

Disease Management from Start to Finish: Key Diseases of Spring Crops

Colleen Warfield, Ph.D.
Ball Horticultural Company
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Note: this presentation has been modified from its original content

- How does it survive?
- How does it spread?
- How can it be managed?

Use this information to help determine what to include in your facility's sanitation plan



Of what are you most afraid?



Botrytis?



Powdery mildew?



Impatiens necrotic spot virus?

Be aware of these diseases

To follow are some examples of recent disease problems that you may or may not encounter, but should be familiar with if you are growing these crops.

Other examples are older problems that still pose a problem and require prevention.



Corynespora cassicola
(Corynespora leaf spot)

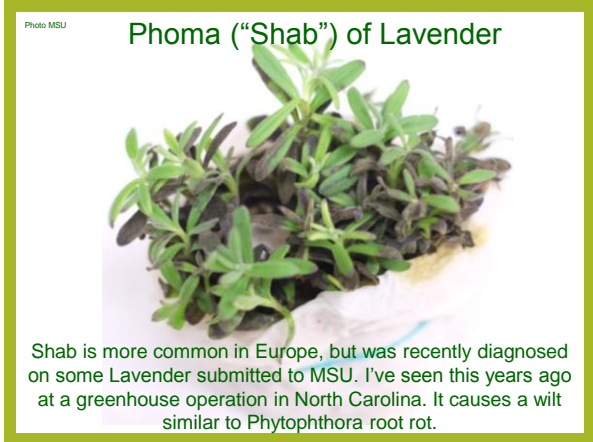
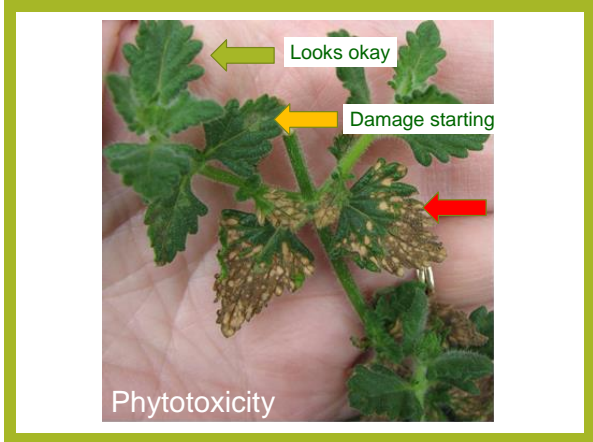
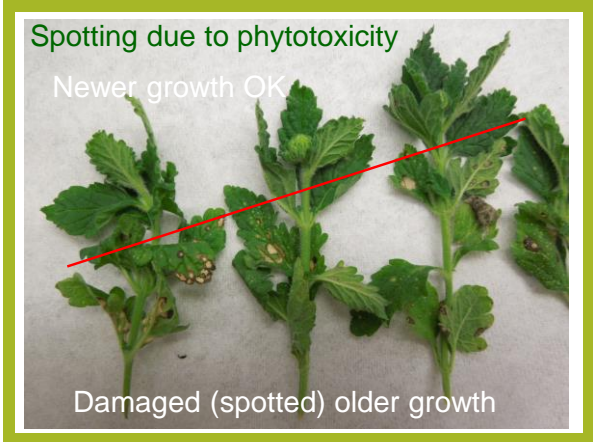
on vegetative verbena



