



BioWorks®
How You Grow Matters™

MFGA Summer Trial Gardens Tour August 10, 2017

Debbie Palumbo-Sanders
Technical Services

dpalumbo-sanders@bioworksinc.com

Responsible

| Economical

| Proven



1. PREVENTATIVE-

this is a numbers game

2. Dealing with another crop- LIVING ORGANISM

Why Growers Start and Continue to Use Biopesticides

1. Low REIs and PHIs
2. Safer for workers, consumers, & environment
 - Many exempt from tolerances and MRLs
3. Reduce development of resistance to synthetic or single mode of action pesticides
 - no known resistance to multiple-MOA biopesticides
4. Improve efficacy of chemical- and bio-pesticides
5. Improve plant, soil and environmental health over time with continued use
6. Consumer demand / better price for crops in market

Misconceptions and Myths of Bioinsecticides

- They do not work as well as synthetic products
- They are incompatible with synthetic products
- They do not have a good shelf-life
- They never cause phytotoxicity
- Single applications are enough
- We do not really know how they work (a black box)

How they do it



Image by Nick Kurzenko

Extract of
Reynoutria sachalinensis
Giant Knotweed

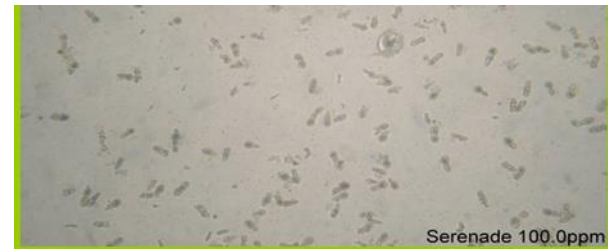


Inhibition of spore germination

No Biofungicide

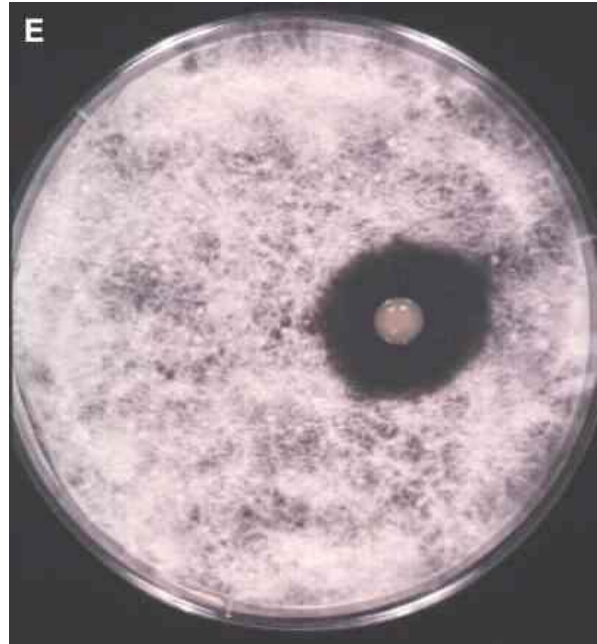


~100% inhibition



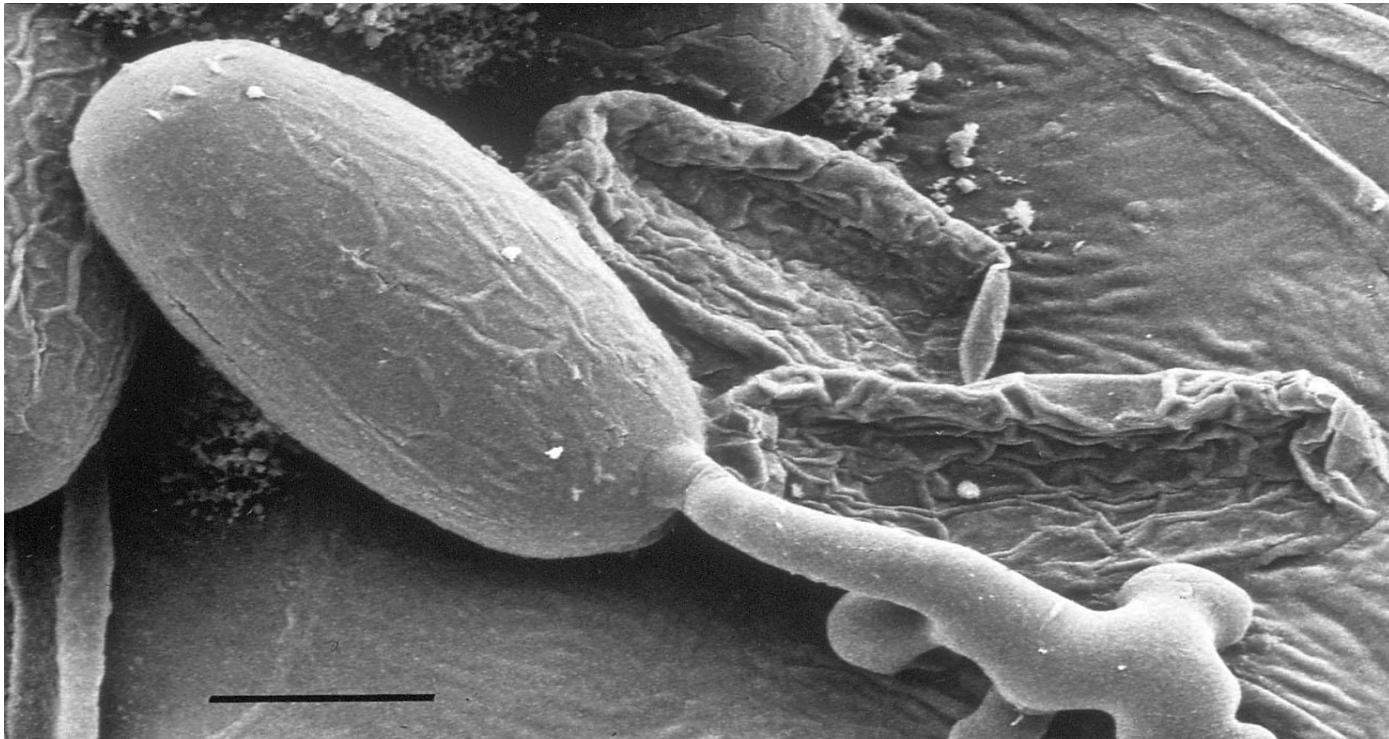
<i>Bacillus subtilis</i> strain QST 713	Cease [®]	BioWorks
<i>Bacillus amyloliquefaciens</i> strain D747	DoubleNickle55 [®]	Certis

How they do it



<i>Streptomyces lydicus</i> WYEC 108	Actinovate [®] SP	Natural Industries
<i>Streptomyces griseoviridis</i> Strain K61	Mycostop [®]	AgBio

SEM of MilStop Treated and Untreated Powdery Mildew Spores



potassium bicarbonate + surfactant	MilStop [®]	BioWorks
potassium bicarbonate	Kaligreen [®]	Toagosei



How they do it

Example: *Beauveria bassiana* strain GHA

- Mortality is not immediate, takes 3-7 days
- Sporulation is not a measure of efficacy

Healthy



Infected



Sporulating



<i>Beauveria bassiana</i> strain GHA	BotaniGard®	BioWorks
<i>Metarhizium anisopliae</i> Strain F52	Met 52®	Novozymes
<i>Paecilomyces fumosoroseus</i> atrain FE 9901	NoFly®	Natural Industries
<i>Isaria fumosorosea</i> Apoka Strain 97	Preferal®	SePRO
<i>Isaria fumosorosea</i> Strain 97	PFR-97®	Certis

