

Update on Disease Control on Cucurbits



Daniel S. Egel
SW Purdue Ag Center
Vincennes, IN

Cucurbit Update Outline

- What is fungicide resistance?
- MOA codes & fungicide labels
- Managing fungicide resistance
 - gummy stem blight
 - powdery mildew
 - downy mildew



My fungicide stopped working—Why?

- Severe disease pressure?
- Improper calibration?
- Improper rate?
- Is disease/crop on label?
- Fungicide resistance?



What is fungicide resistance and why does it happen?

- Fungicides interrupt normal fungal systems
- Systems include cell wall development, energy production, protein synthesis etc.
- Fungicides may have single or multiple MOA.
- When just single MOA, a single mutation may result in resistance.
- Population of resistant fungi may increase with repeated use of single MOA fungicide.
- Low rates of fungicide also encourage resistance.

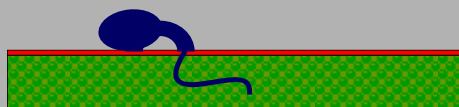
List of single/multiple MOA fungicides

- | | |
|--|--|
| <p>Multiple mode of action (mostly contact)</p> <ul style="list-style-type: none"> • Bravo, Echo, Equus • Dithane, Manzate, Pencozeb • Maneb, Manex • Fixed copper | <p>Single mode of action (mostly systemic)</p> <ul style="list-style-type: none"> • Amistar, Quadris • Cabrio • Endura • Pristine (2) • Tanos (2) |
|--|--|

Two types of Fungicide Mobility

Protectants (contact)

- How do protectant fungicides work?



Protectants provide barrier (red line) that stops spore from entering plant and may kill spore on surface

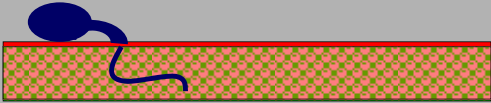
Chlorothalonil
Mancozeb

Courtesy Marty Draper, USDA (modified)

Two types of Fungicide Mobility

Systemic Fungicides

- How do systemic fungicides work?
 - Fungicide absorbed into plant tissue and may move upward or only move locally
 - Prevents spores from entering plant, can stop movement of fungal structures already in plant



Cabrio
Quadris
Pristine
Rally

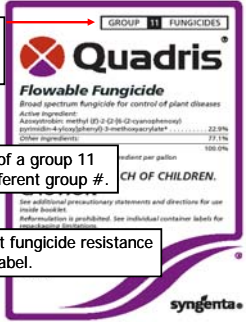
Tanos
Procure

Courtesy Mary Draper

Code number for MOA (official name- FRAC code).

After each application of a group 11 fungicide, choose a different group #.

More information about fungicide resistance Can be found in each label.



BASF
The Chemical Company

GROUP 7 11 FUNGICIDE

Pristine[®] fungicide

For use in berries, leafy vegetables, carrots, crucifer vegetables, grapes, hops, potatoes, peas, pinto, olive, fava, chickpeas, and tree nuts.

ACTIVE INGREDIENTS:

Pyraclostrobin (active) (2-E)-6-chloro-3-(4-chlorophenyl)-5-(4-chlorophenyl)-2-methyl-4-pyridin-3-yl 1H-imidazo[1,2-a]pyridine-3-carboxylate	22.9%
Propiconazole (active) (1S)-1-(4-chlorophenyl)-1-(1H-imidazo[1,2-a]pyridin-3-yl)propan-3-ol	21.2%
Inert ingredients	55.9%
Total	100.0%

EPA Reg. No. 7996-08 EPA Est. No. 7996-08-0001

KEEP OUT OF REACH OF CHILDREN
CAUTION/PRECAUTION

Do not feed or allow to eat any food that has been treated with this product. Do not allow children to play in or on treated areas. Do not allow children to drink from treated areas. Do not allow children to eat any food that has been treated with this product. Do not allow children to drink from treated areas. Do not allow children to eat any food that has been treated with this product. Do not allow children to drink from treated areas.

Net Contents: 25 Gallons (94.6 Liters) BASF CropScience, Agricultural Products, 25 West One, Research Triangle Park, NC 27709

GROUP 43 FUNGICIDE

PRESIDIO[®] FUNGICIDE

For control of late blight and other late blight diseases in potatoes, tomatoes, eggplants, and related plants.

