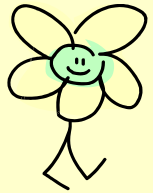
Managing Diseases in the Greenhouse with Biologicals



Cheryl A. Smith

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Cultural methods must be employed to prevent pest problems

(Essential for effective use of any 'chemical' control)

('chemicals' will not correct for poor horticultural methods)

Cultural Components of GH IPM

Prevention

- **Sanitation**
- **Humidity control (air circulation)**
- **Scouting & Diagnosis / ID**
- **pH & nutrient testing**
- **Watering**

Sanitation!

Inspect incoming material

Start clean, keep it clean, end clean

- **sanitize benches, potting areas, mats, trays, irrigation system components**
- **keep hose nozzles off ground/floor**
- **remove plant debris, weeds & algae**

Sanitation Needed!

Look under the benches!

Why biologicals /biorationals

- As a tool to prevent pesticide resistance
- Alternative to ‘conventional’ chemicals
- As a tool for organic growers

Should be some in everyone’s toolbox

Some points to keep in mind…

- **Use preventatively!!**
  - **Won't save a 'situation'**
- **Must be used with cultural methods**
- **Don't use them like a chemical**
  - **Not as a corrective measure**
- **Not like insect parasitoids and parasites**
  - **Many are good saprophytes…no 'feeding'**

Biologicals

How do biological fungicides work?

- **Exclusion by direct competition**
  - **(for colonization / living sites)**
- **Antagonism / Antibiosis**
  - **metabolite production: toxins, antibiotics**
- **Predation or parasitism**

Trichoderma attacking Rhizoctonia

www.bioworksinc.com

How do biological fungicides work?

- **Exclusion by direct competition**
  - **(for sites)**
- **Antagonism / Antibiosis**
  - **metabolite production: toxins, antibiotics**
- **Predation or parasitism**
- **Competition for nutrients**
- **Induce host resistance (ISR)**

How to use biological fungicides?

- **use BEFORE disease occurs**
- **MUST be used in conjunction with cultural methods**

Biocontrol organisms

- **Fungi –**
  - ***Trichoderma* spp.**
    - **different strains**
- **Bacteria**
  - ***Bacillus* spp.**
    - **different strains**
  - ***Streptomyces* spp.**
    - **different strains**

What for what?

Trichoderma – fungal diseases

Bacillus – Fungal & bacterial diseases

Streptomyces – fungal diseases

(in general…always some exceptions)

Trichoderma spp.

Material:

natural, soil-born fungus, various strains

soil (or foliar) application

MOA:

exclusion, competition, antagonism/antibiosis, parasitism, growth enhancement

NOP: Microbial, Non-synthetic, allowed

Toxicity: III "Caution"

Bacillus spp.

Material:

natural, saprophytic bacterium, various strains

soil or foliar application

MOA:

competition, antagonism/antibiosis, growth enhancement, ISR

NOP: Microbial, Non-synthetic, allowed

Toxicity: III "Caution"

Streptomyces spp.

Material:

natural, predominantly soil-inhabiting, bacterial and fungal characteristics, various strains

soil or foliar application

MOA:

exclusion, antagonism/antibiosis, parasitism, growth enhancement

NOP: Microbial, Non-synthetic, allowed

Toxicity: III "Caution"

Soilborne ‘target’ pathogens

- **Pythium**
- **Rhizoctonia**
- **Fusarium**
- **Phytophthora**
- **Thielaviopsis**

check for healthy roots

Not good

Pythium root rot

Pythium root rot – sloughing roots

Blackened areas on roots (Thielaviopsis)

Thielaviopsis

Calibrachoa

stunt

wilt

Thielaviopsis root rot

products for drench

RootShield (G, WP):

***Trichoderma harzianum* T-22; Bioworks OMRI**

RootShield Plus

***T. harzianum* + *T. virens*; Bioworks OMRI**

Mycostop

***Streptomyces griseoviridis* K61; AgBio OMRI**

Actinovate

***S. lydicus*; Natural Industries OMRI**

products for drench

Cease

***Bacillus subtilis* QST713; Bioworks OMRI**

Companion Biological Fungicide

***B. subtilis* GB03; Growth Products (NO OMRI)**

Triathalon BA

B. amyloliquefaciens strain D747: OHP

(NO OMRI)

Rootshield (G, WP) root treatment

0 hr REI OMRI

<u>Target Pathogens</u>:

Pythium

Rhizoctonia

Fusarium

Thielaviopsis

Cylindrocladium

Rootshield Plus (G, WP)

0 hr REI (G, WP)

4 hr REI if dip or dust (WP) **OMRI**

<u>Target Pathogens</u>:

Pythium ***Rhizoctonia***

Fusarium ***Thielaviopsis***

Cylindrocladium

Phytophthora

media-mix

Pro-Mix (BX, BRK, HP, LP15) Biofungicide

***B. pumilis* GHA180 + mycorrhizae**

(*Glomus intraradices*); Premier (NO OMRI)

Pro-Mix Biofungicide (BX, BRK, HP, LP15)

NOT OMRI

<u>Some Target Pathogens</u>:

Pythium ***Phytophthora*** ***Rhizoctonia***

Fusarium ***Sclerotinia***

Some foliar ‘target’ pathogens

- **PM**
- **DM**
- ***Alternaria***
- ***Rhizoctonia* (aerial blight)**
- **Bacteria**
  - ***Xanthamonas, Erwinia, Pseudomonas***

Sedum - powdery mildew

Pansy - downy mildew


Basil - downy mildew

products for foliar application

Mycostop

***Streptomyces griseoviridis* K61; AgBio OMRI**

Actinovate

***S. lydicus*; Natural Industries OMRI**

Cease

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Companion Biological Fungicide

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Triathalon BA

***B. amyloliquefaciens D747; OHP* (NO OMRI)**

Mycostop

0-4 hr REI **OMRI**

Soil & foliar

Target Pathogens:

Fusarium ***Alternaria*** ***Phomopsis***

(root, stem & seed rots & wilt)

Also listed for *Botrytis*

Suppresses:

Phytophthora ***Pythium*** ***Rhizoctonia***

(Can be used same day with several fungicides)

Actinovate SP T&O

0-1 hr REI **OMRI**

Soil & foliar treatments (also vegetables & herbs)

<u>Target Pathogens</u>:

Pythium ***Phytophthora*** ***Rhizoctonia***

Fusarium ***Verticillium*** ***Sclerotinia***

Botrytis ***Alternaria*** **anthracnose**

Erwinia ***Xanthamonas*** ***Pseudomonas***

also DM & PM

Companion Biological Fungicide 2-3-2L

0-4 hr REI **NOT OMRI**

Soil & foliar treatments (also vegetables & herbs)

<u>Some Target Pathogens</u>:

Pythium ***Rhizoctonia*** ***Fusarium* wilt**

Sclerotinia ***Botrytis*** ***Alternaria***

Xanthamonas campestris

also PM

Cease

0-4 hr REI **OMRI**

Soil & foliar

<u>Some Target Pathogens</u>:

Pythium ***Phytophthora*** ***Rhizoctonia***

Fusarium ***Sclerotinia*** **DM & PM**

Botrytis ***Alternaria*** ***Cercospora***

Myrothecium **Rust**

Erwinia ***Xanthamonas*** ***Pseudomonas***

Triathlon BA

4 hr REI **(NOP , no OMRI)**

Soil & foliar treatments **(also vegetables & herbs)**

<u>Target Pathogens</u>:

Pythium ***Rhizoctonia*** ***Botrytis***

Fusarium ***Sclerotinia*** ***rust***

anthracnose

fungal leaf spots ***bacterial leaf spots***

also DM & PM

Efficacy trials

B. Subtilis (Cease)

Botrytis (poinsettia) - as good control as Decree

(Daughtrey, 2002**)**

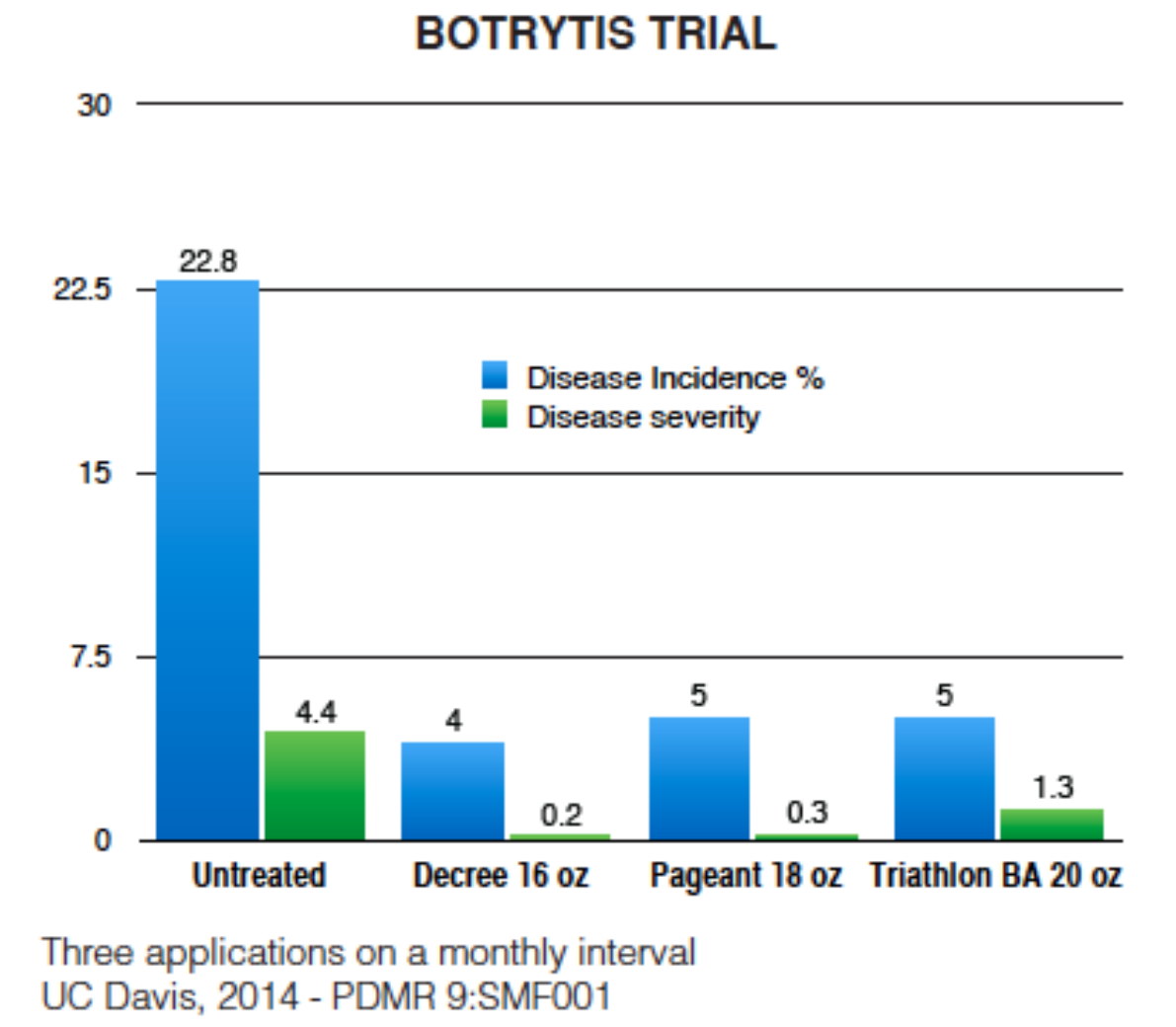
Impatiens DM – NO effect @ 4 or 8 qt rates

(Warfield, 2013**)**

B. Subtilis (Cease) + Potassium Bicarb (Milstop)

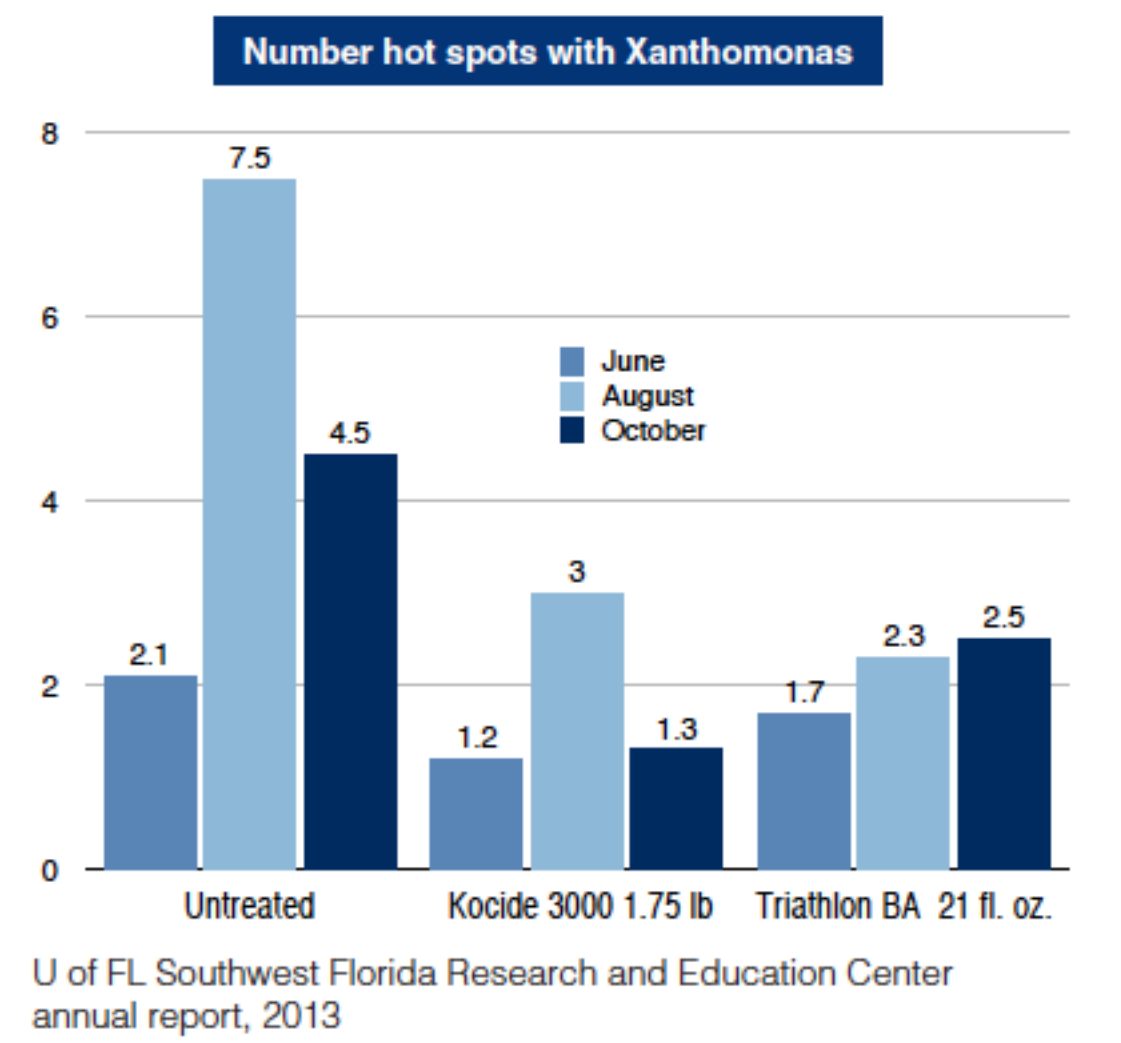
slowed Botrytis on tomato (Villavicencio, 2011**)**