Responsible

Economical

Proven



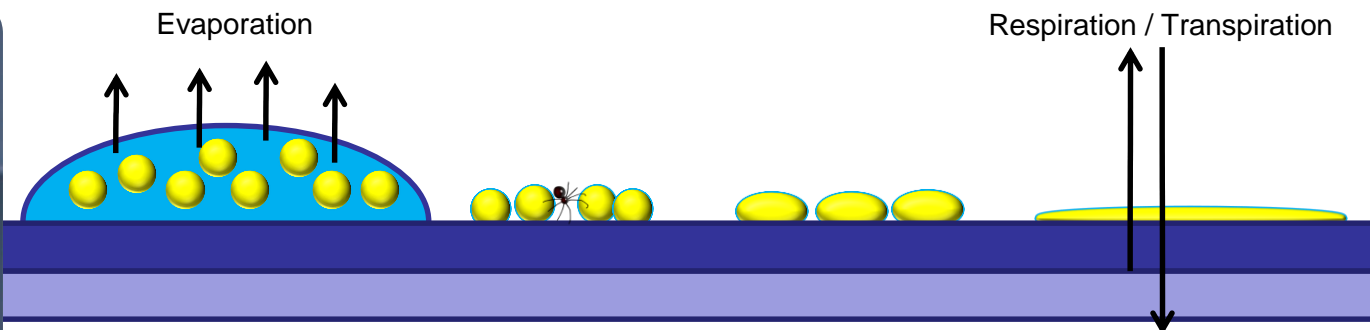
BioWorks®

How You Grow Matters™

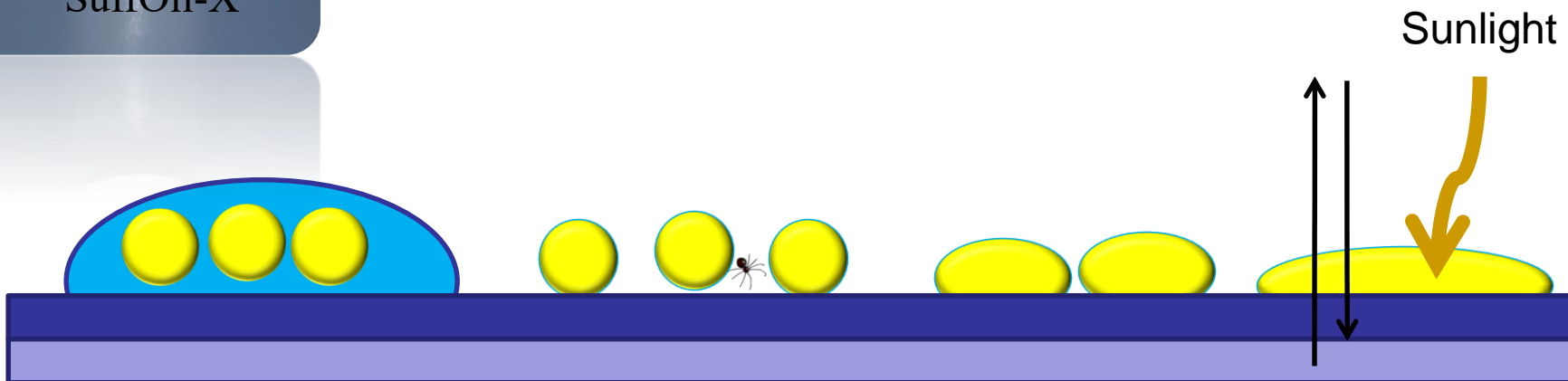
How they do it



SuffOil-X



Pre-emulsified



Other Oils

Respiration / Transpiration

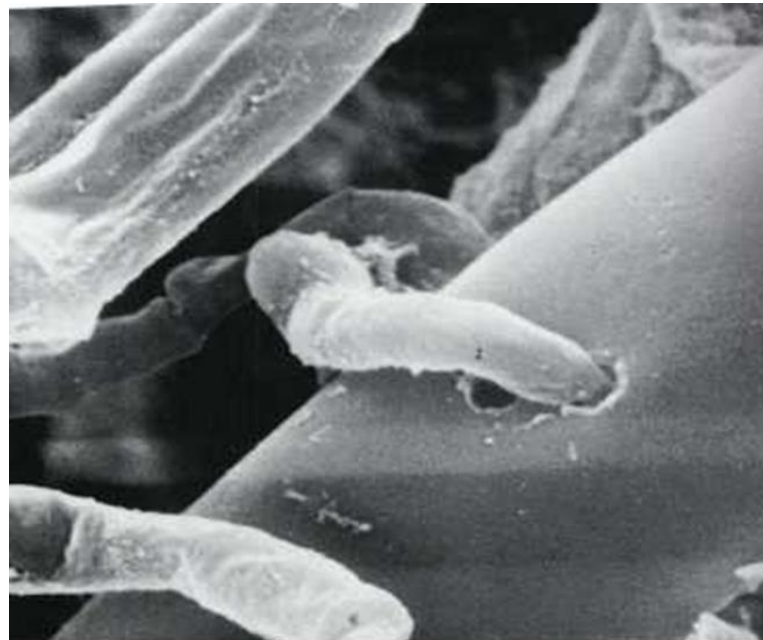
Responsible

Economical

Proven

How they do it

<i>Streptomyces lydicus</i> WYEC 108	Actinovate [®] SP	Natural Industries
<i>Streptomyces griseoviridis</i> Strain K61	Mycostop [®]	AgBio
<i>Gliocladium virens</i> GL-21	SoilGard [®]	Certis
<i>Trichoderma harzianum</i> Rafi strain T-22		
<i>Trichoderma virens</i> strain G-41	RootShield [®] PLUS	BioWorks [®]



Responsible

Economical

Proven



- Think proactive or preventive
- Obtain accurate diagnosis of the problem to select the right products
- Follow label instructions: rates, timing, safety, storage
- Use the appropriate formulation for the job. Ask about compatibility





- Know the active ingredient
- Test new products on a small scale before going “all out”
 - Integrate rather than replace
- Proper application
- Pay attention to shelf life and storage conditions/limits



Dipping Plant Material



Responsible

Economical

Proven



How You Grow Matters™

Utilizing Dips

Clean Up Incoming Plant Material by Utilizing Dips

Bringing in outside plant material also brings in unwanted pests. Many cuttings and young plant material from domestic or off-shore suppliers contain low level insect populations. Whiteflies, thrips, fungus gnats and aphids may arrive unnoticed until later in production when populations can suddenly explode. Incoming plant material may also carry root diseases that also require early prevention.

