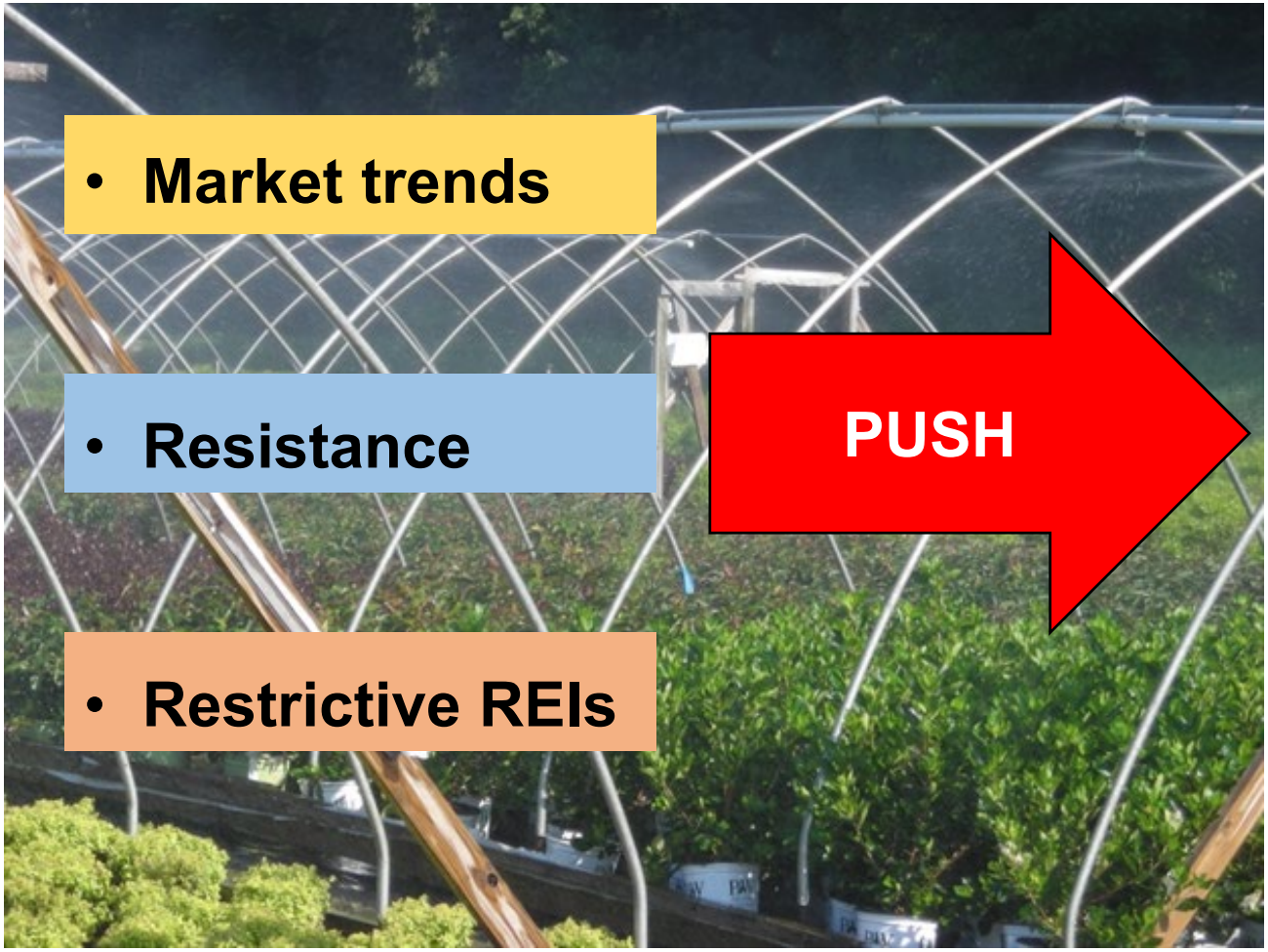
Biofungicides For Root Disease

BioWorks®

BioWorks®

Why do we need to adapt?