Managing Corynespora leaf spot

Fungicide rotation

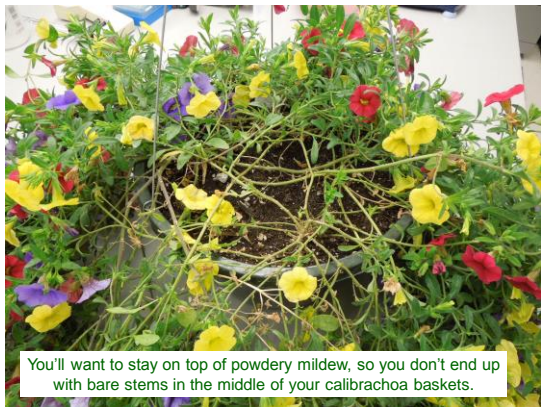
- Palladium (fludioxinil and cyprodinil) FRAC 9 and 12
- Choose one: Insignia (pyraclostrobin), Pageant (pyraclostrobin+boscalid), Orkestra (fluxapyroxad + pyraclostrobin) or Mural (azoxystrobin + benzovindiflupyr) FRAC 7 and/or 11
- Dithane (mancozeb) FRAC M3
- Eagle or Hoist (myclobutanil) FRAC 3



Powdery mildew on Calibrachoa
 (often starts in the interior part of the plant at the base as yellow leaves that become necrotic with time)



Powdery mildew on Calibrachoa
 (sporulation may be sparse and barely visible)



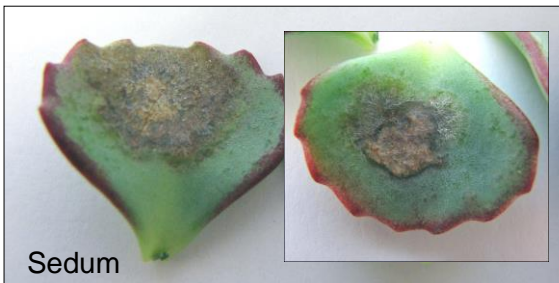
You'll want to stay on top of powdery mildew, so you don't end up with bare stems in the middle of your calibrachoa baskets.

Powdery mildew control on Calibrachoa

- Rotate a tank mix of chlorothalonil (Daconil=class M5 protectant) with triflumizole (Terraguard=class 3) or myclobutanil (Eagle=class 3) with a
- Tank mix containing chlorothalonil (Daconil) with pyraclostrobin+boscalid (Pageant=classes 11+7)

Powdery mildew

Powdery mildew can look like a scabby lesion on succulents. The white mycelium can be seen if you look closely.



Sedum

Impatiens downy mildew



Documented Resistance

- Subdue Maxx
- Adorn
- Pageant
- K-phite



New product giving excellent control:

Segovis
 (2.5 fl oz/100 gal drench)

Downy Mildew on Coleus



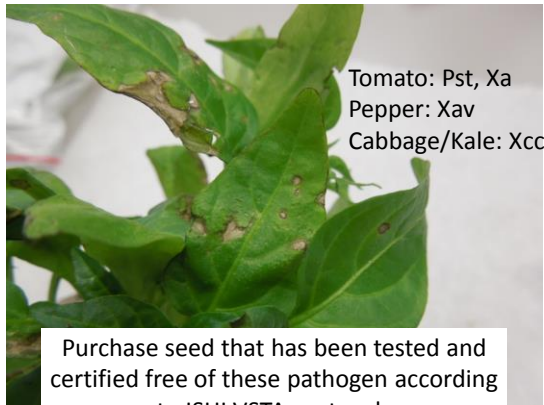
- **Seedborne** pathogens
- Survive in soil or **plant debris**
- **Weeds** may harbor bacterium
- Easily **splash dispersed**

Bacterial speck of tomato
(*Pseudomonas syringae* pv tomato)

Know your source of seed, and testing status



Bacterial spot of pepper
(*Xanthomonas euvesicatoria*)



Tomato: Pst, Xa
Pepper: Xav
Cabbage/Kale: Xcc

Purchase seed that has been tested and certified free of these pathogen according to ISHI VSTA protocols



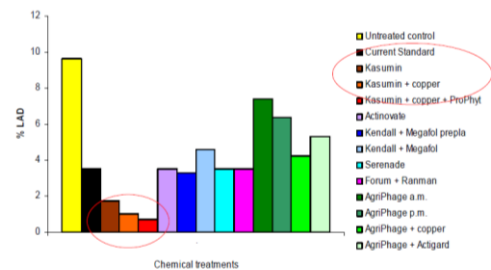
Bacterial speck (PST)
(*Pseudomonas syringae* pv tomato)



