

## Greenhouse Growers Seminar

### Fungicides for Commercial Greenhouses

Brian D. Hudelson

Department of Plant Pathology

University of Wisconsin-Madison/Extension



## Greenhouse Growers Seminar Disease Management

- **REPEAT**
  - R = Resistance
  - E = Exclusion
  - P = Protection
  - E = Eradication
  - A = Avoidance
  - T = Therapy
- **Integrated Pest Management (IPM)**

## Greenhouse Growers Seminar Fungicide Use

- **Why use fungicides?**
  - Other management strategies are ineffective
  - Other management strategies are impractical
  - High probability of economic loss
  - High quality demanded by end consumers
  - Unexpected disease outbreaks occur
  - Liability is an issue

## Greenhouse Growers Seminar Fungicide Use

- **When to use fungicides?**
  - Based on historical disease issues
  - Based on reports of a disease outbreak
  - Based on scouting

## Greenhouse Growers Seminar Fungicide Use

- **What fungicide to use?**
  - Labeling
    - Legal/registered in Wisconsin
    - Greenhouse
    - Broad vs. narrow plant range
  - Efficacy/spectrum/mode of action
    - Effectiveness against the disease in question
    - Broad vs. narrow pathogen range
    - Resistance develop (FRAC code/group)

## Greenhouse Growers Seminar Fungicide Use

- **What fungicide to use?**
  - Safety
    - Human (Danger, Warning, Caution)
    - Crop/Plant
    - Environment
  - Formulation (G, L, LF, EC, DF, W)
  - Longevity/weathering properties

## Greenhouse Growers Seminar Fungicide Use

- **What fungicide to use?**
  - **Application**
    - Where (foliage, soil, water)
    - How (spray, fog, drench)
    - When (once, more than once)
  - **Organic vs. non-organic**
  - **Cost**

## Greenhouse Growers Seminar Fungicide Use

- **What fungicide are available?**
  - **Mode of action/FRAC group/FRAC code**
  - **Multi-Site Contact Activity**
    - Captan (M4)
    - Chlorothalonil (M5)
    - Copper (many different salts) (M1)
    - Mancozeb (M3)
    - Sulfur/Sulphur (M2)  
(FIVE FRAC CODES)

## Greenhouse Growers Seminar Fungicide Use

- **What fungicide are available?**
  - **Nucleic Acid Synthesis (A)**
    - Mefenoxam (4)
    - Metalaxyl (4)  
(ONE FRAC CODE)
  - **Mitosis and Cell Division (B)**
    - Fluopicolide (43)
    - Thiophanate-methyl (1)  
(TWO FRAC CODES)

## Greenhouse Growers Seminar Fungicide Use

- **What fungicide are available?**
  - **Respiration (C)**
    - Ametoctradin (45)
    - Azoxystrobin (11)
    - Boscalid (7)
    - Cyazofamid (21)
    - Fenamidone (11)  
(FOUR FRAC CODES)
    - Fluoxastrobin (11)
    - Flutolanil (7)
    - Penthiopyrad (7)
    - Pyraclostrobin (11)

## Greenhouse Growers Seminar Fungicide Use

- **What fungicide are available?**
  - **Amino Acid and Protein Synthesis (D)**
    - Cyprodinil (9)
    - Pyrimethanil (9)  
(ONE FRAC CODE)
  - **Signal Transduction (E)**
    - Fludioxonil (12)
    - Irpodione (2)  
(TWO FRAC CODES)

## Greenhouse Growers Seminar Fungicide Use

- **What fungicide are available?**
  - **Lipid Synthesis and Membrane Integrity (F)**
    - Alkyl dimethyl benzyl ammonium chloride (14?)
    - Alkyl dimethyl ethylbenzyl ammonium chloride (14?)
    - Etridiazole (14)
    - PCNB (14)
    - Propamocarb (28)
    - Bacillus amyloliquefaciens (44)
    - Bacillus subtilis (44)  
(THREE FRAC CODES)

## Greenhouse Growers Seminar Fungicide Use

- What fungicide are available?
    - Sterol Biosynthesis in Membranes (C)
      - Fenhexamid (17)
      - Fenpyrazamine (17)
      - Imazalil (3)
      - Metconazole (3)
      - Myclobutanil (3)
      - Piperalin (5)
      - Tebuconazole (3)
      - Triadimefon (3)
      - Triflumizole (3)
      - Triticonazole (3)
- (THREE FRAC CODES)

## Greenhouse Growers Seminar Fungicide Use

- What fungicide are available?
  - Cell Wall Biosynthesis (H)
    - Dimethomorph (40)
    - Mandipropamid (40)
    - Polyoxin D (zinc salt) (19)
  - Melanin Synthesis in Cell Wall (I)
    - None

## Greenhouse Growers Seminar Fungicide Use

- What fungicide are available?
    - Host Plant Defense Induction (P)
      - None
    - Unknown Mode of Action
      - Cymoxanil (27)
      - Fosetyl-AI (33)
      - Oxathiapiprolin (U15)
- (THREE FRAC CODES)

## Greenhouse Growers Seminar Fungicide Use

- What fungicide are available?
  - Not Classified
    - Aliphatic petroleum hydrocarbons (NC)
    - Mineral oil (NC)
    - Carbonic acid (monopotassium salt) (NC)
    - Hydrogen peroxide (NC)
    - Peroxyacetic acid (NC)
    - Phosphorous acid (mono- and di-potassium salts) (NC)
    - Sodium percarbonate (NC)

## Greenhouse Growers Seminar Fungicide Use

- What fungicide are available?
  - Not Classified
    - Canola oil (NC)
    - Caprylic acid (NC)
    - Neem oil (NC)
    - Rhamnolipid biosurfactant (NC)
    - Bacillus licheniformis (NC)
    - Bacillus pumilus (NC)
    - Gliocladium virens strain G-21 (NC)

## Greenhouse Growers Seminar Fungicide Use

- What fungicide are available?
  - Not Classified
    - Pythium oligandrum strain DV 74 (NC)
    - Streptomyces griseoviridis (NC)
    - Streptomyces lydicus (NC)
    - Trichoderma asperellum (NC)
    - Trichoderma gamsii (NC)
    - Trichoderma harzianum (NC)
    - Trichoderma virens (NC)

## **Greenhouse Growers Seminar Fungicide Use**

- **Summary**
  - Consider ALL disease management options
  - Integrate disease management with other management needs
  - Use the right fungicide for each situation
  - Manage fungicide active ingredients properly
  - Use fungicide products effectively and safely
  - Find help when you need it

## **Greenhouse Growers Seminar Fungicide Use**

- **Resources**
  - Kelly Solutions ([www.kellysolutions.com](http://www.kellysolutions.com))
  - Fungicide Resistance Action Committee (Search on “FRAC code” + current year)
  - WI DATCP ([datcp.wi.gov](http://datcp.wi.gov))
  - Pesticide Applicator Training ([ipcm.wisc.edu/pat](http://ipcm.wisc.edu/pat))
  - County UW-Extension office ([www.uwex.edu](http://www.uwex.edu))
  - Plant Disease Diagnostics Clinic ([pddc.wisc.edu](http://pddc.wisc.edu))

## **Greenhouse Growers Seminar How to Contact the PDDC**

*Plant Disease Diagnostics Clinic  
Department of Plant Pathology  
University of Wisconsin-Madison  
1630 Linden Drive  
Madison, WI 53706-1598  
(608) 262-2863  
[pddc@plantpath.wisc.edu](mailto:pddc@plantpath.wisc.edu)  
[pddc.wisc.edu](http://pddc.wisc.edu)  
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