Dips are very successful when biological control agents (BCAs) are used. By dipping plant material, BCAs have a head start in keeping pest populations in check. By using the BioWorks products below, there is no risk of pesticide residues that will interfere with BCA feeding, growth or reproduction.

Dips are simply the use of biopesticides, alone or tank-mixed, in a tray or tub where bundles or bags of cuttings, or trays of plugs can be briefly submerged and thoroughly wetted. Plant material is then stuck or planted. Using dips, many cuttings or trays can be quickly treated, resulting in the use of less overall volume of pest control product(s). (See Guidelines for Dipping and Dip Process below) **Effective dips can significantly reduce the need for multiple applications of chemical pesticides later in the crop cycle.** The bottom line is that dipping saves money and time for growers. BioWorks products have been effectively used in dips:

BotaniGard® 22WP

(Do not use BotaniGard ES)

Mycotrol® WPO

WSDA Approved (Do not use Mycotrol ESO)

RootShield® WP

OMRI Listed

NemaShield®

Exempt from EPA labeling requirements

ON-Gard®

OMRI Listed

RootShield® PLUS® WP

OMRI Listed

Rates for Dipping

Note that there are two rate charts. One is for unrooted cuttings (URC) and bare-root plants (no medium surrounding the roots) and the second chart is for plugs, liners or other young plants that are potted in a growing medium which surrounds the roots.

For Unrooted Cuttings (URC) and Bare-root Plants: (Do not use this rate chart for plugs)

Products*	Metric Rate	US Rate
BotaniGard 22WP OR Mycotrol WPO	2.5 grams / liter	1.5 oz / 5 gallons
NemaShield	1 million / liter	19 million / 5 gallons
ON-Gard	2.5 ml / liter	1.6 fl oz / 5 gallons
RootShield WP OR RootShield PLUS® WP	2.5 grams / liter	1.5 oz / 5 gallons

*Products can be mixed together or used individually

BioWorks • 100 Rawson Rd., Ste. 205 • Victor, NY 14564
1 (800) 877-9443 • bioworksinc.com

Utilizing Dips 060217

©2017 BioWorks, Inc.



How You Grow Matters™

For Plugs, Liners or Other Plant Material Growing in a Potting Medium:

Products*	Metric Rate	US Rate
BotaniGard 22WP OR Mycotrol WPO	2.5 grams / liter	1.5 oz / 5 gallons
NemaShield	1 million / liter	19 million / 5 gallons
ON-Gard	2.5 ml / liter	1.6 fl oz / 5 gallons
RootShield WP**	0.4 grams / liter	0.25 oz / 5 gallons
OR		
RootShield PLUS® WP**	0.6 grams / liter	0.4 oz / 5 gallons

*Products can be mixed together or used individually

**Select either RootShield WP or RootShield PLUS® WP

Guidelines for Dipping

- Clean and disinfect the dipping tank and equipment before preparing a new dip suspension. Prepare only as much dip suspension as can be used in one day. If plant pathogens are a concern, prepare a new dip suspension regularly. (Recent research has shown that disease transmission from Erwinia is unlikely.)
- Use cool water when making up the suspension, keep out of direct sunlight, and maintain cool water temperatures (60 - 70° F) throughout the dipping process.
- If NemaShield is included, keep the suspension cool (60 - 70° F) and aerate the suspension to keep the nematodes alive and vigorous.
- Dip suspension should not be used for more than one day. NemaShield nematodes and BotaniGard spores will not survive overnight.
- Frequently agitate dip solution throughout use.
- Avoid dipping sensitive plants such as African violet, tender ferns, etc.
- Conduct a test by dipping a small number of plants and observe for plant damage before using dip treatment. Observe plants for 7 - 10 days for signs of injury. Do not use dips if there is any visible damage to test plants.
- Do not dip stressed/wilted cuttings or transplants.