Efficacy trials



Three applications on a monthly interval
UC Davis, 2014 - PDMR 9:SMF001

Efficacy trials

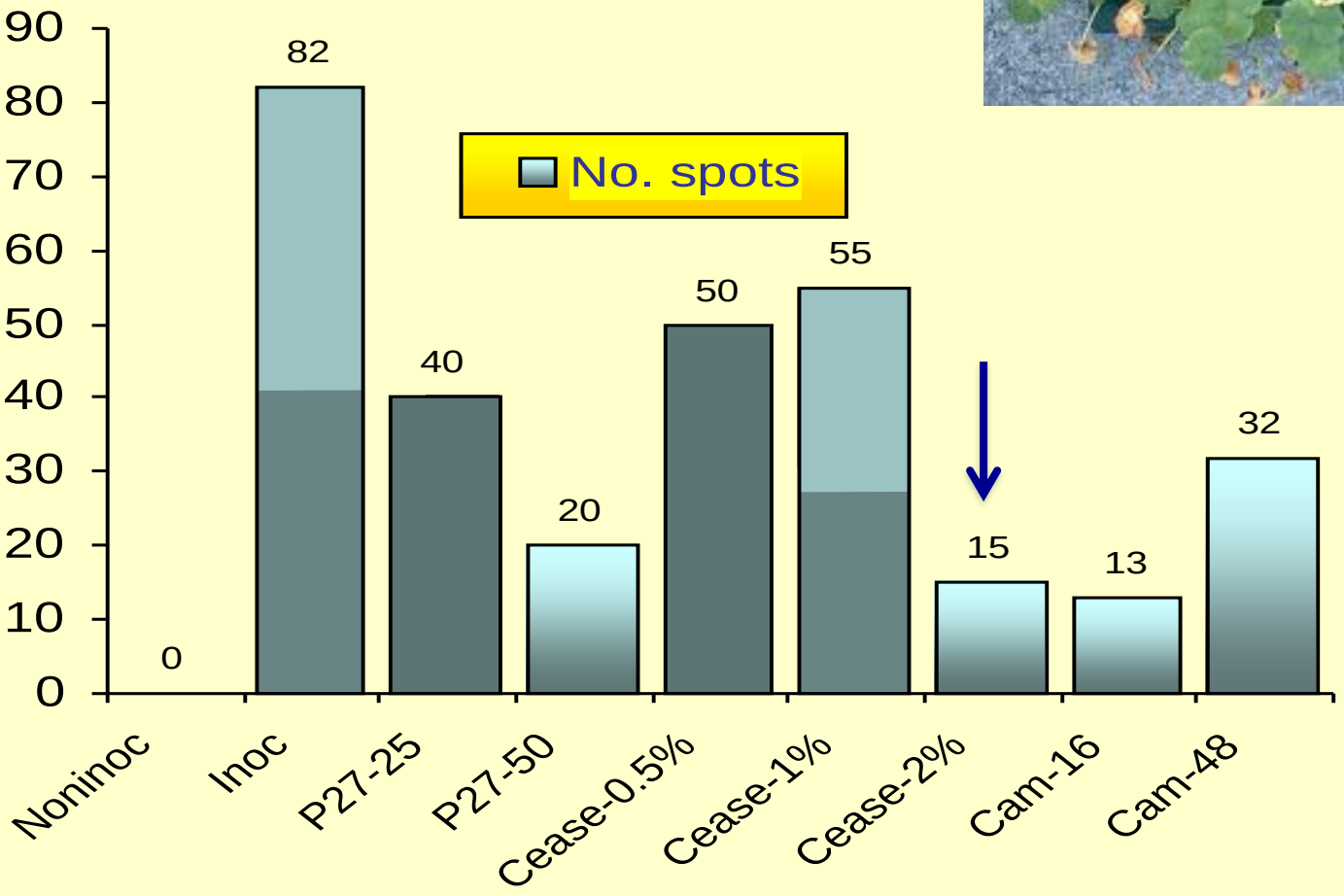


U of FL Southwest Florida Research and Education Center annual report, 2013

Efficacy trials

Done by Chase Horticultural Research

