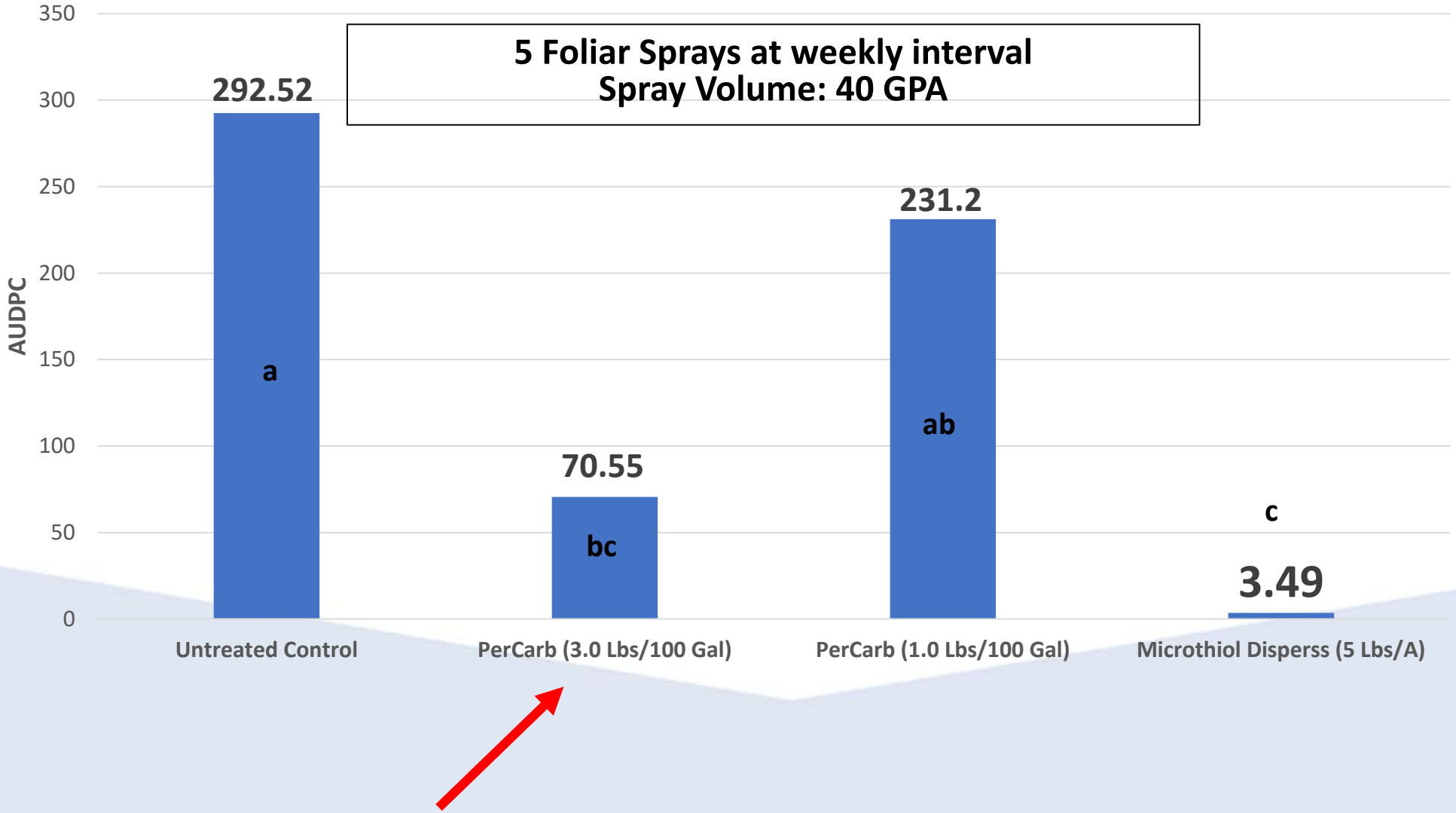
Carrot Powdery Mildew, 2016

BioSafe Systems



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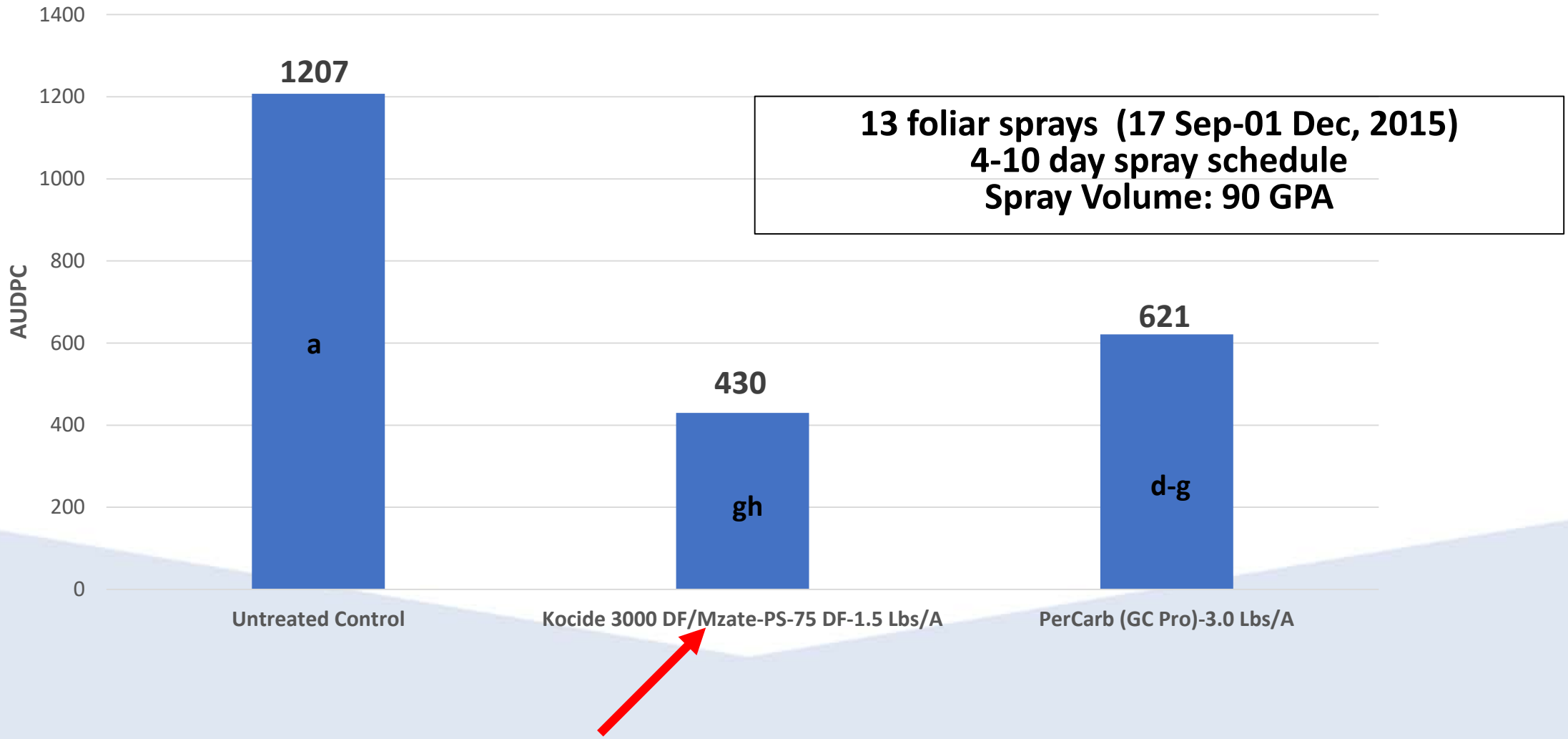
Tomato Bacterial Spot, UFL, 2015

BioSafe Systems



13 foliar sprays (17 Sep-01 Dec, 2015)
4-10 day spray schedule
Spray Volume: 90 GPA

SIMPLY SUSTAINABLE. ALWAYS EFFECTIVE.

PerCarb®

BioSafe Systems

2019 IR-4 Biopesticide Study Request(s)

- **-Study requests to develop and support additional data for registration in California.**
- -Powdery Mildew and Scab (Apples)
- -Powdery Mildew and Black Rot (Grapes)
- -Bacterial Leaf Spot/Angular Leaf Spot (Cucurbit and Pepper)
- -Botrytis, Bacterial Spot and Speck (GH Tomato)
- -Botrytis (Herbs)
- -*Cercospora* and *Cladosporium* Leaf Spots (Leafy Greens)

SIMPLY SUSTAINABLE. ALWAYS EFFECTIVE.