Integrated plant health management

- Cultural practices
- Plant nutrition
- **Use of biofungicides**
- Integration of conventional and biological products

BioWorks®

Starting to use biofungicides?

Product performance is affected by:

- Selection of the right product for the situation and disease
- Timing and method of application
- Repeat applications being made as-needed

Will work when:

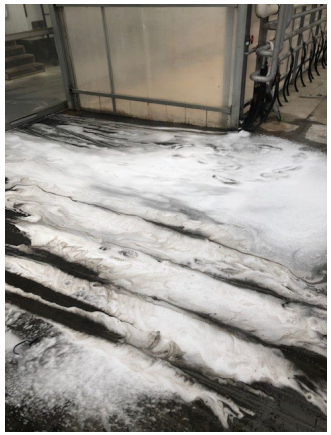
- Applied *preventatively*
- Disease pressures are low to moderate
- Used with other compatible inputs

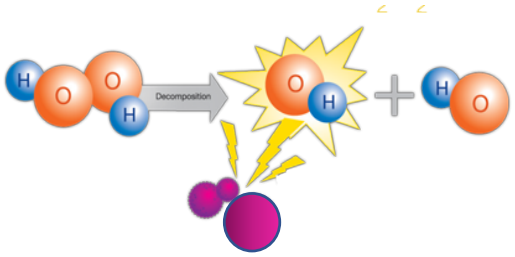
Right product, right place, right time

Prevention is (so much) better than cure!

Sanitation and cultural practices are fundamental

- Plant tissue and water analyses, accurate disease diagnoses
- H_2O_2 (PERpose Plus®, ZeroTol®, Jet-Ag™) is a great tool
  - surfaces, tools, blocks, cuttings, rooting benches
- Limit access to propagation areas to avoid transfer in/out





Biofungicides for root diseases

Trichoderma spp. – RootShield *PLUS*$^{+}$, Asperello

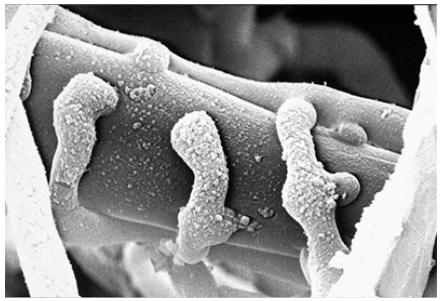
Bacillus species – Cease, Stargus, Double Nickel

Streptomyces species – Actinovate, Mycostop

Bacillus subtilis vs *Fusarium*

Inhibition of *Fusarium* by *Trichoderma*

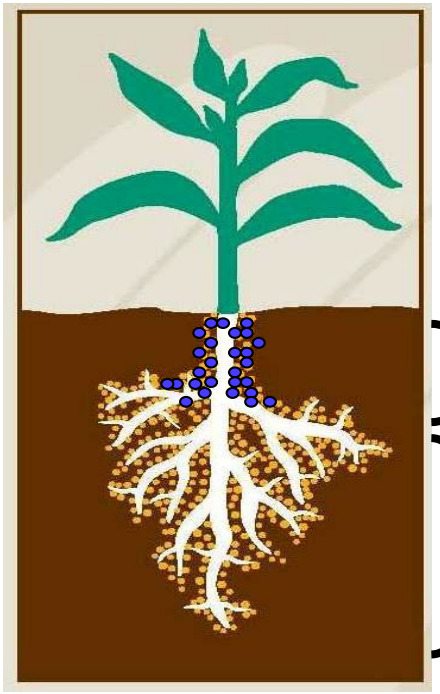
- **Competition:** Colonize roots, outcompete pathogens for space or nutrients
- **Antagonism:** Metabolites/enzymes kill or inhibit other microorganisms
- **Parasitism:** Microbial agent attacks or consumes the pathogen
- **Induced resistance:** Activate plant defenses