Dip Process

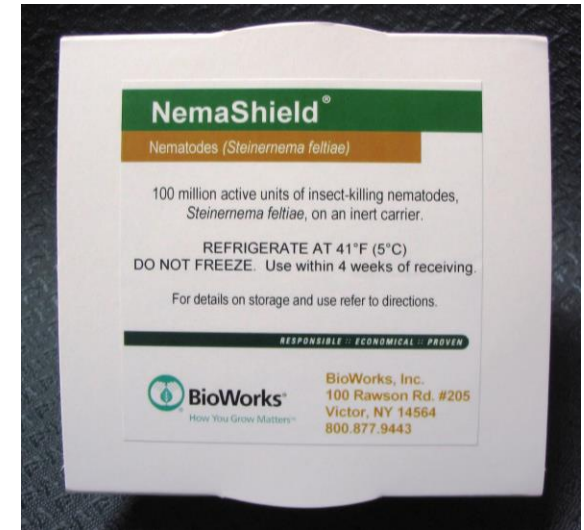
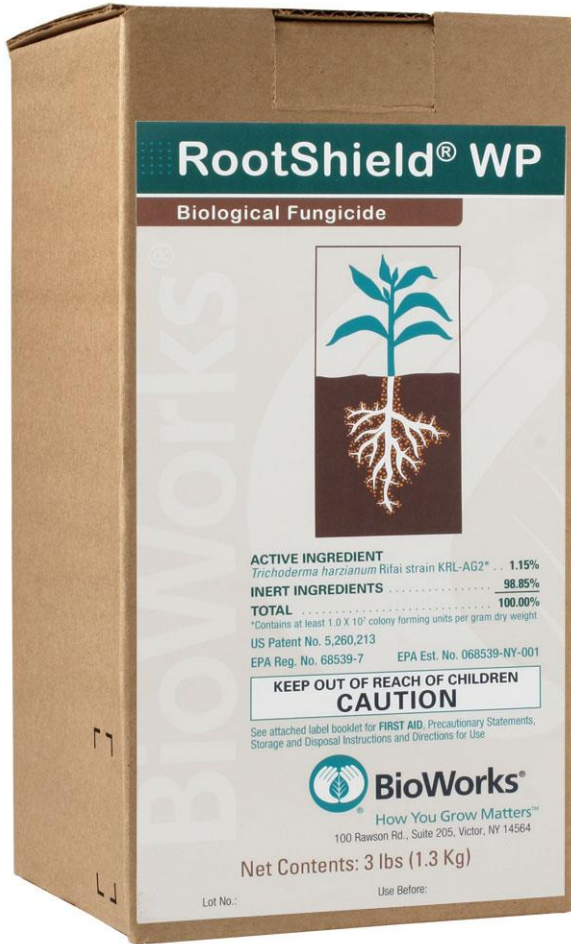
- Dip vegetative or hardwood cuttings prior to planting into rooting substrate. Place unrooted cuttings in a mesh bag, immersion tray with lid, or loose in the tank. Ensure that the cuttings are not packed too tightly to promote maximum surface area coverage. Immerse the cuttings completely, gently moving the tray, bag, or plants around in the solution for at least 5 seconds to allow the solution to completely wet all surfaces. Verify that there are no dry surface areas. After dipping vegetative cuttings, keep them cool and shaded. Avoid exposing dipped cuttings to full sun, high temperature, or other stress.
- Dip trays of plugs, individual pots of liners, or other potted young plants into the suspension and gently move around for at least 5 seconds. Ensure that all surfaces have been wetted. Allow plants to dry before watering.

For any questions concerning these or any other BioWorks products, please contact us at 800-877-9443. BotaniGard®, Mycotrol®, NemaShield®, ON-Gard® and RootShield® are all registered trademarks of BioWorks®, Inc. Please refer to product labels for complete application details. Always read and follow label directions. All rights reserved.