ACTIVE INGREDIENT: 2-(2,6-dichlorophenyl)-2,6-dimethyl-1,3-dioxane-5-carboxamide 1,1-dioxide 99.9%

INERT INGREDIENTS: 0.1%

Total: 100.0%

EPA Reg. No. 7996-08 EPA Est. No. 7996-08-0001

KEEP OUT OF REACH OF CHILDREN
CAUTION

Do not feed or allow to eat any food that has been treated with this product. Do not allow children to play in or on treated areas. Do not allow children to drink from treated areas. Do not allow children to eat any food that has been treated with this product. Do not allow children to drink from treated areas.

Net Contents: 5 Gallons (18.9 Liters) Valent, 10000 North Central Expressway, Dallas, TX 75243

Group 3

Bayer CropScience

Folicur[®] 3.6 F Follar Fungicide

For control of specified diseases on various crops.

ACTIVE INGREDIENT: 1-(4-chlorophenyl)-1-(1H-imidazo[1,2-a]pyridin-3-yl)propan-3-ol 36.7%

INERT INGREDIENTS: 63.3%

Total: 100.0%

EPA Reg. No. 266-282 EPA Est. No. 266-282-0001

STOP - Read the label before use
Keep out of reach of children
CAUTION

Do not feed or allow to eat any food that has been treated with this product. Do not allow children to play in or on treated areas. Do not allow children to drink from treated areas. Do not allow children to eat any food that has been treated with this product. Do not allow children to drink from treated areas.

Net Contents: 5 Gallons (18.9 Liters) Bayer CropScience, 10000 North Central Expressway, Dallas, TX 75243

Group M

SuperWetterStik[®]

Bravo[®] Weather Stik[®]

For control of late blight and other late blight diseases in potatoes, tomatoes, eggplants, and related plants.

ACTIVE INGREDIENT: 2-(2,6-dichlorophenyl)-2,6-dimethyl-1,3-dioxane-5-carboxamide 1,1-dioxide 54.0%

INERT INGREDIENTS: 46.0%

Total: 100.0%

EPA Reg. No. 7996-08 EPA Est. No. 7996-08-0001

KEEP OUT OF REACH OF CHILDREN
CAUTION

Do not feed or allow to eat any food that has been treated with this product. Do not allow children to play in or on treated areas. Do not allow children to drink from treated areas. Do not allow children to eat any food that has been treated with this product. Do not allow children to drink from treated areas.

Net Contents: 5 Gallons (18.9 Liters) Valent, 10000 North Central Expressway, Dallas, TX 75243



Gummy Stem Blight of watermelon




Gummy Stem Blight of muskmelon

Products labeled for gummy stem blight of muskmelon/watermelon


Multiple MOA	Group 11	Group 7	Group 3
Bravo, Echo, Equus	Amistar, Quadris	Pristine (+11)	Folicur (new)
Dithane, Manzate, Penncozeb	Cabrio		
Maneb, Manex	Flint		
	Pristine (+7)		

Early spring 2008-muskmelon & watermelon growers begin to complain that Pristine was ineffective in 2007.

- Stored GSB strains
- Laboratory assay



No information yet about resistance to group 11 fungicides.



1996 strain of GSB fungus-sensitive to group 7 fungicide-boscalid.

2008 strain of GSB fungus-resistant to group 7 fungicide-boscalid.