Gliocladium catenulatum (LalStop®) vs *Rhizoctonia solani*

BioWorks®

RootShield *PLUS*+



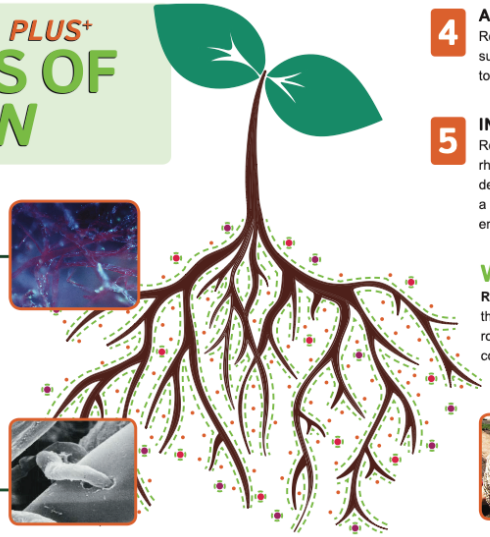
BioWorks®

ROOTSHIELD *PLUS*+ MODES OF *ACTION*

1 COMPETES WITH AND EXCLUDES PATHOGENS
RootShield *PLUS*+ takes up space in the rhizosphere and crowds out pathogens. It not only overtakes that space, it eats nutrients as well - causing pathogens to starve.

2 SHIELDS ROOTS
Not only does RootShield *PLUS*+ grow on the roots, it shields them from pathogens. It acts as a barrier that pathogens cannot get through.

3 HUNTS AND EATS PATHOGENIC FUNGI
RootShield *PLUS*+ seeks out, attacks and eats fungal pathogens.



4 ANTAGONIZES PATHOGENS
RootShield *PLUS*+ releases anti-pathogen substances creating a zone that is inhospitable to pathogens.

5 INDUCES HOST RESISTANCE
RootShield *PLUS*+, with its presence in the rhizosphere, signals the plant to accumulate defensive gene products, which give the plant a better defense response in subsequent encounters with pathogens.

Where does it grow?

RootShield *PLUS*+ grows in the soil and on the roots (rhizosphere). It grows along with the roots as they expand into the soil. It can even coil around the root, securing its position.

KEY:
Pathogens
RootShield *PLUS*+

bioworksinc.com
(800) 877-9443
expert@bioworksinc.com

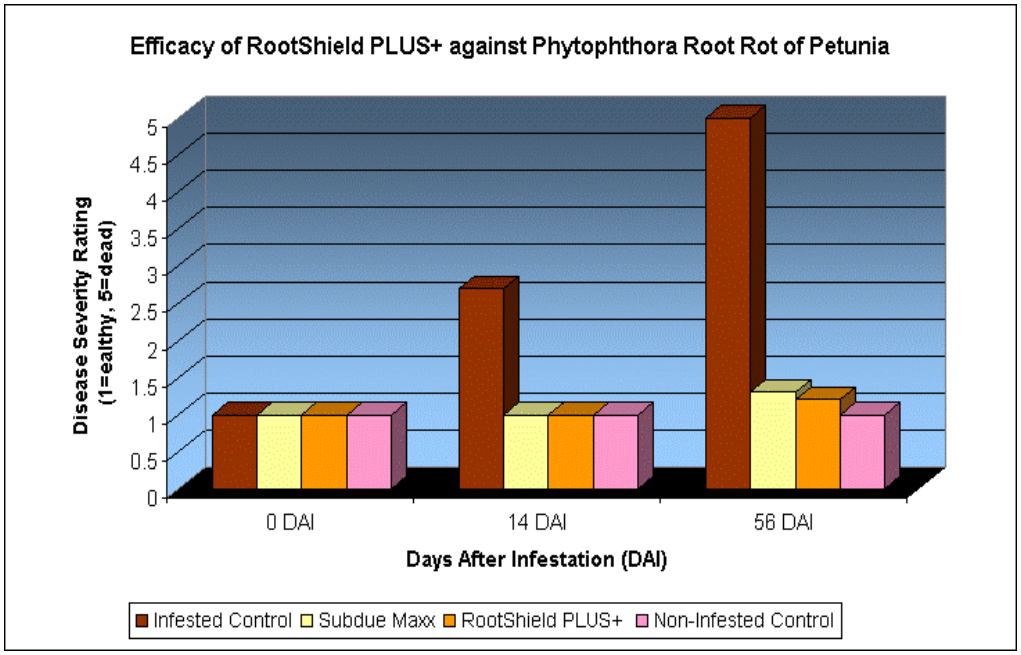
SAFE. PROVEN. EFFECTIVE.