TerraStart®

BioSafe Systems

- US EPA Registered **Pre-Plant Soil Treatment for Control of Soil Borne Plant Pathogens**
- Labeled to suppress and control soilborne plant pathogens and their associated diseases such as *Fusarium, Phytophthora, Pythium, Rhizoctonia, Ralstonia solanacearum, Sclerotinia sclerotiorum, Sclerotium rolfsii, Thielaviopsis and Verticillium*
- EPA Registration No. 70299-18
- Not Registered in CA

<u>Active Ingredients</u>:

Hydrogen Peroxide: 18.50%

Peroxyacetic Acid: 12.00%

SIMPLY SUSTAINABLE. ALWAYS EFFECTIVE.

TerraStart®

BioSafe Systems

Pre-Plant Soil Treatment Program

- DIRECT INJECT APPLICATION,
- DRIP OR SPRINKLER IRRIGATION SYSTEMS
- DIRECT SOIL DRENCH
- Pre-wet soil preferably with a surfactant. Inject TerraStart directly into the water of the drip system at a 1:265 – 1:132 dilution rate (3.8 to 7.6 gallons of TerraStart per 1000 gallons of water; equivalent to 500 – 1,000 ppm of peroxyacetic acid).
- Depending on soil type, approx. 3,000 to 6,000 gallons of finished TerraStart solution per treated acre to treat top 6-10 inches of soil bed.
- Applications should be made at a minimum of 48 hours prior to planting/transplanting to allow any residual TerraStart to dissipate in the soil.

SIMPLY SUSTAINABLE. ALWAYS EFFECTIVE.

TerraStart®

BioSafe Systems

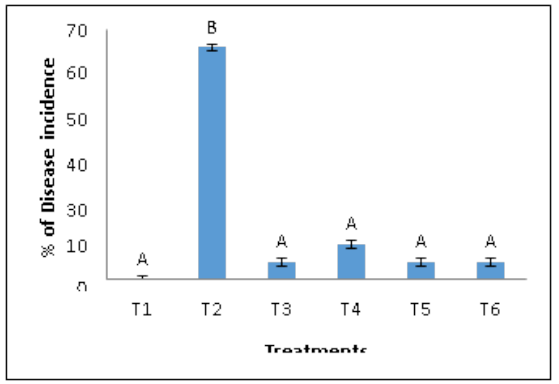
Pre-Plant Soil Treatment Program

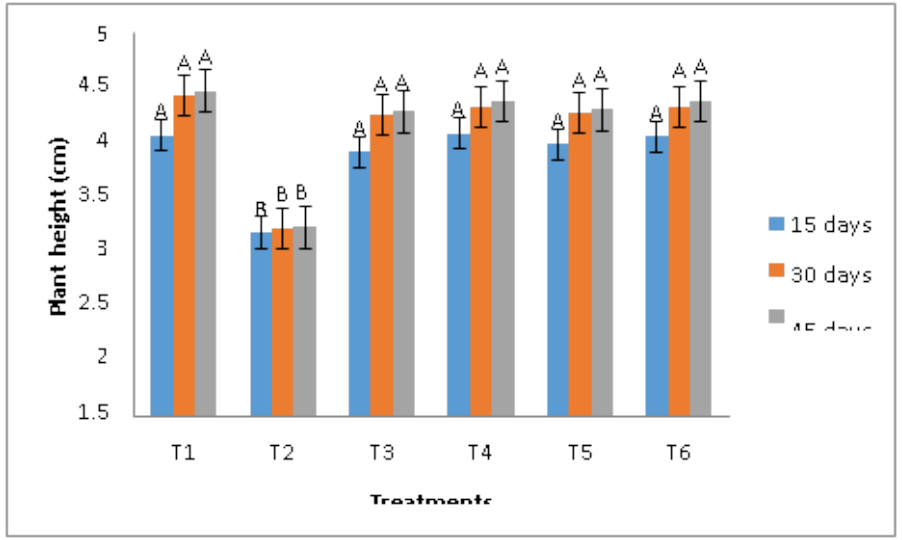
AS A DIRECT INJECT APPLICATION THROUGH DRIP OR SPRINKLER IRRIGATION SYSTEMS OR AS A DIRECT SOIL DRENCH

Soil Type	Total Number of Gallons of TerraStart Concentrate/Treated-Acre		Gallons of Water to be used with TerraStart per Treated Acre
	1:132	1:265	
Light (Sandy/Loam)	23.0	11.5	3,000 gallons
Medium (Loam)	34.0	17.0	4,500 gallons
Heavy (Loam/Clay)	45.5	22.5	6,000 gallons

TerraStart on Phytophthora Root Rot Control in Citrus Seedlings (TAMU, TX-2018)