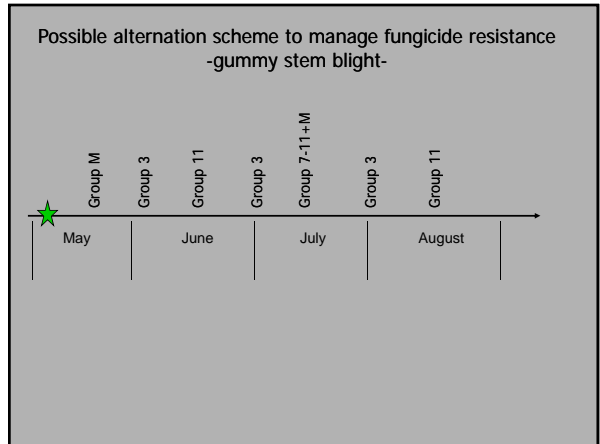
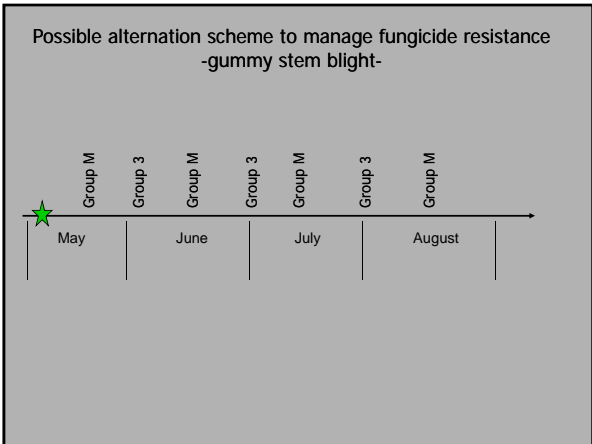
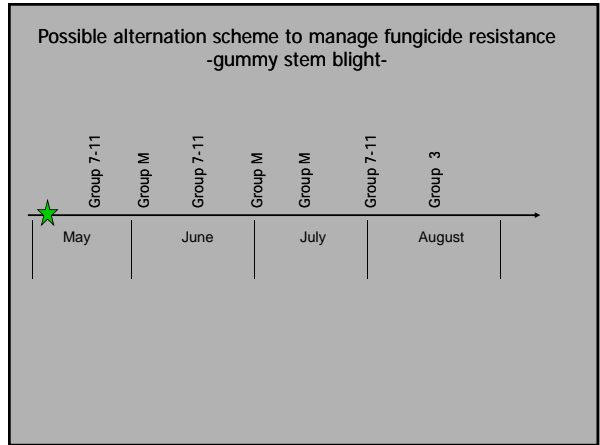
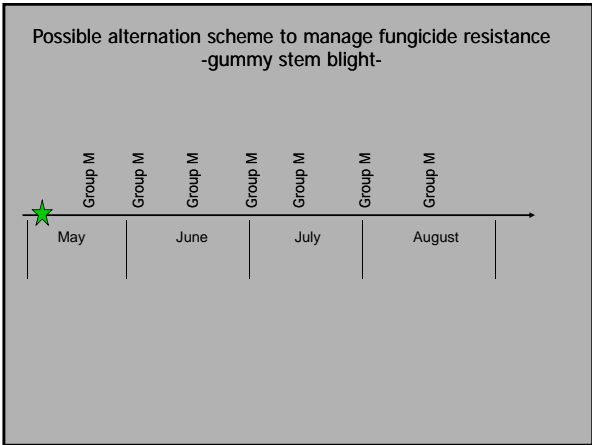
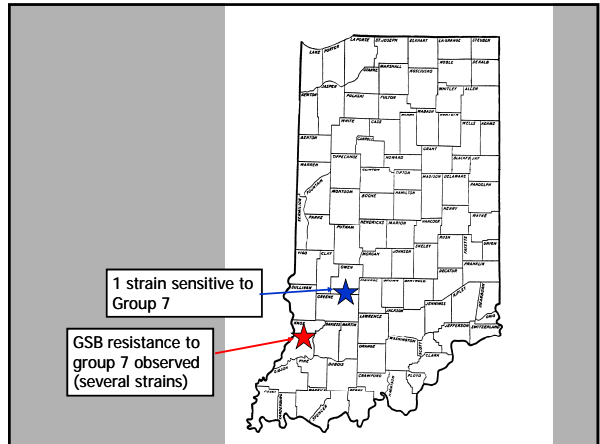
Boscalid is group 7 portion of Pristine

Results of Laboratory Tests for Resistance of GSB strains to Group 7

Year	Group 7 Resistance
1996-2006	None
2007	2 strains resistant
2008	All but 1 strain resistant

2008 strains of the GSB fungus includes:

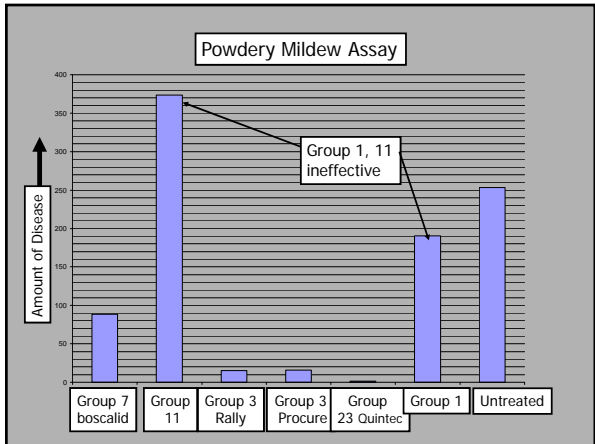
- Resistant strain from transplant
- Only sensitive strain from north of primary production area.

