

Four Years of Downy Mildew in Indiana: Field Trials and More.

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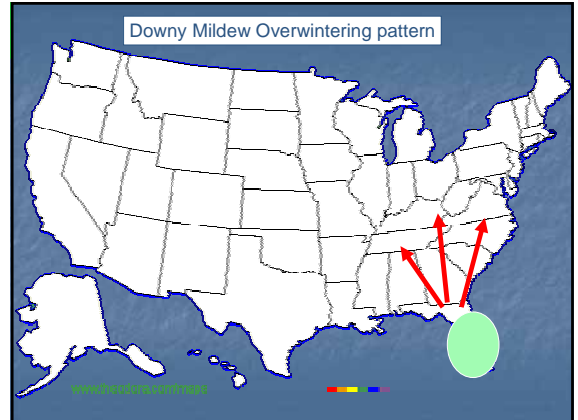
Outline...

- Downy mildew introduction
- Symptoms
- Introduction of fungicides
- 2005/6 field trials
- Management recommendations

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Downy Mildew Overwintering pattern



Recent Downy Mildew History

Year	First observation of downy mildew	
	Date	Crop
2002 and earlier	Approx. every 5 years in late Aug/early Sept.	Usually pumpkin
2003	July 22	Watermelon
2004	August 13	Pumpkin
2005	August 9	Pumpkin
2006	July 18	Cucumber

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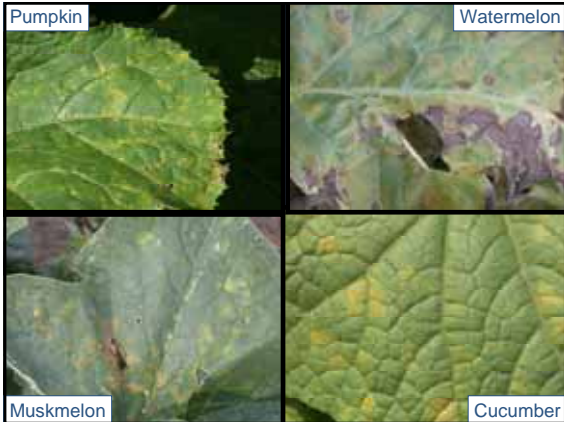




Cucumber



Muskmelon



Pumpkin

Watermelon

Muskmelon

Cucumber

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Contact Fungicides...
 ...kills fungi with which it comes into direct contact on plant surface. Contact fungicides do not move within the plant. Multiple modes of action.

Systemic fungicides...
 ...move within the plant, usually toward the tip of the plant, so that existing fungi may be killed. Often have only one mode of action-resistance may occur.

Fungicide resistance and FRAC codes



Contact Fungicides

Fungicides	Resistance Risk	Alternation or tank mix	Other diseases
Bravo, Echo, Equus (chlorothalonil)	Multiple modes of action (M) - resistance unlikely	Can be used in alternation with systemic fungicides- alternation not necessary for resistance	Effective against a broad range of diseases.
Dithane, Manzate, Penncozeb (mancozeb)			
Maneb, Manex (maneb)			
Kocide, Champ, Cuprofix (copper hydroxide/sulfate)			

Fungicides for downy mildew management- Contact fungicides-

- FRAC group M, resistance unlikely
- Many diseases/season long
- Relatively inexpensive
- Good rotational partners
- Moderate downy mildew control

Systemic fungicides in group 11

Fungicides	Resistance Risk	Alternation or tank mix	Other diseases
Amistar, Quadris (azoxystrobin)	11 medium-high- Cross resistance possible.	Alternation required, tank mix recommended	Label may include powdery mildew, black rot.
Cabrio (pyraclostrobin)			
Flint (trifloxystrobin)			
Pristine (boscalid, pyraclostrobin)			
Quadris Opti (azoxystrobin, chlorothalonil)	11 & M Medium high	Premix, alternation required	See above
Reason (fenamidone)	11, high	Alternation	Alternaria

Fungicides for downy mildew management- Systemic fungicides in group 11

- Season long control for several diseases
- High chance of cross resistance
- Tank mix with contact when DM threatens

Specialized Systemic fungicides for downy mildew I

Fungicide	Resistance risk (FRAC)	Alternation or tank mix	Other diseases
Acrobat, Forum (dimethomorph)	15, medium	Tank or premix	With premix
Previcur Flex (propamocarb)	28, low-medium	Alternation	Pythium
Reason (fenamidone)	11, high	Alternation	Alternaria
Ranman (cyazofamid)	21, medium-high	Alternation	Phytophthora
Ridomil (mefenoxam)	48 (high)	Alternation	Depends on premix