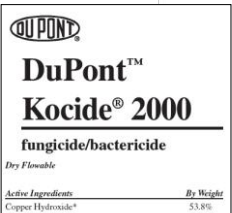
Xanthomonas bacterial leaf spot on pepper (Xav)

Xanthomonas leaf spot on pepper

Bacterial SPOT Severity 9/14/06




NC STATE UNIVERSITY



DuPont™
Kocide® 2000
fungicide/bactericide

Dry Flowable

Active Ingredients: Copper Hydroxide*
By Weight: 53.8%

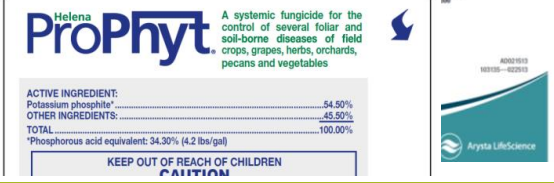


Kasumin™ 2L
Bactericide
GROUP 2B BACTERICIDE
COMMERCIAL LIQUID

READ THE LABEL BEFORE USING
KEEP OUT OF REACH OF CHILDREN
POTENTIAL SENSITIZER

Guarantees: Kasugamycin, present as hydrochloride hydrate: 2.00%
Chloranil 1,2-bis(2-chlorophenyl)-3-urea acid 0.25% as a preservative

REGISTRATION NO. 20081 PEST CONTROL PRODUCTS ACT
Ag 4441 300




Helena ProPhyt A systemic fungicide for the control of several foliar and soil-borne diseases of field crops, grapes, herbs, orchards, pecans and vegetables

ACTIVE INGREDIENT: Potassium phosphite*54.50%
OTHER INGREDIENTS:45.50%
TOTAL100.00%
*Phosphorous acid equivalent: 34.30% (4.2 lbs/gal)

KEEP OUT OF REACH OF CHILDREN
CAUTION

Arysta LifeScience



FRUITING VEGETABLES—CROP GROUP 9 (GREENHOUSE OR FIELD): Eggplant, Groundcherry, Pepino, Pepper (includes bell pepper, chili pepper, cooking pepper, pimento, sweet pepper), Tomatillo, Tomato		
Disease Suppression	Application Rate	Application Timing and Resistance Management
Bacterial Spot (<i>Xanthomonas campestris</i> pv. <i>vesicatoria</i>) Bacterial Stem Canker (<i>Corynebacterium michiganensis</i> subsp. <i>michiganensis</i>)	1.2L/ha	<ul style="list-style-type: none"> Spray volume must be sufficient to provide good coverage of treated foliage. Begin applications when conditions favour disease development. Repeat applications at intervals that are necessary or when conditions favour disease development.

RESTRICTIONS AND OTHER INFORMATION:

- Do not apply more than 3.6 L Kasumin 2L Bactericide per hectare per year.
- Do not make more than 3 applications of Kasumin 2L Bactericide per season.
- A minimum interval of 7 days between applications is required.
- Do not make more than two consecutive applications of Kasumin 2L Bactericide. If additional applications are needed, rotate with another product with a different mode of action that is registered for this use.
- For resistance management purposes, do not apply on greenhouse vegetable transplants.
- Do not apply Kasumin 2L Bactericide within 1 day of harvest.

TANK MIXES
Kasumin 2L Bactericide may be tank-mixed with Kocide DF Fungicide/Bactericide (PCP# 24538), Kocide 101 Fungicide (PCP# 14417), or Kocide 2000 (PCP# 27348) for control of registered bacterial diseases on tomatoes and peppers (greenhouse and field). When applied as a tank-mix combination, read and observe all label directions, including rates, and restrictions for each product used in the tank-mix. Follow the more stringent label precautionary measures for mixing, loading and applying stated on both product labels.