Biofungicides for root diseases

Success begins in propagation

- Drench rooting cubes/wedges, flats, etc., with biofungicide 5 -10 days after sticking
- Pre-incorporate granules into growing medium
- Or Dipping
- Disease protection from the get-go, re-apply according to product recommendations

Trichoderma: as good as traditional chemistry



RootShield *PLUS*+ vs Subdue Maxx vs *Phytophthora* root rot on Petunia

Performance comparable to (or better than) chemistry

Compatibility means:

- May be tank-mixed or used in rotation
- When disease pressures are high
- Combination enhances performance

BioWorks®

Practical considerations

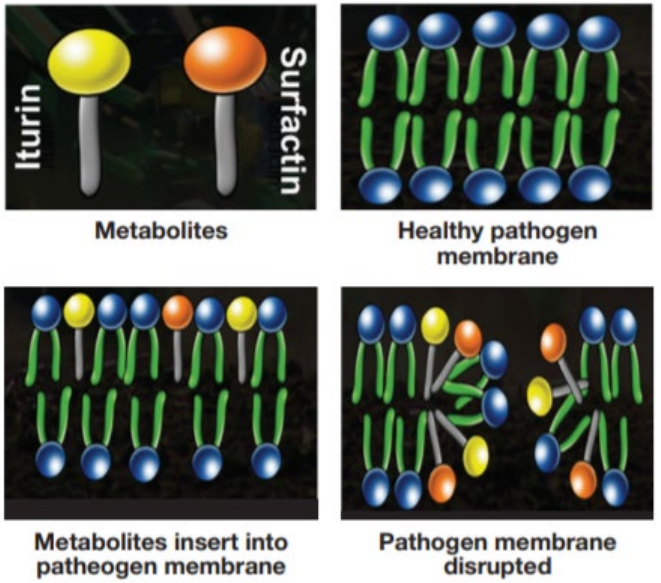
RootShield® *PLUS*$^{+}$: Compatibility

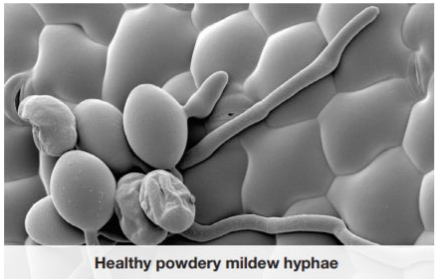
Brand Name	Active Ingredient	Compatibility
CEASE	*B. Subtilis* QST713	Apply 1-day apart (soil)
Heritage	Azoxystrobin	Yes
Mural	Azoxystrobin + Benzobindiflupyr	Yes
Pageant	Pyraclostrobin + Boscallid	Yes
Daconil	Chlorthalonil	Yes
OHP6672	Thiophanate methyl	Yes
Camelot, Phyton 35	Copper soap, Copper sulfate	NO (apply 1-d apart)
Terrazole, Protect TO	Etridiazole, Mancozeb	NO (apply 1-d apart)
Natural enemies		
NemaShield, Nemasys	*Steinernema feltiae*	OK to use
Predatory rove beetle	*Dalotia coriaria*	OK to use
Predatory mite	*Stratiolaelaps scimitus*	OK to use

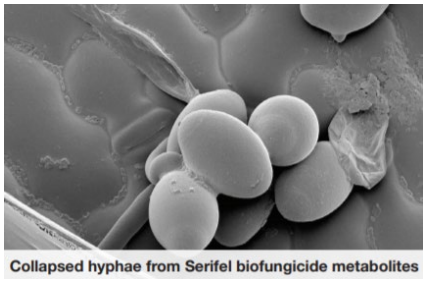
Microbial biofungicides: *Bacillus* spp.