- T1-Untreated-Uninoculated
- T2-Untreated-Inoculated
- T3-Ridomil Gold
- **T5-TerraStart as a Soil Drench at 1:132 strength post-inoculation and prior to planting**





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TerraStart®

BioSafe Systems

2019 IR-4 Biopesticide Study Request(s)

- **Study requests to develop and support additional data for registration in California.**

- Nematodes, *Rhizoctonia* and Charcoal Rot (Strawberry)
- Soilborne Diseases (Landscapes and Orchards)
- *Phytophthora* (Cucurbits and Fruiting Vegetables)
- Root Rot (Ginseng)
- Verticillium Wilt (Eggplant)
- Fusarium Root Rot (Green Beans)

SIMPLY SUSTAINABLE. ALWAYS EFFECTIVE.

BioCeres® WP

BioSafe Systems

Biological Mycoinsecticide

Active Ingredient: ***Beauveria bassiana*** strain-ANT-03

Formulation Type: Wettable Powder (WP)

Contains a minimum of 1.0 $x10^{10}$ viable conidia/g gram

EPA Registration #: 89600-2

Pending Registration in California

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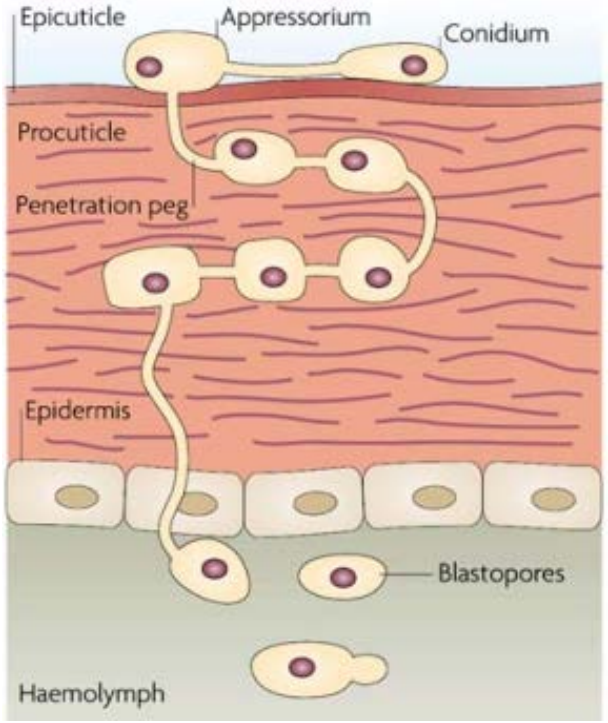
BioCeres® WP

BioSafe Systems

Mode of Action

Beauveria bassiana

- ***An entamopathogenic*** **fungus belonging to order Hypocreales**
- **Occurs naturally in the soils throughout the world**
- **Can attack both larval and adult stages**



- Adhesion to the cuticle
- Germination (infection) via enzymatic activity and mechanical pressure
- Penetration of the fungus into the insect
- Multiplication and sporulation

- Infection via contact and ingestion
- Pathogenicity for all development stages including eggs, nymphs anddiapausing insects

SIMPLY SUSTAINABLE. ALWAYS EFFECTIVE.

BioCeres® WP

BioSafe Systems

Labeled Application Rates and Methods

1.0-3.0 Lbs/Acre for most crops*

Conventional ground apps: At least 50 Gallons of solution/A. Ensure thorough coverage of plant foliage but not to run off.

Spray Interval: 5-7 days as needed

Pre-Harvest Interval (PHI): 0 (Zero) Days

Can be applied by air (Field Crops).

(*Refer Label for Appropriate Crop Specific Rates)

SIMPLY SUSTAINABLE. ALWAYS EFFECTIVE.

BioCeres® WP

Insect Pests Labeled

- ✓Aphids
- ✓Bud Weevil
- ✓European Corn Borer
- ✓Plant Bugs
- ✓Thrips
- ✓Whiteflies
- ✓Spotted Wing Drosophila
- ✓Striped Cucumber Beetle