NET CONTENTS: 10 L

Arysta LifeScience

Another Spray program for bacterial leaf spot on pepper

Spray with a fixed copper (Copper-Count N, Kocide)

Adding 200 ppm streptomycin (Agri-mycin 17-1.0 lb in 100 gal of the copper spray with a spreader-sticker) will improve the effectiveness of the spray program.

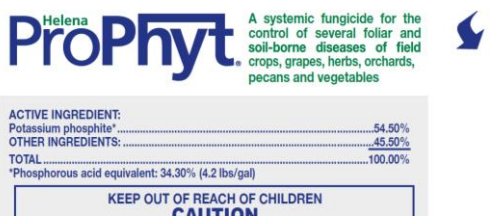
Make applications on a 7- to 10-day schedule if spots appear.



Basil downy mildew



Study in Italy showed contamination in a seedlot of ~10 seed in 170,000 (too low to detect by grow-out assays)

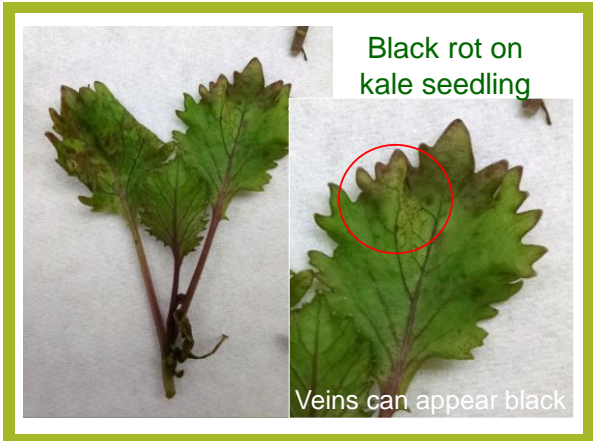
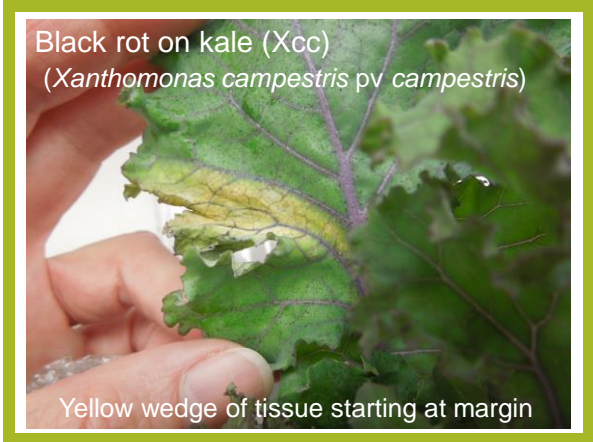


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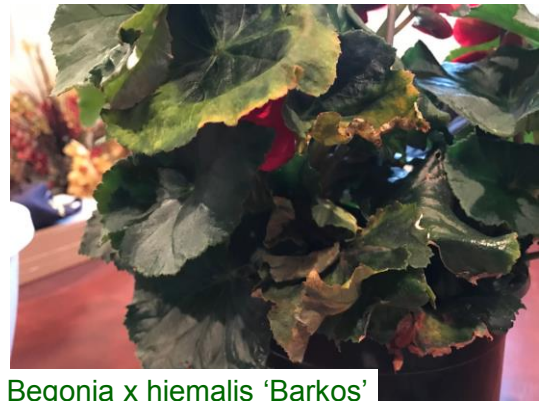
KEEP OUT OF REACH OF CHILDREN
CAUTION

Product for managing downy mildew; labeled for basil (apply as a drench at the drench rate)





Moderate to high resistance to Xanthomonas



Begonia x hiemalis 'Barkos'



Leaf symptoms look very similar to Xanthomonas bacterial leaf spot

Bacterial leaf spot on Begonia (Xanthomonas)



Begonia x hiemalis 'Barkos'