Primary MOA: Antagonism

- *Bacillus subtilis, B. pumilis, B. amyloliquefaciens*
- Produce antimicrobial metabolites (lipopeptides) during fermentation
- Metabolites physically disrupt cell membranes, cells collapse; inhibits fungal growth
- Induce plant resistance




Healthy powdery mildew hyphae


Collapsed hyphae from Serifel biofungicide metabolites

Serifel® Biofungicide. BASF
CEASE® Biofungicide, BioWorks

SAFE. PROVEN. EFFECTIVE.

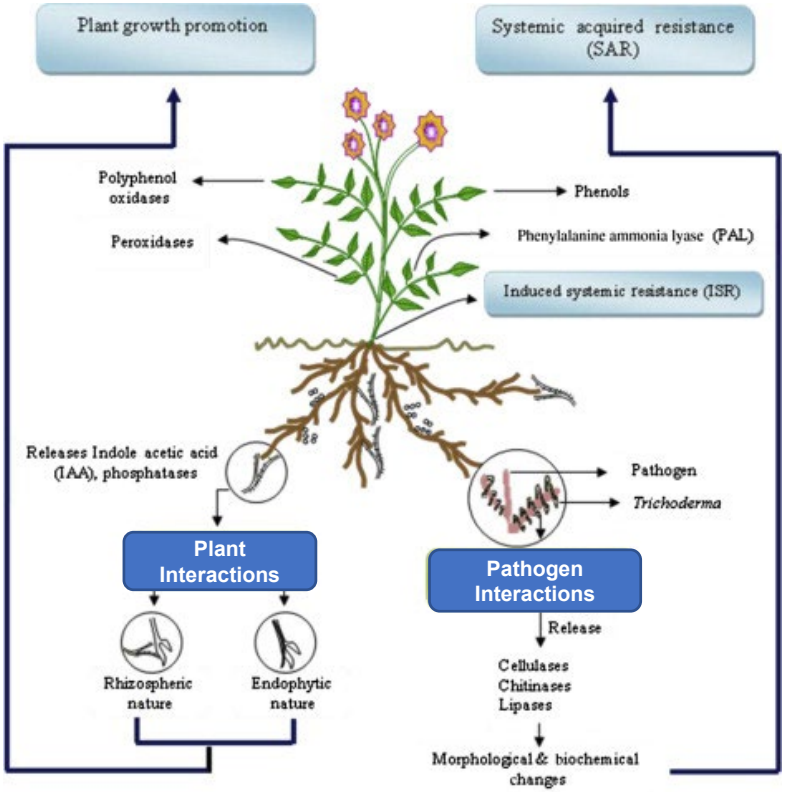
Botanicals: Plant activators

Induce plant resistance

- Regalia® MAXX, extract of giant knotweed
- Activates plant defenses
- Plants produce and accumulate specialized proteins and other compounds known to inhibit fungal diseases.
- Induces production of phytoalexins, cell strengtheners, antioxidants, phenolics and PR proteins, which all inhibit plant pathogens.

Intrinsic benefits provided by *Trichoderma* and *Bacillus*

- Stimulate root growth
- Induce proliferation of root hairs
- Aid uptake and use of nutrients from soil
- Enhance plant resistance to abiotic/biotic stresses
- Improve crop productivity.