Specialized Systemic fungicides for downy mildew II

Fungicide	Resistance risk (FRAC)	Alternation or tank mix	Other diseases
Tanos (cymoxanil, famoxadone)	27, 11 High	Both required	Phytophthora Alternaria
Curzate (cymoxanil)	27, medium-high	Tank mix	--

Fungicides for downy mildew management- Specialized systemic fungicides

- Several FRAC groups
- Chance of resistance variable
- Primarily for downy mildew
- Best used when downy mildew in area

Premixes-contact & systemic

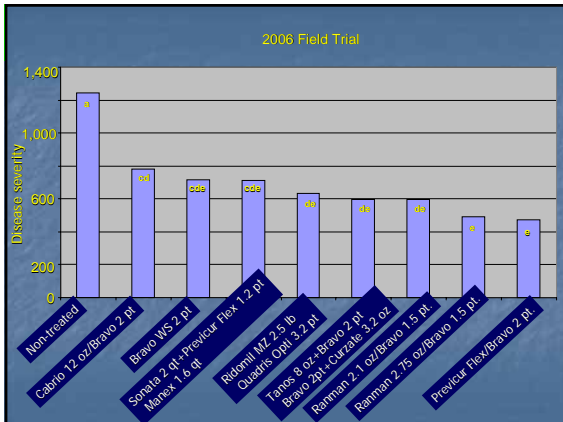
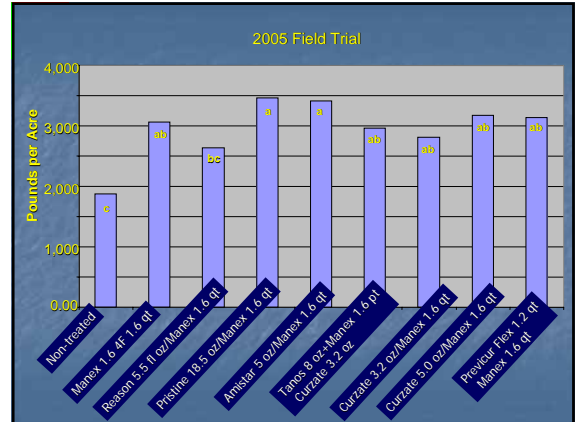
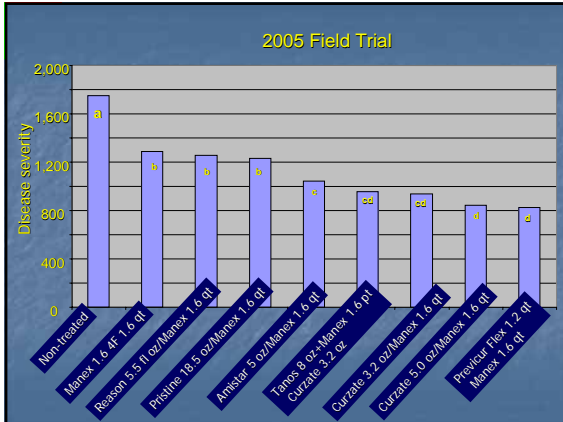
Fungicide	Resistance Risk	Alternation or tank mix	Other diseases
Ridomil Bravo Gold (mefenoxam, chlorothalnil)	FRAC 48, M. High	Alternation	Black rot
Quadris Opti (azoxystrobin, chlorothalonil)	11 & M Medium-high	Premix, alternation required	Several
Gavel (mancozeb, zoxamide)	FRAC 22, Low-medium	No	Alternaria

Premixes...

- Less chance of resistance
- Contact may control additional disease

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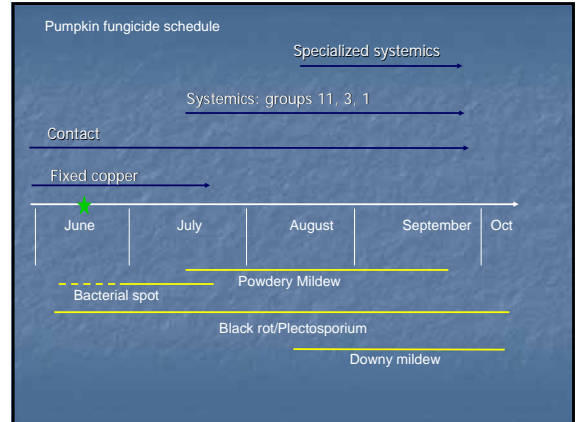
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Downy Mildew Favorites