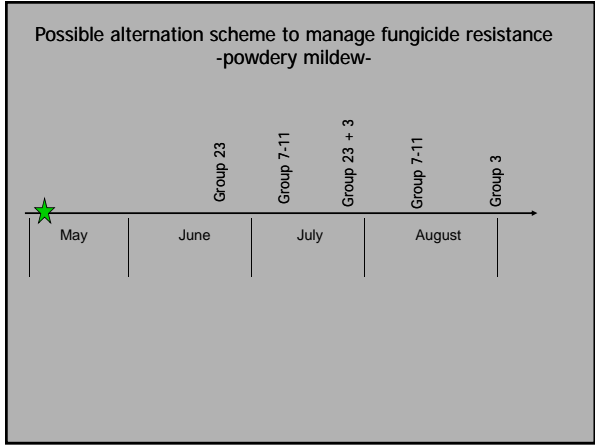
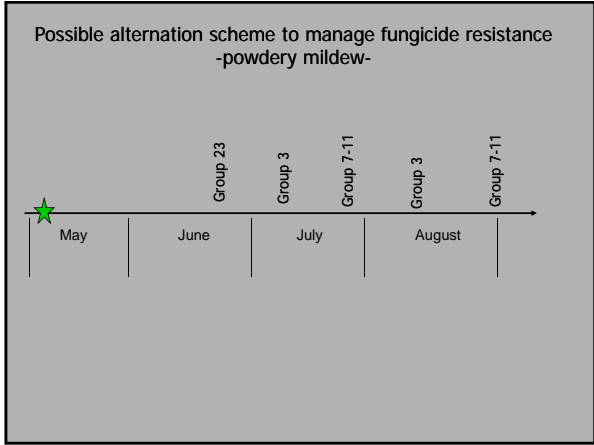
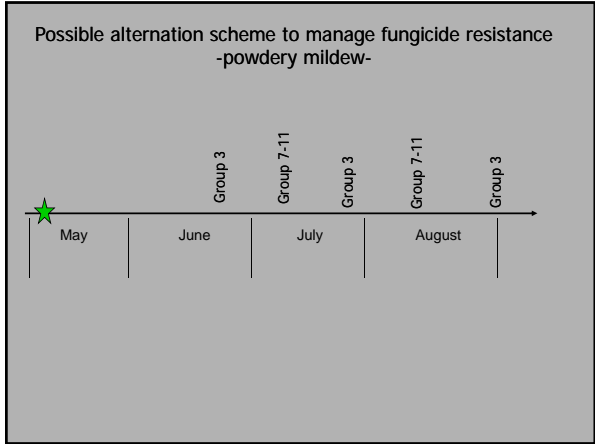





Products labeled for powdery mildew of cucurbits

Group 1	Group 3	Group 7	Group 11	Group 23
Topsin	Folicur	Pristine (+11)	Amistar, Quadris	Quintec
	Procure		Cabrio	
	Rally (Nova)		Flint	
			Pristine (+7)	





