Lessons from Onion Downy Mildew & Stemphylium Leaf Blight

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Onion Downy Mildew
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- *Peronospora destructor* = oomycete
- Wild & cultivated *Allium* spp.
- Obligate biotroph = only infects living tissue
- 2 spore types:
  1. **Sporangia** = asexual, wind- & splash-dispersed
  2. **Oospores** = sexual, soilborne, seedborne, crop residues, infected bulbs, wind- & splash-dispersed from soil
- Seedborne: insignificant?
- Survival: volunteers, bulbs, seed, soil, infested crop residues
- Spread: soil, water, wind, transplants, bulbs
Oospores (40-44 um)

Sporangia (18-29 x 40-72 um)
Favorable conditions

- Cool & wet: <72°F, wet leaves or >95% RH
- Sporulation at 43-80°F (optimum 52-55°F)
- Dense canopy – seed vs. bulb crops
- No sporulation if >75°F & dry
- Dry, sunny weather impedes development

- Long latent period - 9-16 days
- Sporangia form by night, disperse by day
- Sporangia survive 1-3 days on foliage
Months of a biennial onion seed crop in central WA

Mean temperature (F)

Thrips (IYSV), bacteria

Fungi/oomycetes (Botrytis, downy mildew)

Direct-seeding

Bulb planting

Harvest

Temperature & onion seed crop diseases (c. WA)

2016
Moisture & temperature
2014 Downy Mildew Outbreak in NY

13 August 2014

27 August 2014
Opportunistic (secondary) infection of downy mildew lesions
Opportunistic infections: *Stemphylium vesicarium*

*Stemphylium vesicarium* & downy mildew

*Stemphylium vesicarium* & thrips damage (also with IYSV)

M. Trent
Spread & survival of *S. vesicarium* & *A. porri*

- **Sources of inoculum**
  - infested culled onions & debris: >1 year
  - infected seed - relative significance unknown?

- **Dispersal of spores**
  - wind
  - splashing water (rain or irrigation)
  - machinery/people moving in crop

- **Optimum conditions = moist & ‘warm’**
  - high relative humidity (>90% for spore production)
  - extended leaf wetness (>4 h for infection by *A. porri*)
  - air temperature:
    - *A. porri*: 77-81°F = optimum (43-93°F)
    - 64-77°F = spore germination (both fungi)
    - lower temp’s: longer leaf wetness needed for infection
Other factors affecting Stemphylium leaf blight

- **Crop stress**
  - heat, moisture
- Irrigation (furrow vs. drip vs. overhead)
- Thrips injury
- Age of leaves, maturity of crop
- Cultivar susceptibility/tolerance
- Strains of the fungus
  - more virulent strains in MI, NY, WI, Ontario in the last few years
2006 onion bulb crop, Columbia Basin, WA

Photo courtesy of Mark Trent
Management of downy mildew

- Clean planting material—seed, bulbs, transplants, sets
- Crop rotation 3–4 years out of *Allium* spp.
- Spatial & temporal isolation
  - green bridge from annual bulb crops & biennial seed crops
- Well drained fields, rows directed into prevailing wind
- Avoid dense plantings & windbreaks
- Irrigation: *surface or drip rather than overhead*
- Destroy infested crop residues after harvest
- Avoid excessive N fertilization
- Partial resistance to downy mildew
  - no choice in seed crops
Management of downy mildew

- **Fungicides:**
  - seed treatments: e.g., metalaxyl, mefenoxam
  - foliar sprays: adjuvants (waxy foliage), coverage
  - scouting, accurate & early identification, preventive applications
  - fungicide resistance management
  - choice of fungicide(s)
  - **Limited efficacy:** coppers, dithiocarbamates (e.g., mancozeb = FRAC Group M3), chlorothalonil (FRAC Group M45), strobilurins (FRAC Group 11 - e.g., fenamidone = Reason)
  - **Better efficacy:**
    - Phenylamides (FRAC Group 4) - e.g., mefenoxam (Ridomil Gold, etc.)
    - Phosphonates (FRAC Group 33) - phosphorus acid (Aliette)
    - Carboxylic acid amides (FRAC Group 40) - dimethomorph (e.g., Forum), mandipropamid (Revus)
    - Famoxadone + cymoxanil (FRAC Groups 11 + 27) - Tanos
  - forecasting (bulb crops): e.g., DOWNCAST, INIMIL, ...
Management of Stemphylium leaf blight

- Crop rotation (at least 2 years)
- Clean seed/treated seed
- Reduce duration of leaf wetness – irrigation, plant density
- Sanitation (NOT soilborne pathogen)
  - destroy onion cull piles
  - bury onion debris
- Minimize injury & stress
- Resistant cultivars?
  - most cultivars susceptible to purple blotch
  - Sweet Spanish types more susceptible
- Fungicides
2013 Fungicide field trial in NY: Stemphylium leaf blight severity

Data courtesy of Christy Hoepting 2015

- Luna Tranquility
- Merivon
- Inspire Super (Ind)
- Fontana (Ind)
- Endura (Ind)
- Inspire (Ind)
- Tilt (Ind)
- Hoepning (Scal/Merivon)
- Quadrise Top (Ind)
- Scala 18 (Ind)
- Omega (Ind)
- Pristine (Ind)
- Sividal (Ind)
- Caval (Ind)
- Calvrio (Ind)
- Quadrise (Ind)
- Untreated with OT/DM
- Untreated (no pesticides)
A. Initial, preventative program:

- **Mancozeb or phosphorous acid**
  - Tank mix when fungicides have no DM activity
    - E.g., Luna Tranquility, Inspire Super, Scala, Rovral
    - Mancozeb better than phosphorous acid

- **FRAC Group 11 fungicides**
  - Quadris Top (3, 11)
  - Merivon (7, 11)
  - Tanos (11, 27)
Cornell University recommended fungicide program for DM & SLB

B. Once DM is detected:

<table>
<thead>
<tr>
<th>Product (rate per acre)</th>
<th>FRAC groups</th>
<th>Disease(s) controlled</th>
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<tbody>
<tr>
<td><strong>Weeks 1, 2 &amp; 4</strong></td>
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<tr>
<td>Ridomil Gold Bravo 2.5 pt* + mancozeb 3 lb + Luna Tranquility 16 fl oz</td>
<td>4, M5, M3, 7, 9</td>
<td>DM, DM, SLB</td>
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</tbody>
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| **Weeks 3, 5:**                             |             |                       |
| Orondis 1.6 fl oz + Quadris Top             | US15, 3, 11 | DM, SLB, DM           |

* No more than 2 consecutive applications of Ridomil Gold Bravo (maximum 3 applications)

Stemphylium vesicarium resistance to Quadris (azoxystrobin) in NY

Fungicide sensitivity of Stemphylium vesicarium isolates to azoxystrobin (Quadris):
Conventional onion fields (n = 24)

DNA testing:
86% of insensitive isolates tested positive for resistance to FRAC 11

S. Pethybridge and F. Hay 2015 (courtesy of C. Hoepting, Cornell Univ.)
Application of a pesticide to a crop or site that is not on the label is a violation of pesticide law and may subject the applicator to civil penalties.

In addition, such an application may also result in illegal residues that could subject the crop to seizure or embargo action.

It is your responsibility to check the label before using any product to ensure lawful use, and obtain all necessary permits in advance.