Improved seed germination

Ranunculus seed

Products applied as a sprench at seeding

Pageant Intrinsic applied again 14 days later

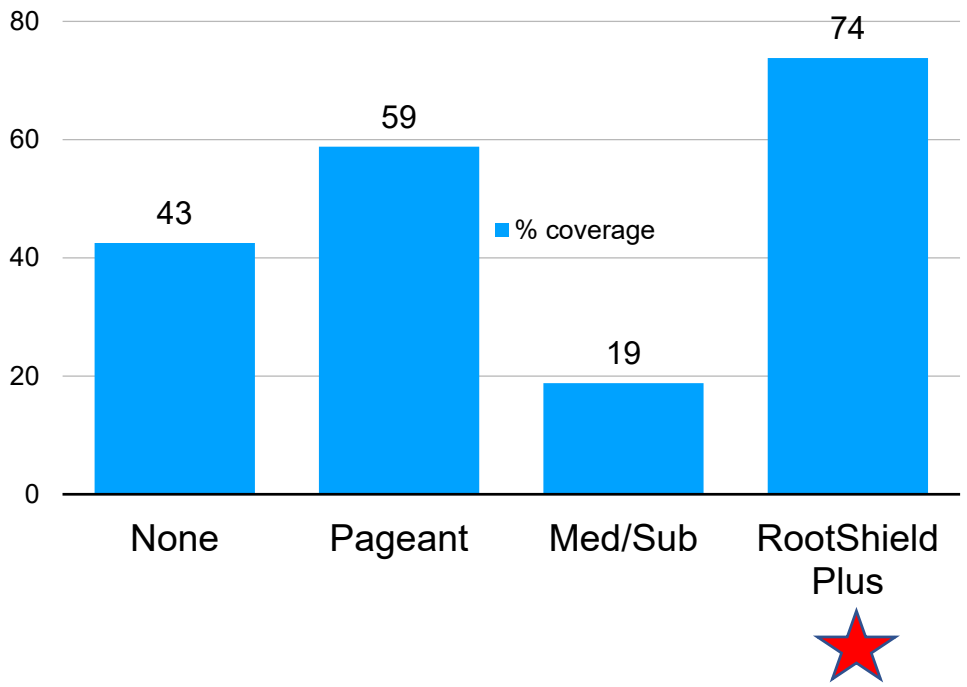
Treatments

A. None

B. Pageant Intrinsic (4 oz/100 gal)

C. Medallion/Subdue Maxx (ea. 1 oz/100 gal)

D. RootShield Plus (8 oz/100 gal)



Conclusions

- **Highest germination/growth with RootShield Plus** applied at seeding
- Better than Pageant
- Lowest growth with the fungicide standard treatment

Chase Agricultural Consulting, LLC.
Practical Solutions for Growers

SAFE. PROVEN. EFFECTIVE.

BioWorks®

Improved seed germination

SAFE. PROVEN. EFFECTIVE.