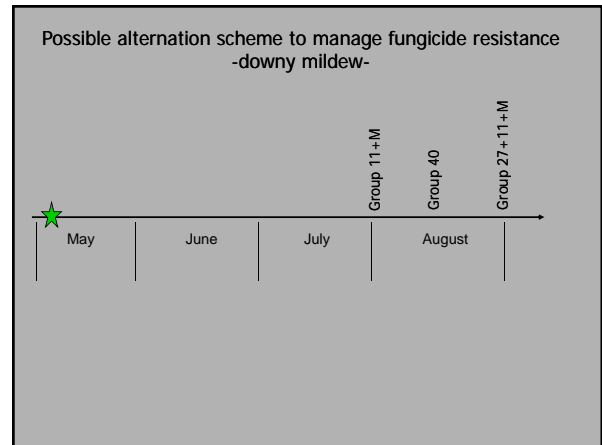
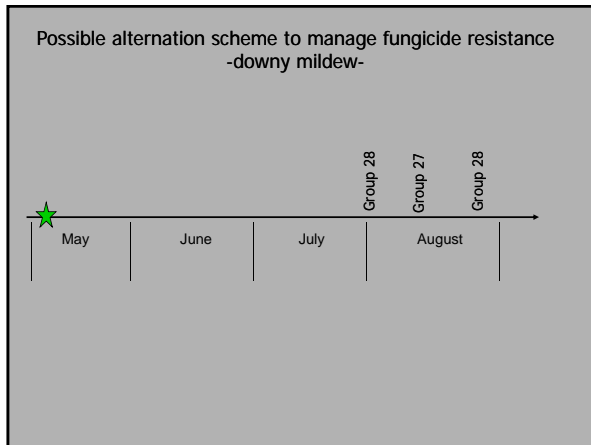
Products labeled for downy mildew of cucurbits (partial list)

Multiple MOA	Group 7	Group 11	Group 21	Group 27	Group 28	Group 40
Bravo, Echo, Equus	Pristine (+11)	Amistar, Quadris	Ranman	Curzate	Previcur Flex	Presidio
Dithane, Manzate, Penncozeb		Cabrio		Tanos (+11)		
Maneb, Manex		Flint				
		Pristine (+7)				
		Tanos (+27)				

2005 research trial

Treatment, rate/A	AUDPC
Non-treated	1,749.25 a
Manex 4F, 1.6 qt	1,290.50 b
Reason 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	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
Previcur Flex 66SL, 1.2 qt + Manex 4F, 1.6 qt	823.50 d

Group 11 ineffective



- Cucurbit Update Take Home**
- Fungi may change to be resistant to fungicides
 - Single MOA fungicide may lose effectiveness
 - Fungicide resistance observed in Indiana
 - Gummy stem blight
 - Powdery mildew
 - Downy mildew
 - Use MOA codes to manage fungicide resistance
 - Alternate MOA code in fungicide applications





BASF
The Chemical Company

GROUP 7 FUNGICIDE

Endura
fungicide

For use in dry and well-aerated beans, head and stem tomatoes, leafy lettuce greens, bulb vegetables, cabbins, carrots, button vegetables, grapes, lettuce, peas, snap and dried shelled peas, potatoes, root and tuber vegetables, and soybeans.

Active Ingredient: Endura (pyrimorobinyl) 95% (w/w) 100%
 Inert Ingredients: 5% 100%
 Total: 100% 100%

EPA Reg. No. 1998-107 EPA Est. No. _____

**KEEP OUT OF REACH OF CHILDREN
WARNING/AVISO**

It is not to be used in areas where a sign is posted to indicate a child or adult should not enter the area. Not to be used in areas where a child or adult should not enter.

See the attached label for complete First Aid, Precautionary Statements, Directions For Use, and Conditions of Sale and Warranty.

Net contents _____

BASF Corporation
 Agricultural Division
 P.O. Box 1180
 Research Triangle Park, NC 27709

Procure 50WS
Agricultural Fungicide

Net Contents _____

Active Ingredient: Procure (pyrimorobinyl) 95% (w/w) 100%
 Inert Ingredients: 5% 100%
 Total: 100% 100%

**KEEP OUT OF REACH OF CHILDREN
CAUTION**

FIRST AID

• If inhaled: Remove person to fresh air. If breathing is difficult, use oxygen. If breathing stops, use artificial respiration. Call a poison control center or doctor for treatment advice.

• If on skin: Wash with plenty of water. If irritation occurs, call a poison control center or doctor for treatment advice.

• If in eyes: Flush eyes with plenty of water for at least 15 minutes. Call a poison control center or doctor for treatment advice.

• If swallowed: Call a poison control center or doctor immediately for treatment advice. Do not induce vomiting unless instructed to do so by a poison control center or doctor. Do not give anything by mouth to someone who is unconscious.

• Tell all health care providers about all medicines you are taking and all the medicines you have taken.

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