BioWorks®
How You Grow Matters™

Dipping Plant Material





Dipping Plant Material



8/31/2017

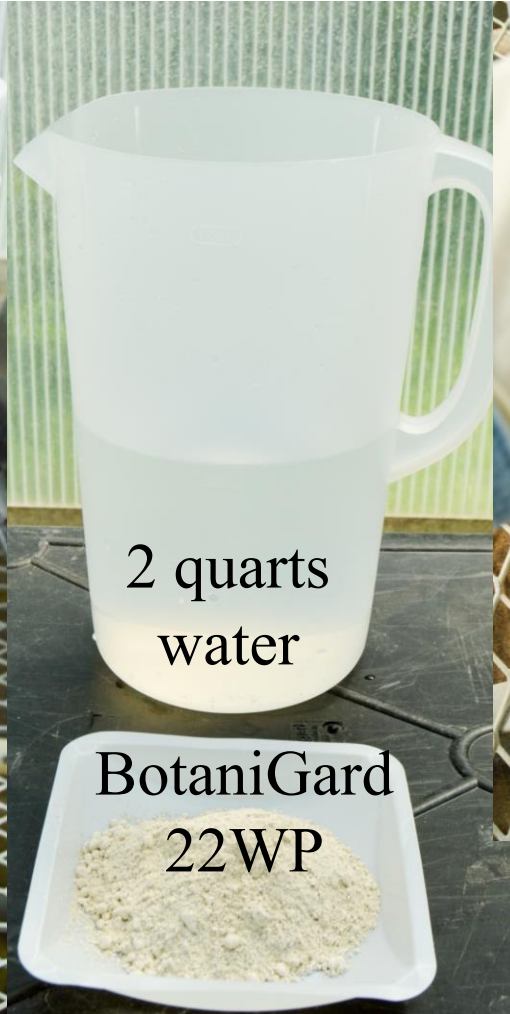
Responsible

Economical

Proven



Dipping Plant Material

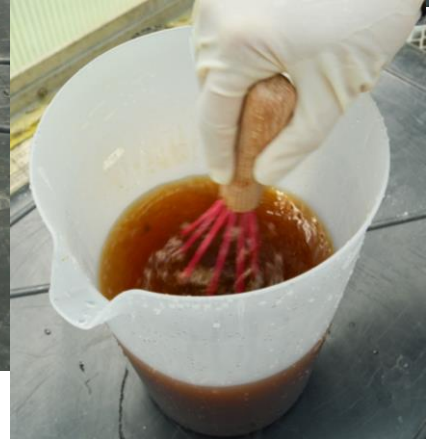
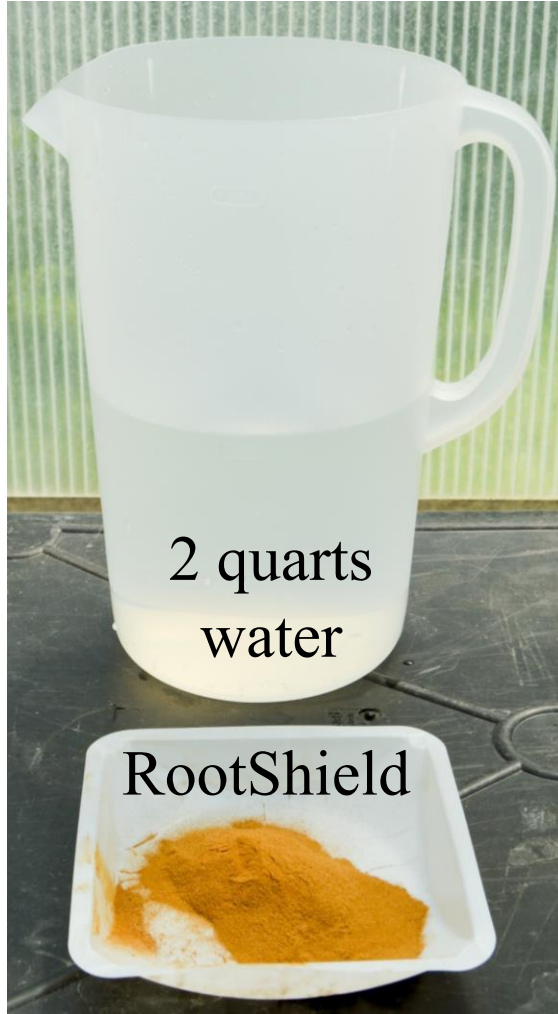