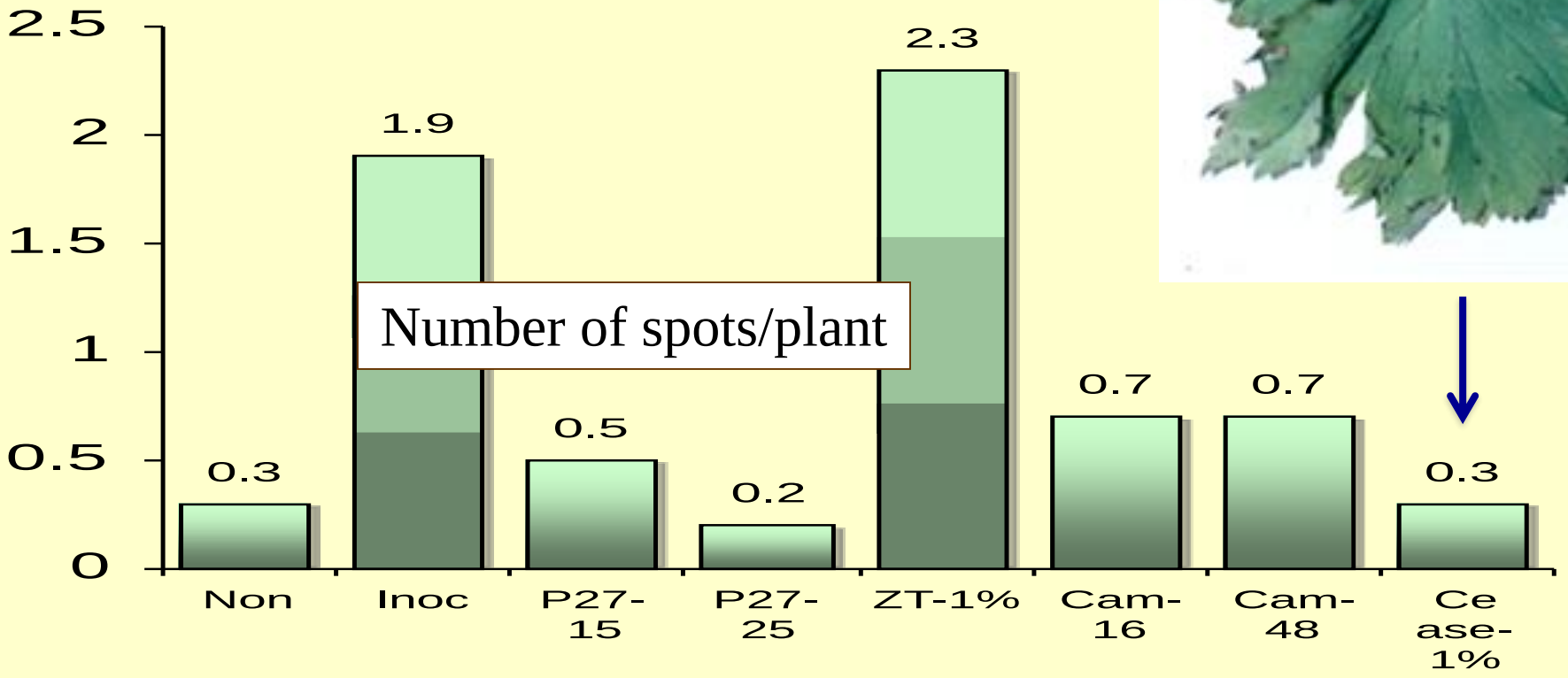
Control of Xanthomonas on Geranium



Chase Horticultural Research, Inc.
Education for Horticulture

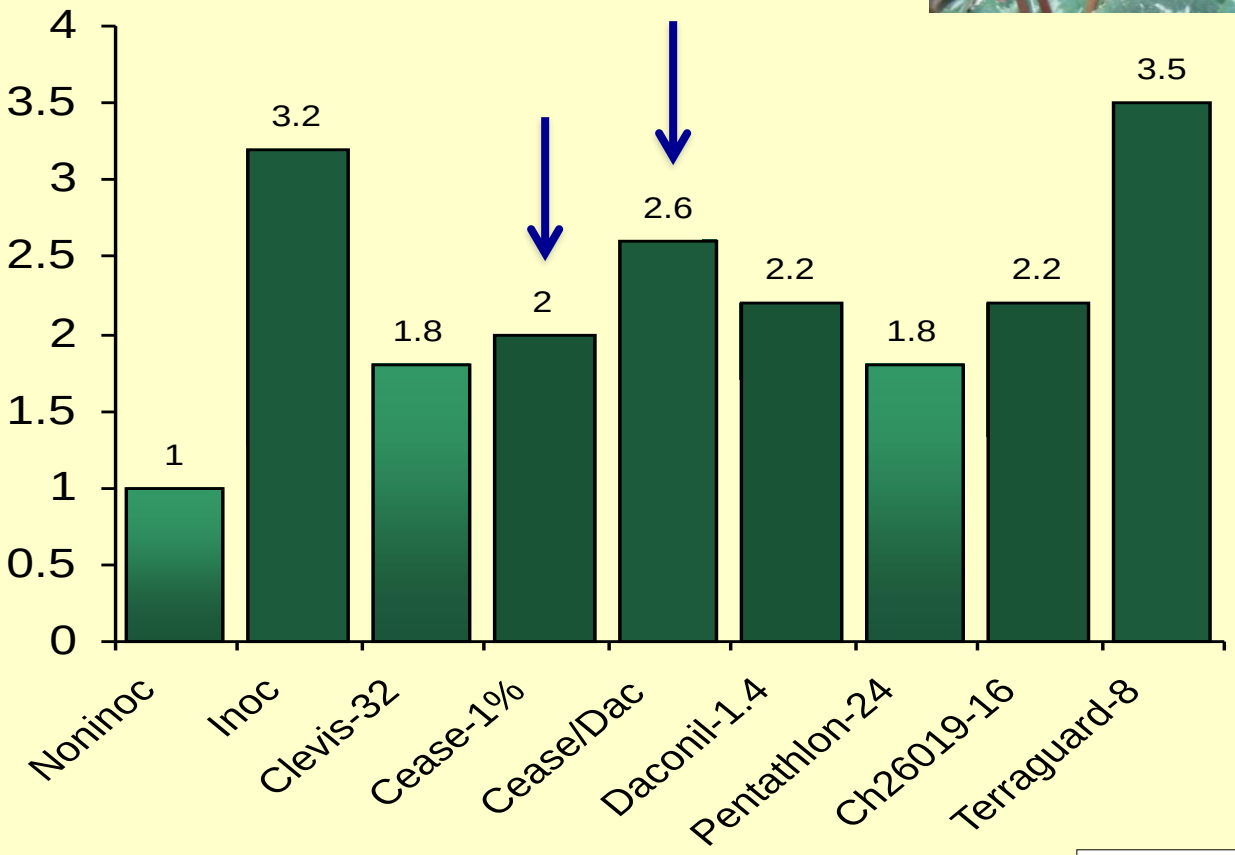
Control of Pseudomonas leaf spot on Delphinium

Products were applied three times on a weekly interval.



