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

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Note: this presentation has been modified from its original content

Of what are you most afraid?
- Botrytis?
- Powdery mildew?
- Impatiens necrotic spot virus?

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

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.

Managing Corynespora leaf spot

Fungicide rotation
- Palladium (fludioxonil 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

Corynespora cassiicola
(Corynespora leaf spot)
on vegetative verbena
Spotting due to phytotoxicity

Newer growth OK

Damaged (spotted) older growth

Phytotoxicity

Damage starting

Looks okay

Cabaret Orange Calibrachoa

Cause not yet determined; suspect a fungal leaf spot

Colletotrichum leaf spot on Armeria

Note the small black “dots” inside lesions

Phoma leaf spot on Rhoeo

Phoma (“Shab”) of Lavender

Shab is more common in Europe, but was recently diagnosed on some Lavender submitted to MSU. I’ve seen this years ago at a greenhouse operation in North Carolina. It causes a wilt similar to Phytophthora root rot.
Powdery mildew on Calibrachoa
(often starts in the interior part of the plant at the base as yellow leaves that become necrotic with time)

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)

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

![Downy Mildew on Coleus](image)

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**Bacterial speck of tomato**

(Pseudomonas syringae pv tomato)

Know your source of seed, and testing status

![Bacterial speck of tomato](image)

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**Bacterial spot of pepper**

(Xanthomonas euvesicatoria)

![Bacterial spot of pepper](image)

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

![Purchase seed that has been tested and certified free of these pathogen according to ISHI VSTA protocols](image)

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**Tomato: Pst, Xa**

**Pepper: Xav**

**Cabbage/Kale: Xcc**

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**Bacterial speck (PST)**

(Pseudomonas syringae pv tomato)

![Bacterial speck (PST)](image)

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**Xanthomomas leaf spot on pepper**

![Xanthomomas leaf spot on pepper](image)

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**Xanthomonas bacterial leaf spot on pepper (Xav)**

![Xanthomonas bacterial leaf spot on pepper (Xav)](image)

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**Xanthomonas leaf spot on pepper**

![Xanthomonas leaf spot on pepper](image)

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**Xanthomonas bacterial leaf spot on pepper (Xav)**

![Xanthomonas bacterial leaf spot on pepper (Xav)](image)
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.

Avoid growing plugs from certified seed next to non-certified seed to avoid cross-contamination (especially by splashing)

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)

Product for managing downy mildew; labeled for basil (apply as a drench at the drench rate)
Black rot on kale (Xcc) 
(*Xanthomonas campestris pv campestris*)

Yellow wedge of tissue starting at margin

Black rot on kale seedling

Veins can appear black

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Xanthomonas Bacterial Blight of Zinnia

Can be seedborne

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**Zinnia elegans**

Highly susceptible to powdery mildew, Xanthomonas, Alternaria 'Magellan'

**Zinnia angustifolia**

Highly resistant to powdery mildew, Xanthomonas, Alternaria

**Zinnia marylandica** = *Zinnia angustifolia*  
*Zinnia elegans* (violacea)

High Res: PM & Alternaria  
Mod-High Res: Xanthomonas

**Zinnia Zahara**

Highly susceptible to Xanthomonas
Zinnia marylandica ‘Zahara’

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
**Fusarium wilt**

Sporulation

**Compare Fusarium to Rhizoctonia**

Dry, shredded cankers; no sporulation

Rhizoctonia crown rot of Impatiens

**Infection begins at soil line and moves up stem**

Rhizoctonia crown/stem rot on dianthus

**Rhizoctonia aerial blight**

Spiderweb-like mycelium

Place affected plant on a moist paper towel in a plastic bag. Seal the bag and allow to sit over night. Look for spider web-like mycelium stretching from the affected tissue to the paper towel.
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)
Young galls of *Agrobacterium tumefaciens*, be careful not to confuse with normal callusing.

Edema on geranium

Don’t confuse crown gall with edema

Edema on cabbage seedling

Don’t confuse crown gall with edema

Intumescence on Angelonia

Don’t confuse crown gall with intumescence

Pericallis with TSWV (Tomato spotted wilt virus)

INSV on Pericallis

INSV ImmunoStrips will not detect TWV or vice-versa
Tobacco rattle virus (TRV) on Dicentra

Saw this in every store I went in last season

Tomato mosaic virus (ToMV) on Calibrachoa

Agdia TMV ImmunoStrips will detect ToMV

How are cuttings handled? Could you be spreading TMV?

Experimental Trial on TMV Spread

14 Nov 2014

12 Dec 2014

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 positive plants found in over 4 months across more than 1200 plants with new protocol.

Ethyl alcohol
Ethyl alcohol

Isopropyl alcohol

Good for bacteria and fungi, but not as effective for non-enveloped viruses (TMV)

Dieback: could be Botrytis, Phytophthora, Sclerotinia

Split the stems open

Note dry, bleach stems

Sclerotinia blight (white mold)
**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.

**Original plug: roots severely infected**

**Management of Thielaviopsis**
- thiophanate-methyl (3336/OHP 7762)
  - Terraguard
  - Medallion

Black root rot of pansy (*Thielaviopsis basicola*)
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
Pre-Treatment:

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

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Allow the proper contact time

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

Results: No Wash vs. Wash

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

Results: Greenshield

Results: Greenshield

No Wash+ Greenshield 20 min dip

Wash+Greenshield+20 min dip
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Results: Aseptrol (chlorine dioxide)

Results: Bleach

No Wash + Bleach 10 min dip

Limex Plug Tray Washer: 160F and 205F for ~11 seconds = Effective for fungi

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.
Prevention

DISEASE

Detection ——— Control