Improved rooting in woody ornamentals

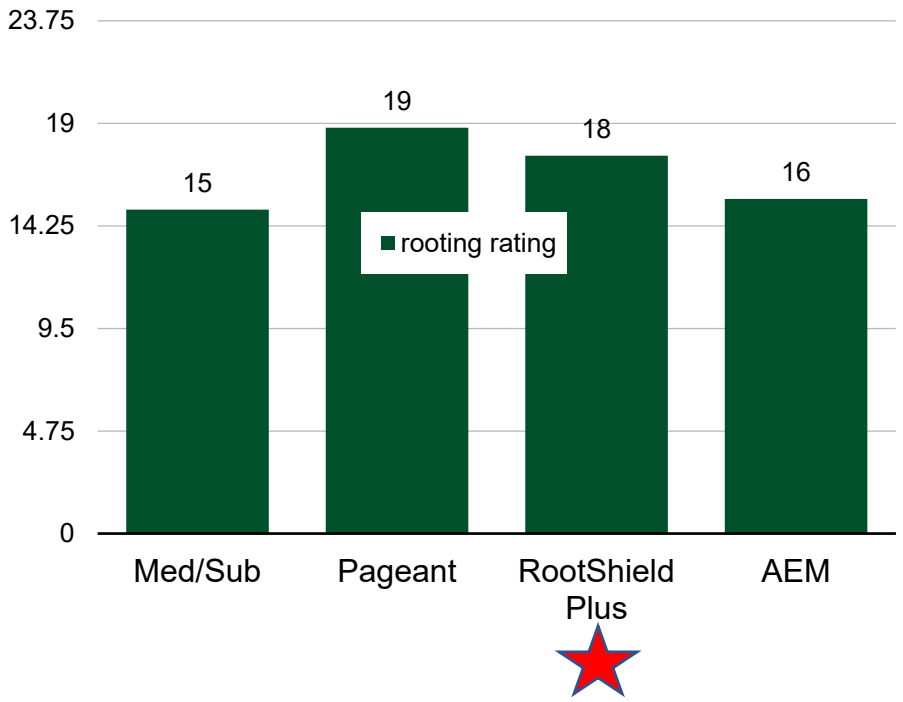
Crepe Myrtle

Products applied as a sprench at sticking

Pageant Intrinsic applied again 14 days later

Treatments

A. Medallion and Subdue Maxx (ea. 1 oz/100 gal)
B. Pageant Intrinsic (4 oz/100 gal)
C. RootShield Plus (8 oz/100 gal)
D. AEM1 (25 oz/100 gal) (Efficient Microorganisms)



Conclusions

- At the end of the trial, the best rooting was seen with Pageant Intrinsic
- **Closely followed by RootShield Plus**.

Chase Agricultural Consulting, LLC.
Practical Solutions for Growers

SAFE. PROVEN. EFFECTIVE.

BioWorks®

Biologicals do best when applied early

Viburnum ‘Spring Lace’ – 6/18

Illicium parviflorum ‘BananAppeal’ – 8/20

Start Clean - Stay Clean

SAFE. PROVEN. EFFECTIVE.

Improved survival after transplanting

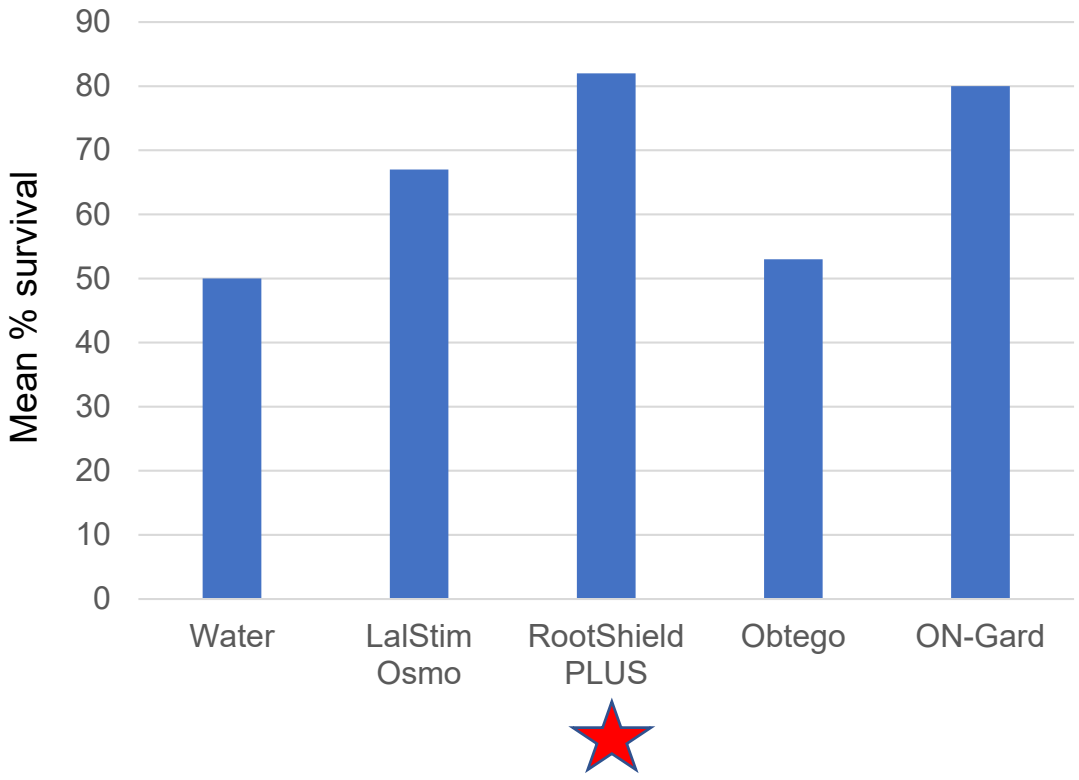
Trial conditions very stressful

- Dry, hot days to cool/ cold nights

Best treatments for top quality were

- RootShield Plus
- ON-GARD
- All other treatments did not promote plant growth over the water control.