Severe rot at base



Rhizoctonia on Candytuft



Rhizoctonia Damping Off



Rhizoctonia leaf spot



Discard entire strip or tray

Managing Rhizoctonia

- Medallion (fludioxonil)
- Terraclor 400 (PCNB)
- Pageant (pyraclostrobin+boscalid)
- Tourney (metconazole)
- Orkestra (fluxapyroxad+pyraclostrobin)
- Heritage (azoxystrobin)

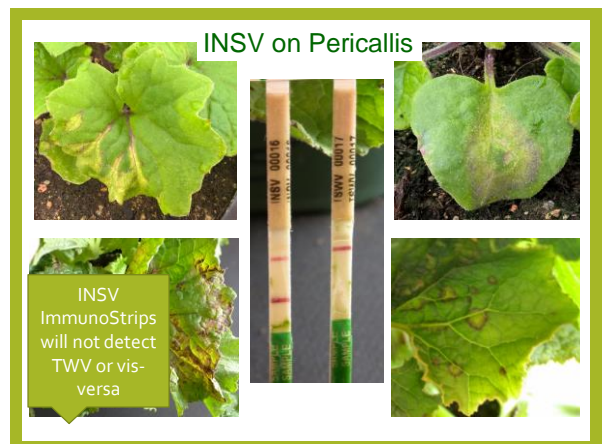
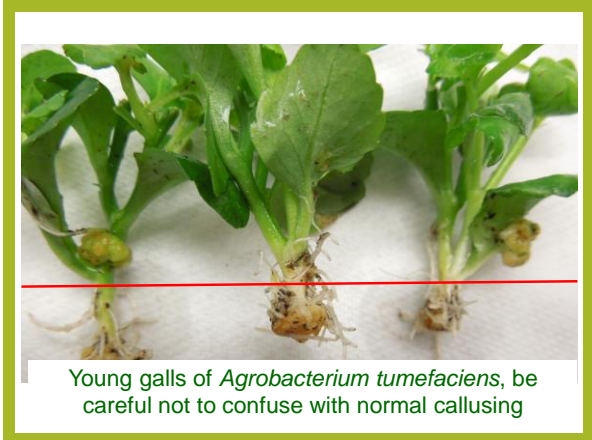
Managing Fusarium

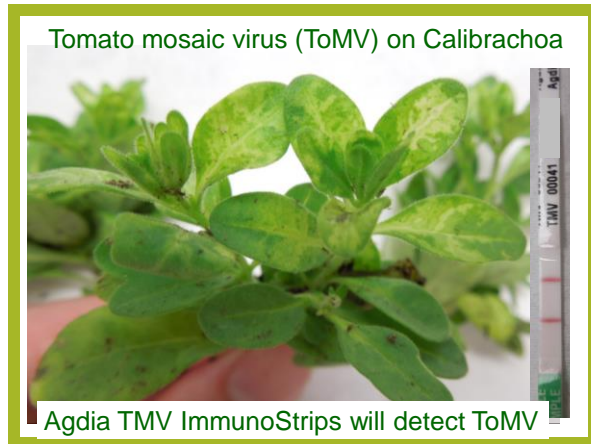
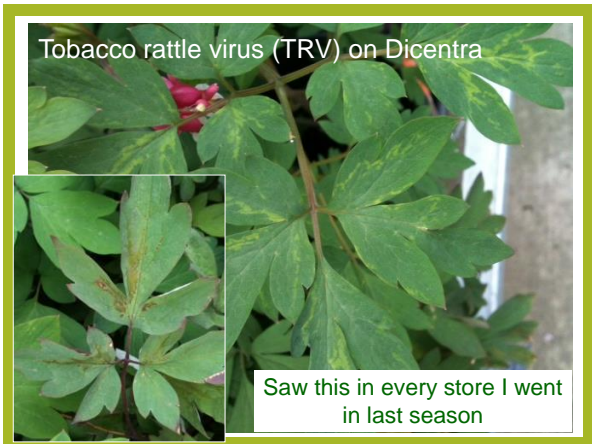
(products that work on both Fusarium and Rhizoctonia)