Mix Well



BioWorks®
How You Grow Matters™

Dipping Plant Material



8/31/2017

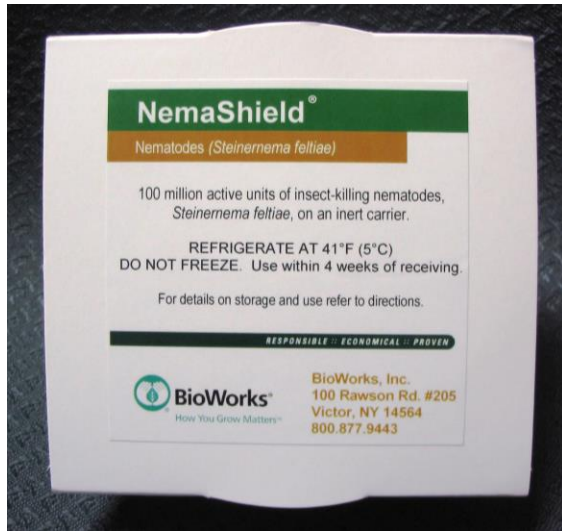
Responsible

Economical

Proven



Dipping Plant Material

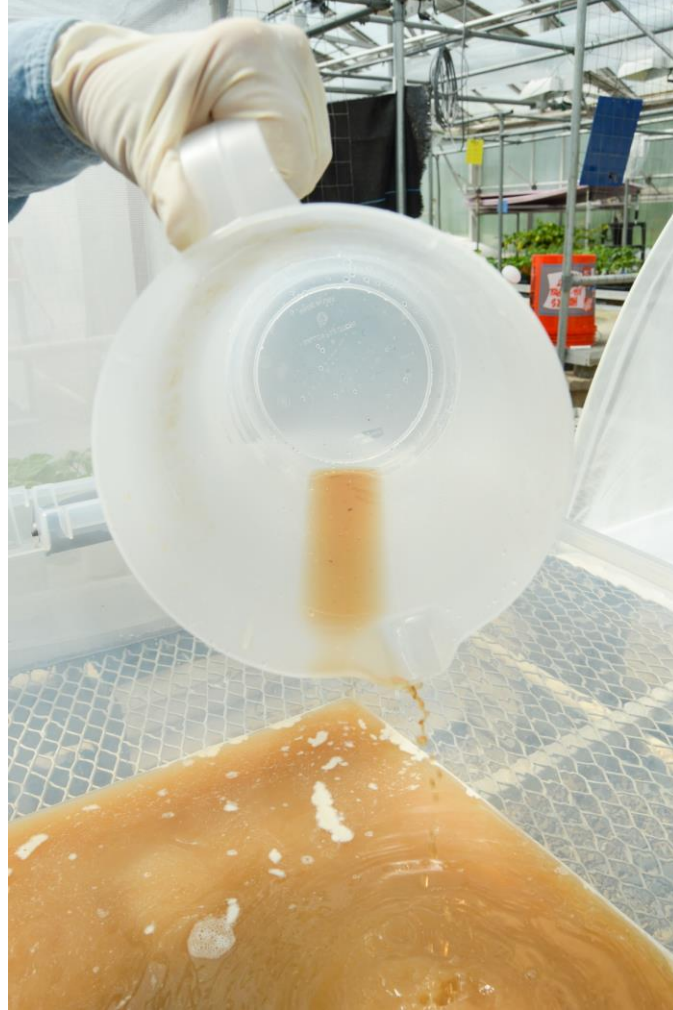


100 mil into 2 gallons cool water, aerated, out of direct sun. Each 5 gallons will need apx.19 million nematodes or 1 ½ quarts from the 2 gallon bucket.



BioWorks®
How You Grow Matters™

Dipping Plant Material





BioWorks[®]
How You Grow Matters™

Dipping Plant Material





BioWorks®
How You Grow Matters™

Dipping Plant Material





BioWorks®
How You Grow Matters™

Dipping Plant Material





BioWorks®
How You Grow Matters™

Dipping Plant Material





BioWorks®
How You Grow Matters™

Dipping Plant Material





BioWorks®
How You Grow Matters™

Dipping Plant Material





Dipping Plant Material



For use in controlling Whitefly, Aphids, Thrips, Psyllids, Weevils and Mealybugs in Ornamentals and Vegetables, Indoor/Outdoor Nursery, Greenhouse, Shadehouse, Commercial Landscape, Interiorscape and Turf.

Active Ingredient: <i>Beauveria bassiana</i> Strain GHA.....	22.0%*
Inert Ingredients:	78.0%**
Total:	100.0%

*Based on the weight estimate of 4.78×10^{-12} grams per spore.

**Contains petroleum distillates.

BotaniGard 22WP contains 2×10^{13} viable spores per pound.

KEEP OUT OF THE REACH OF CHILDREN

**Store between
40°F and 85°F**

CAUTION



Dipping Plant Material

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Chemical-resistant gloves such as nitrile rubber or butyl rubber
- Shoes plus socks

Mixers/loaders and applicators must wear a dust/mist filtering respirator meeting NIOSH standards of at least R-95 or P-95. Repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

USER SAFETY RECOMMENDATIONS

Users should:

- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted-entry interval. The requirements in this box apply only to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 4 hours unless wearing the appropriate personal protective equipment.