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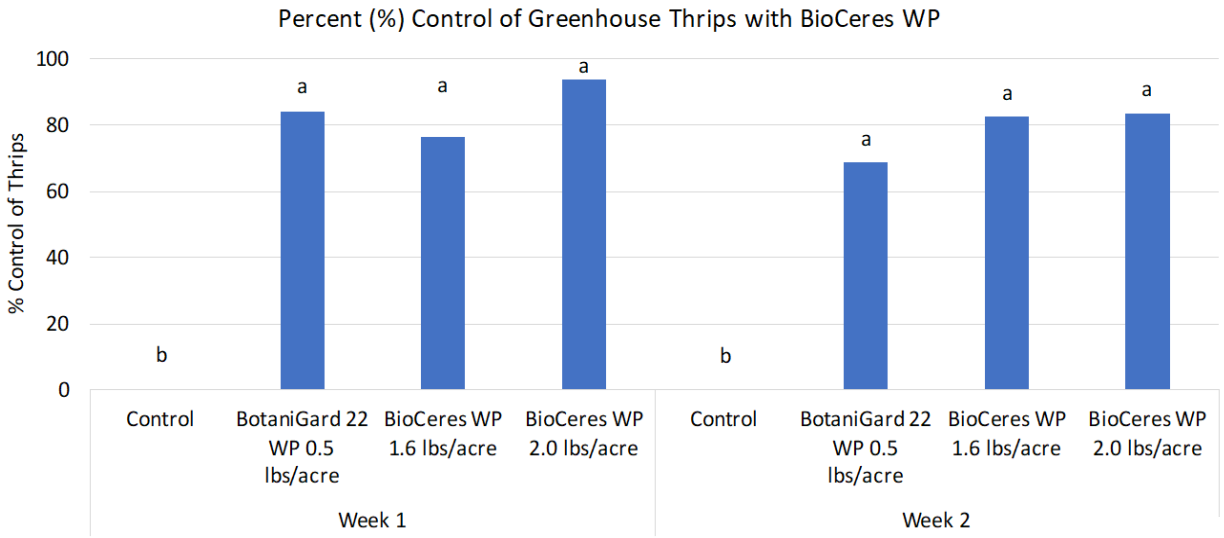
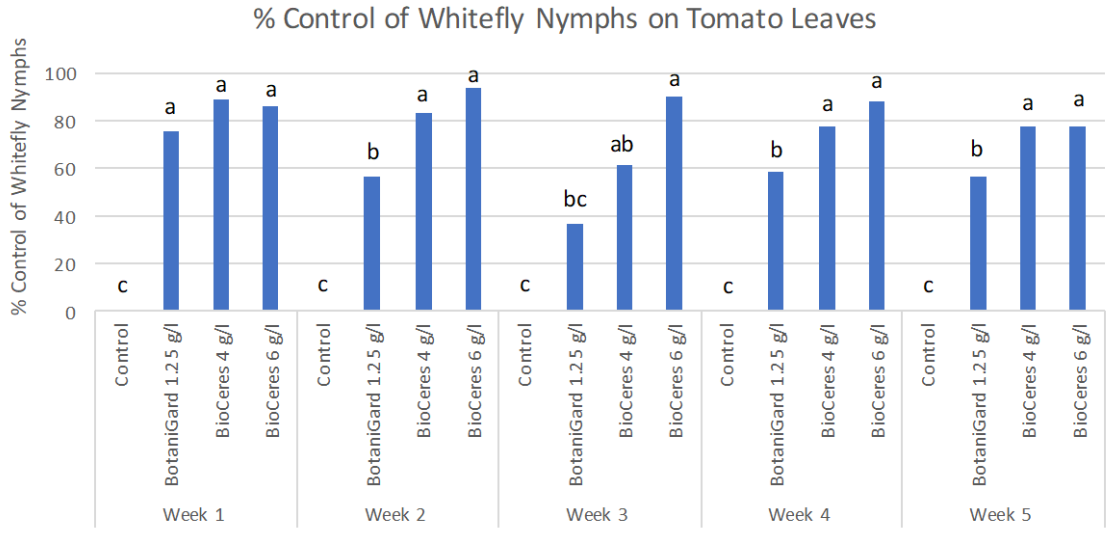
BioSafe Systems