- Medallion (fludioxonil)
- Terraclor 400 (PCNB)
- Pageant (pyraclostrobin+boscalid)
- Tourney (metconazole)
- Orkestra (fluxapyroxad+pyraclostrobin)
- Heritage (azoxystrobin)



Lobelia erinus with stem and leaf galls caused by *Agrobacterium tumefaciens*



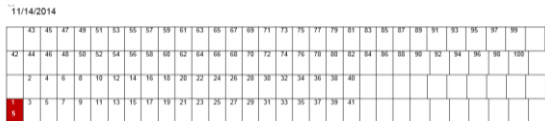


How are cuttings handled? Could you be spreading TMV?

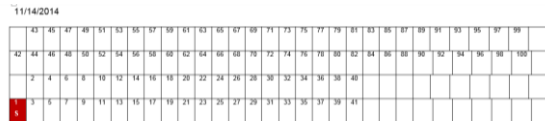


14 Nov 2014

12 Dec 2014

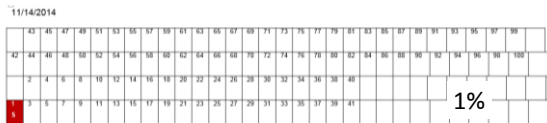


Spread of TMV



Spread of TMV





Spread of TMV



2016: All plants assayed for TMV at transplant

Sinks installed outside of greenhouse:
Must wash hands with soap and water prior to entering any GH

Sink installed inside petunia greenhouse:
Must wash hands with soap and water prior to leaving GH

Gloves are not worn (worker preference)

Workers dip hands in 20% non-fat dry milk (prepared daily) between plants

No 1 positive plants found in over 4 months across more than 1200 plants with new protocol.



Sclerotinia blight (white mold) on petunia

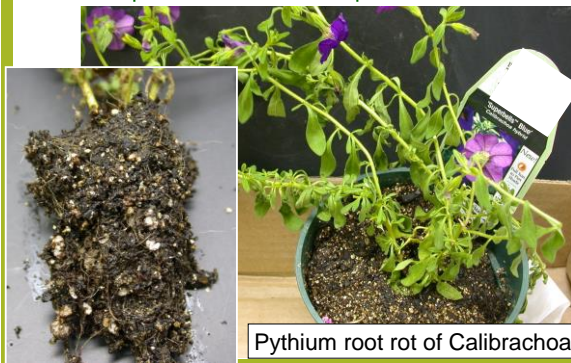


Key Root Rot Pathogens

Pythium
Phytophthora

Thielaviopsis
Rhizoctonia
Fusarium

Pythium infections of Calibrachoa are almost always present with Thielaviopsis root rot



Pythium root rot of Calibrachoa



Black root rot of pansy (*Thielaviopsis basicola*)

Original plug: roots severely infected



Thielaviopsis basicola (black root rot)

Management of Thielaviopsis

- ❖ thiophanate-methyl (3336/OHP 7762)
- Terraguard
- Medallion



Cleaning and Disinfection Protocol

Remove all visible debris

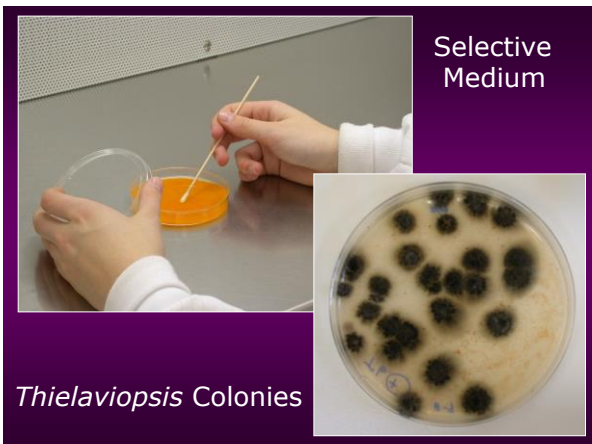
Wash the area or item
with water (and detergent)