Fungicide	Resistance risk (FRAC)	Alternation or tank mix	Other diseases
Provicur Flex (propamocarb)	28, low-medium	Alternation	Pythium
Ranman (cyazofamid)	21, medium-high	Alternation	Phytophthora
Tanos (cymoxanil, famoxadone)	27, 11 High	Both required	Phytophthora Alternaria
Curzate (cymoxanil)	27, medium-high	Tank mix	--
Gavel (mancozeb, zoxamide)	22, Low-medium	No	Alternaria





2005 research trial

Treatment, rate/A	AUDPC
Non-treated	1,749.25 a
Manex 4F, 1.6 qt	1,290.50 b
Reaxon 500SC, 5.5 fl oz Manex 4F, 1.6 qt	1,259.00 b
Pristine 38WG, 18.5 oz Manex 4F, 1.6 qt	1,228.25 b
Amistar 80WP 5 oz Manex 4F, 1.6 qt	1,046.00 c
Tanos 50WDG, 8 oz + Manex 4F, 1.6 qt Curzate 60DF, 3.2 oz	958.00 cd
Curzate 60DF, 3.2 oz + Manex 4F, 1.6 qt	936.50 cd
Curzate 60DF, 5 oz + Manex 4F, 1.6 qt	841.75 d
Previcour Flex 66SL, 1.2 qt Manex 4F, 1.6 qt	823.50 d

2005 research trial

Treatment, rate/A	lb./A
Non-treated	1,873.2 c
Manex 4F, 1.6 qt	3,056.9 ab
Reaxon 500SC, 5.5 fl oz Manex 4F, 1.6 qt	2,634.2 bc
Pristine 38WG, 18.5 oz Manex 4F, 1.6 qt	3,461.1 a
Amistar 80WP 5 oz Manex 4F, 1.6 qt	3,414.5 a
Tanos 50WDG, 8 oz + Manex 4F, 1.6 qt Curzate 60DF, 3.2 oz	2,958.1 ab
Curzate 60DF, 3.2 oz + Manex 4F, 1.6 qt	2,814.2 ab
Curzate 60DF, 5 oz + Manex 4F, 1.6 qt	3,171.0 ab
Previcour Flex 66SL, 1.2 qt Manex 4F, 1.6 qt	3,138.6 ab

Downy Mildew by the Numbers

6 hours	Time required for sporangial production-100% RH
1 hour	Time required for sporangia germination-free moisture & 68F
59-68F	Optimum temp. for production of sporangia
4 days	1 generation-59 F nights & 77F days

Downy mildew trial methods...

- 4 replication
- Randomized
- Applications approx. weekly
- 3-point hitch application
- Pie pumpkin
- Applications 18 Jul-8 Sep

2006 research trial

Treatment, rate/A	AUDPC
Non-treated	1,242 a
Ocabrio 20EG, 12 oz Bravo WS, 2 pt	779 cd
Bravo WS, 2 pt	718 cde
Sonata, 2 qt + Previcur Flex 66F, 1.2 pt + Manex 4F, 1.6 qt	712 cde
Ridomil Gold MZ 68WP, 2.5 lb Quadris Opti, 3.2 pt	632 de
Tanos 50WDC, 8 oz + Bravo WS, 2 pt Bravo WS, 2 pt + Curzate 60DF, 3.2 oz	597 de
Ranman 400SC, 2.1 oz Bravo WS, 1.5 pt	597 de
Ranman 400SC, 2.75 oz Bravo WS, 1.5 pt	490 e
Previcur Flex 66 F Bravo WS, 2 pt	472 e

Systemic fungicides-group 33

Fungicides	Resistance Risk (FRAC)	Alternation or tank mix	Other diseases
Aliette (fosetyl-AI)	33-low.	Some formulations recommend tank-mix.	Some formulations list <i>Phytophthora</i> sp. and gummy stem blight
Agri-Fos, Phostrol, Prophyte (phosphorous acid, phosphite)			

- Fungicides for downy mildew management-
Systemic fungicides-Phosphonates (33)
- Some formulations labeled for additional diseases
 - Tank mix recommended
 - Resistance chance low

Cultural Management of Pumpkin Diseases

Disease	Survival	Comments
Bacterial fruit spot	Residue	Tillage/rotation critical
Black rot	Residue	Tillage/rotation critical
Downy mildew	South	Tillage/rotation not a factor
Fusarium fruit rot	Soil	At least 4 years rotation
Powdery mildew	Residue & south	Tillage/rotation moderate importance
Virus diseases	South/weeds	Tillage/rotation not a factor