BioCeres® WP
Efficacy Studies





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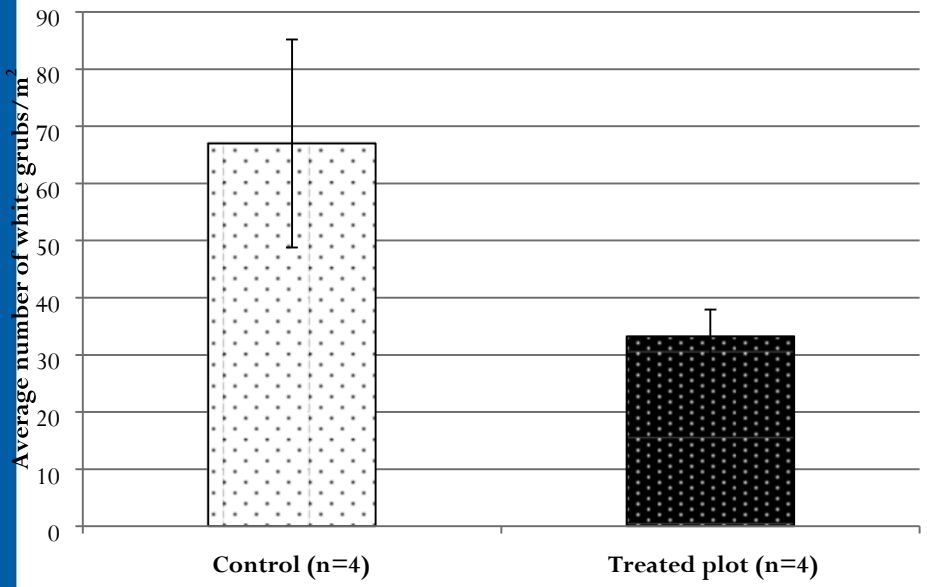
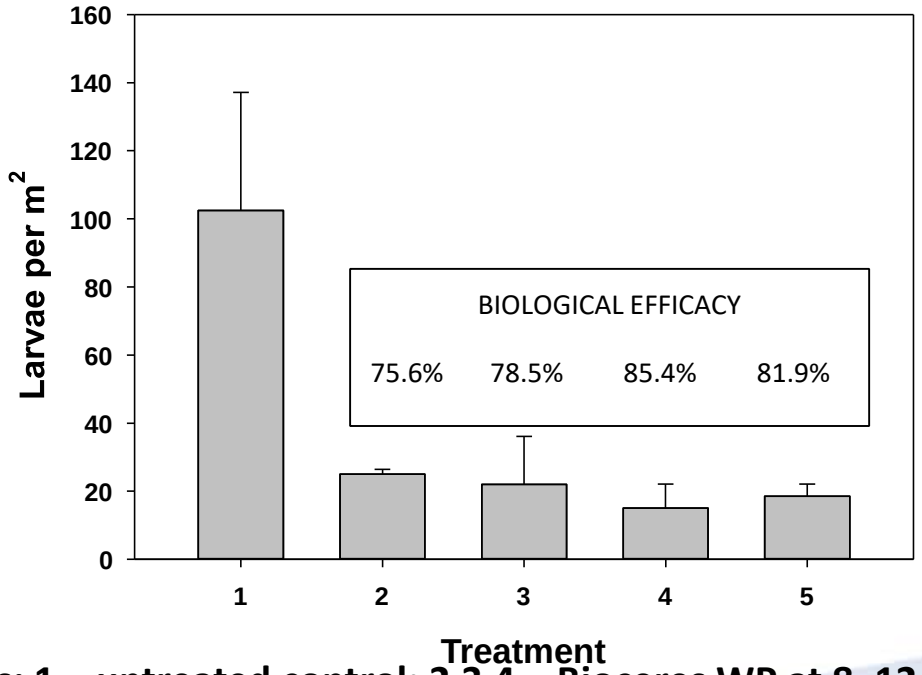
BioCeres® GR
Efficacy Studies on White Grubs



Two applications of BioCeres GR, rate 20 g/m², early fall on the presence of Chafer white grubs of Turfgrass-2015 (n=4 for both control and treated conditions).



Treatments: 1 – untreated control; 2,3,4 – Bioceres WP at 8, 12 and 16 g/L; 5 – Bioceres GR at 20g/m2

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BioCeres® WP

BioSafe Systems

2019 IR-4 Biopesticide Study Request(s)

-Study requests to develop and support additional data for registration in California.

-BMSB, SWD and White Fly (Q-Biotype)-All crops

-Apple Maggot and Codling Moth-Apple

-Asian Ambrosia Beetle (Avocado)

-ACP (Citrus)

-Berry Borer (Coffee)

-Cabbage Aphid (Brassicas)

-Striped Cucumber Beetle (Cucurbits, Vegetables)

-Colorado Potato Beetle (Potato)

-Potato Leaf Hopper (Potato)

-Chilli Thrips (All Crops)

-Varroa Mite (Honey Bee)

-Bagrada Bug and Cabbage Looper (Brassica)

-Corn Root Worm (Corn)

-Squash Bugs (Cucurbits)

-Flea Beetles (Eggplant)

-Pepper Weevil (GH Pepper)

-Wireworms (Potato)

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Thank You

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