Allow the area to dry completely

Select and apply
an appropriate, effective disinfectant

Allow the proper contact time

Thoroughly rinse away any residual disinfectant
and allow the area or item to dry



Cleaning and Disinfection Protocol

Remove all visible debris

Wash the area or item
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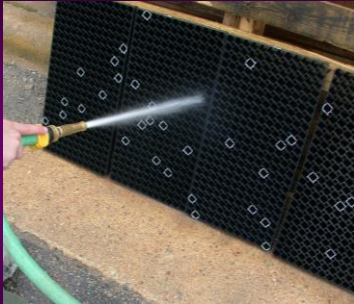
Allow the area to dry completely

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Pre-Treatment:



One half of the trays were pressure-washed with clear water

Results: No Wash vs. Wash



Cleaning and Disinfection Protocol

Remove all visible debris

Wash the area or item with water (and detergent)

Allow the area to dry completely

Select and apply an appropriate, effective disinfectant

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Thoroughly rinse away any residual disinfectant and allow the area or item to dry

Results: Zerotel 1:50 vs. 1:300 dil

No Wash 1:300

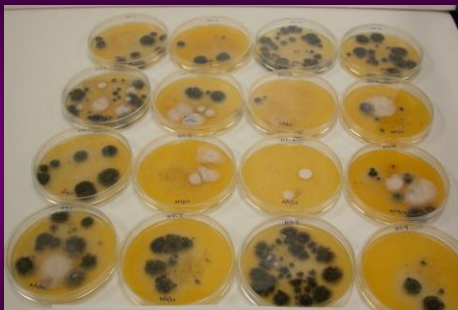
Wash 1:300

No Wash 1:50

Wash 1:50

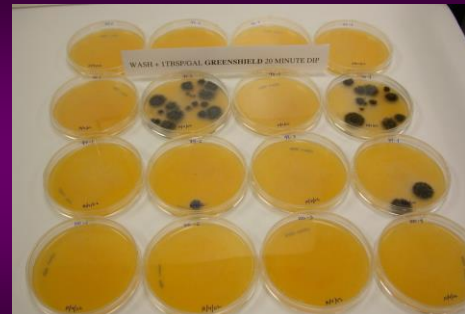


Results: Greenshield



No Wash+ Greenshield 20 min dip

Results: Greenshield



Wash+Greenshield+20 min dip

Cleaning and Disinfection Protocol

Remove all visible debris

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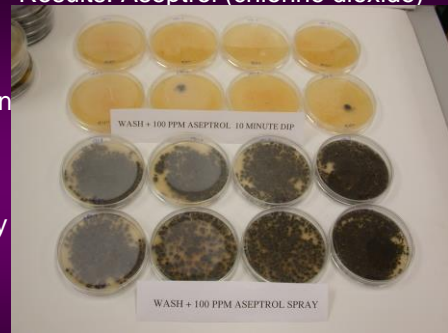
Allow the proper contact time

Thoroughly rinse away any residual disinfectant
and allow the area or item to dry

Results: Aseptrol (chlorine dioxide)

Dip
10 min

Spray



Wash + 100 ppm Aseptrol

Results: Bleach



No Wash + Bleach 10 min dip



Cleaning and Disinfection Protocol

Remove all visible debris

Wash the area or item
with water (and detergent)

Allow the area to dry completely

Select and apply
an appropriate, effective disinfectant

Allow the proper contact time

Thoroughly rinse away any residual disinfectant
and allow the area or item to dry

Preseason Sanitation Checklist

Train new employees and hold a refresher course for current employees on how to recognize disease problems, understand where these pathogens come from, how they spread, and what actions are required within clean areas to prevent pest and disease problems.