Chase Horticultural Research, Inc.
Education for Horticulture

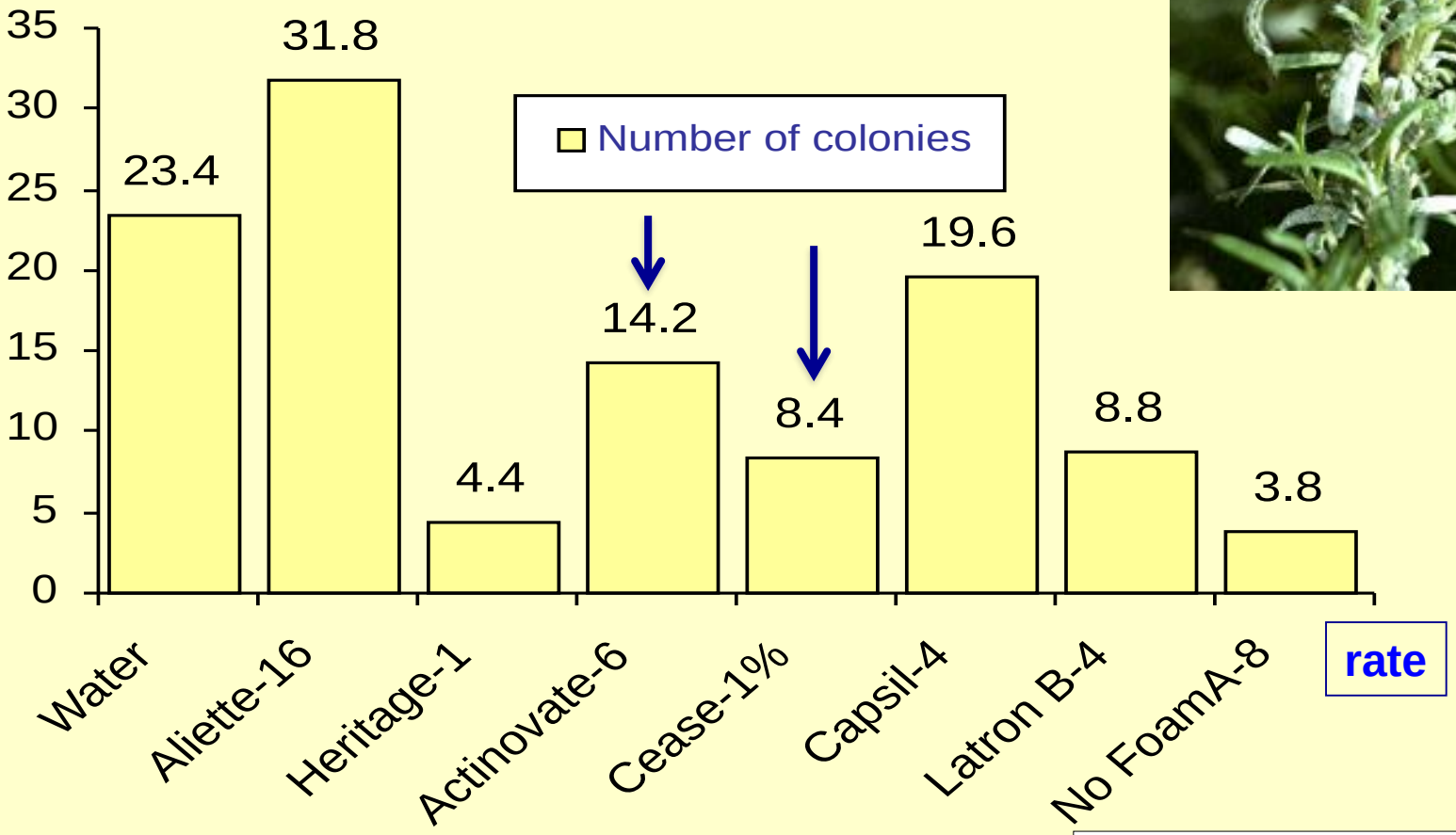
Colletotrichum leaf spot on Cyclamen



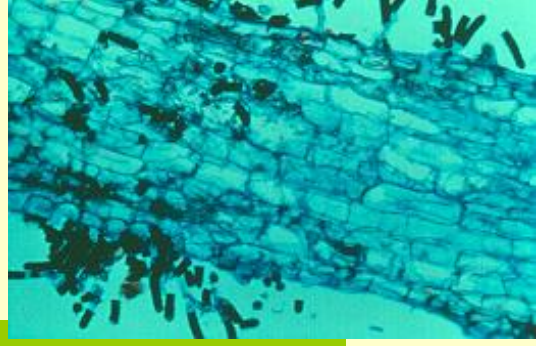
Three sprays on a 7-day interval

Chase Horticultural Research, Inc.
Education for Horticulture

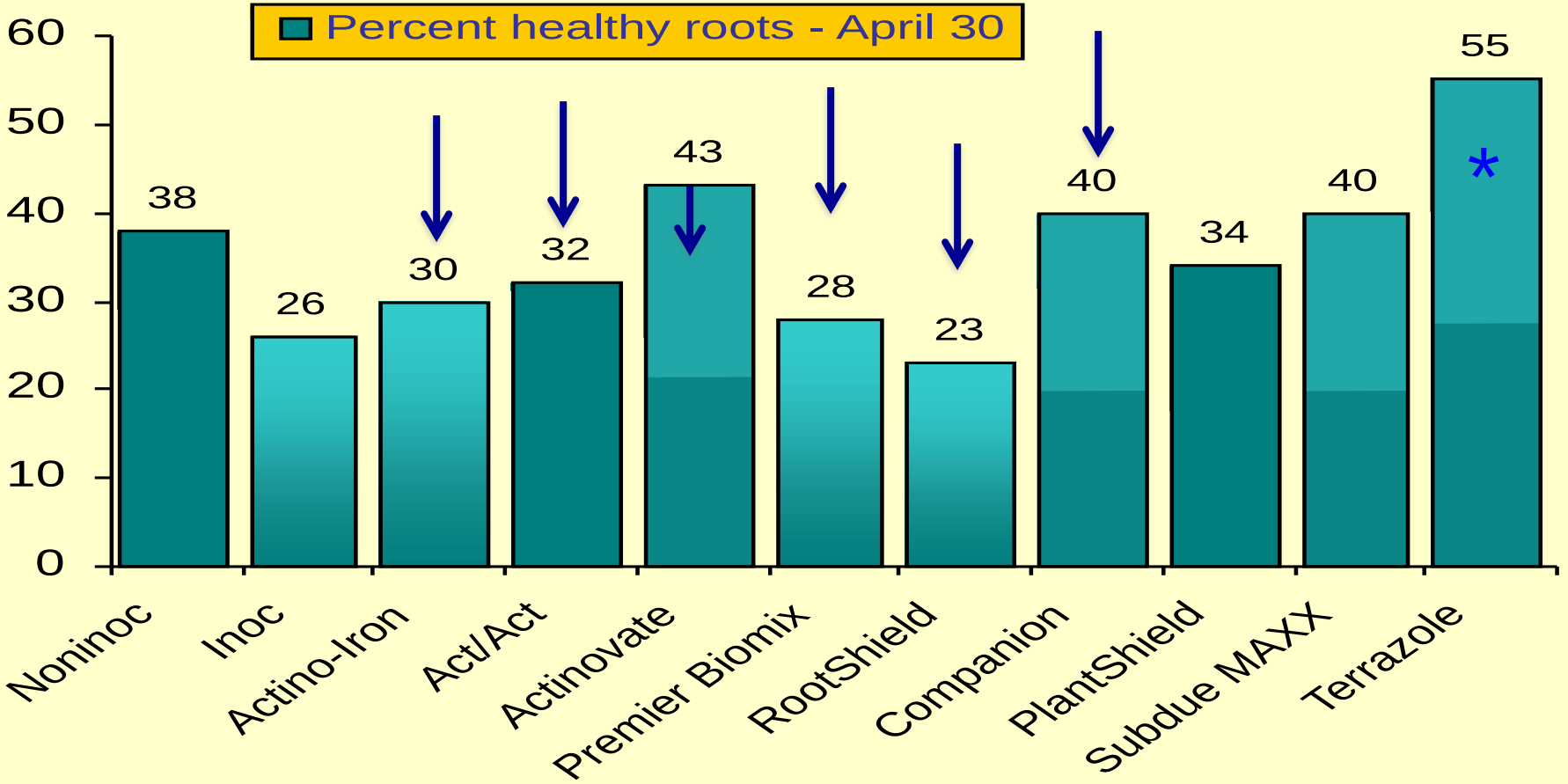
Eradication of powdery mildew on Rosemary with biocontrols and wetting agents



Black root rot control on Pansy



Pythium root rot control on Geranium



Chase Horticultural Research, Inc.
Education for Horticulture

Triathlon BA

Disease	Results
Alternaria leaf spot	variable
Blue mold (downy mildew)	variable
Botrytis	good to excellent
Fireblight	some
Powdery mildew	some to very good
Rhizoctonia damping-off and leaf spot	good to very good
Rust	variable
Xanthomonas blight and leaf spot	very good to excellent

Summary provided by A. R. Chase, Chase Ag Consulting, LLC.

Disadvantages of microbial fungicides

- may not work quickly
- do not eradicate pathogen/rescue infected host
- shorter shelf life
- may be expensive
- compatibility with other pesticides

Regalia Biofungicide

Extract of giant knotweed *Reynoutria sachalinensis*

4 hr REI **OMRI**

Soil & foliar treatments (also vegetables & herbs)

MOA

ISR, also translaminar

Target Pathogens:

PM controlled very well

Pythium ***Phytophthora*** ***Rhizoctonia***

Verticillium

Native to northeast Asia, N. Japan, & far eastern Russia

Efficacy trial

Study done in FL with Gerbera PM:

77% reduction with 1% Regalia

Has to be applied early, well-before disease is likely to occur.

Repeat applications…ISR takes time

Some additional points to keep in mind…

- **If not organic production:**
  - **Rotation with chemicals may give better results (than either alone)**
  - **Can help preserve usefulness of synthetic chemicals (prevent resistance)**

Cultural methods must be employed to prevent pest problems

Essential for effective use of any biological or chemical control

In Summary

- **Biocontrol (and biorational) products:**
  - **Aid in resistance management**
  - **Often have short REI**
  - **Some have plant health benefits**
  - **Can help to reduce ‘chemical’ use**
  - **Many are OMRI-listed**
  - **May have lower risk of phytotoxicity**

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