PPE required for early entry to treated areas (that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water) is:

- Coveralls
- Chemical-resistant gloves such as nitrile rubber or butyl rubber
- Shoes plus socks



REFERENCE THE FULL LABEL

RootShield® WP Biological Fungicide

ACTIVE INGREDIENT:

Trichoderma harzianum Rifai strain KRL-AG2* 1.15%

OTHER INGREDIENTS: 98.85%

TOTAL: 100.00%

*Contains at least 1.0 x 10⁷ colony forming units per gram dry weight.

EPA Reg.No. 68539-7 Net Contents: 1 lb, 3lb, or 30 lb

EPA Est. No. 068539-NY-001

KEEP OUT OF REACH OF CHILDREN

CAUTION



RootShield WP

Personal Protective Equipment (PPE): Applicators and other handlers must wear long-sleeved shirt and long pants, waterproof gloves, and shoes plus socks. When dumping or opening bags, or other operations where dusts may be created, mixer/loaders and applicators must wear a dust/mist filtering respirator meeting NIOSH standards of at least N-95, R-95, or P-95. Repeated exposure to high concentrations of microbial proteins can cause allergic sensitization. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

RootShield WP

AGRICULTURAL USE REQUIREMENTS

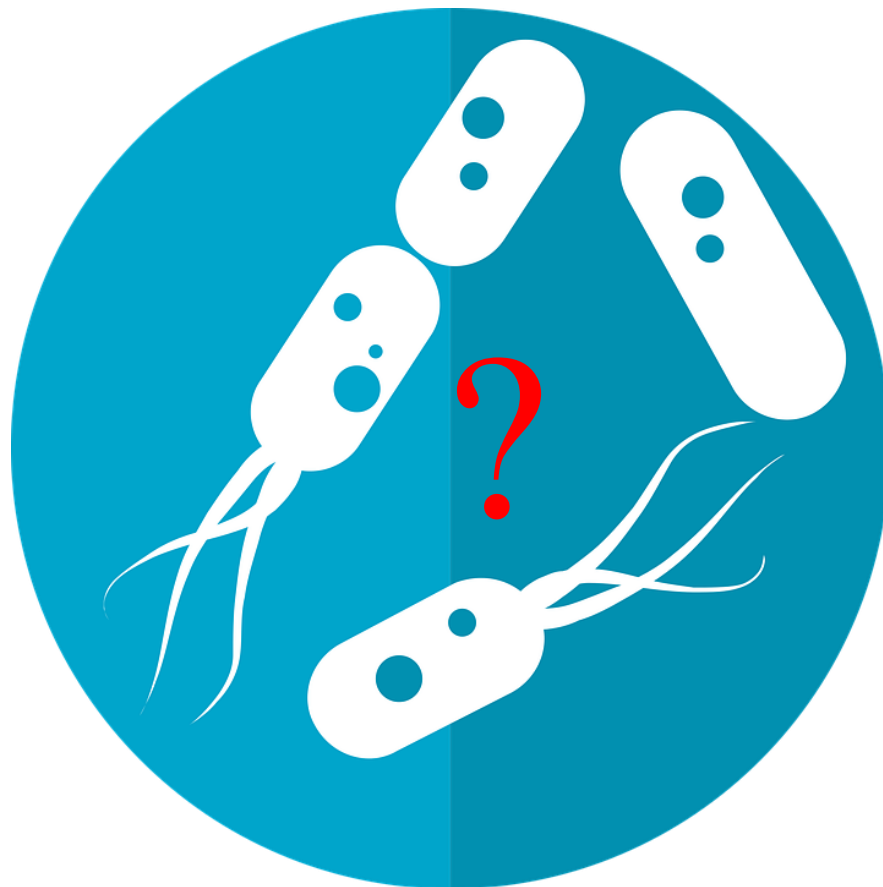
Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

For enclosed environments: There is a **restricted entry of zero (0) hours for this product when applied as a** soil application via soil drench, in-furrow spray, transplant starter solution, **dip**, soak, or chemigation when used in enclosed environments such as glasshouses and greenhouses.



BioWorks®
How You Grow Matters™

Dipping Plant Material



Cost in Use: actual cost to use a product in a program:

- Product cost
- Cost per application: product, labor, and equipment
- Number of applications per crop
- Number of diseases or pests controlled by product

Actual Benefits: direct and indirect

- Cost savings: Same or improved efficacy with lower cost in use
- Increased productivity: low REI, low/no PHI
- Greater plant safety (low phytotoxicity)
- Greater worker safety
- Lower resistance to conventional fungicides and insecticides
- Greater compatibility with other inputs



BioWorks®

How You Grow Matters™

Thanks for listening



www.animalhi.com

Debbie Palumbo-Sanders
dpalumbo-sanders@bioworksinc.com