Effect of post-transplanting products on survival of *Pittosporum tenuifolium*



Chase Agricultural Consulting, LLC. Practical Solutions for Growers

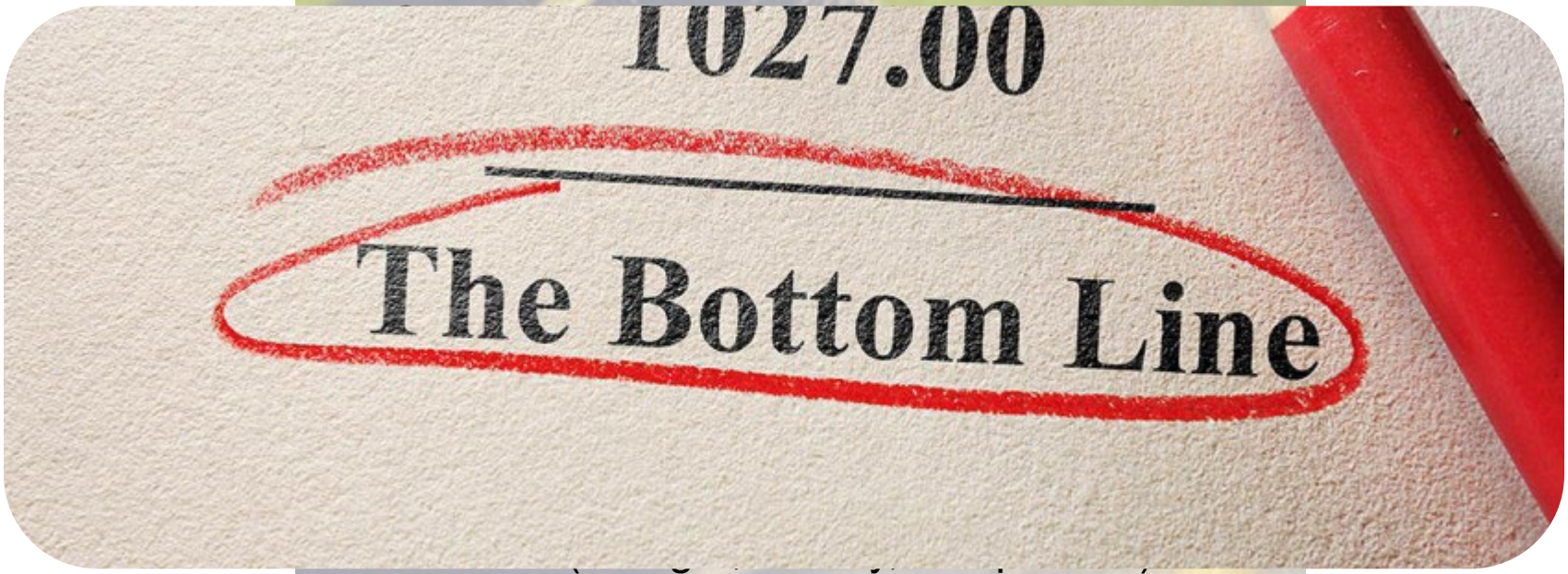
SAFE. PROVEN. EFFECTIVE.

BioWorks®

Benefits of biofungicides

Biocontrol benefits

- Stronger plant disease resistance
- Reduced need for fungicide soil drenches



Thank you

Advances (and Opportunities) in Biofungicides

.....

BioWorks®