

# Disease Management Strategies

## Disease Diagnosis

Before making any management decisions, always make sure to get the right diagnosis of your problem first.

Accurate diagnoses can save time and money because some diseases look alike but have very different management strategies. Moreover, there are several plant health issues (nutritional problems, herbicide injuries, and others) that mimic plant diseases. Unwittingly treating a nutrient deficiency with pesticides wastes time and money, and does not solve the underlying condition.

Submitting samples to a diagnostic laboratory is the best way to ensure the correct diagnosis. For a list of labs, see Page 15.

## Healthy Plant Material

Contaminated seed or transplants can introduce diseases, so saving vegetable seeds for next year's crop is not recommended. Table 24 lists some diseases that may be transmitted by seed to transplants.

Whether you are purchasing transplants or producing them yourself (see Transplant Production, page 9, be certain to inspect seedlings regularly.

## Disease-Resistant Varieties

Whenever possible, use varieties resistant to diseases. Some varieties may not be completely resistant to particular diseases, however, incomplete or partial resistance may be available. Some seed catalogs may refer to tolerance. Table 24 presents information about the availability of resistant varieties.

## Tillage and Crop Rotation

In most situations, crop rotation and fall tillage are the biggest factors in disease management. This is because most pathogens overwinter in crop residues and are unable to survive once the residue decomposes. Tillage (especially fall tillage) helps control diseases by reducing the amount of inoculum (pathogen structures) that survives the winter.

Rotating fields to different crops each year also helps control diseases by preventing the build-up of certain plant pathogens in the soil. Table 24 provides tillage and crop rotation recommendations. A general rule states that crops should not be rotated to others in the same botanical family. Table 17 identifies botanically related crops.

There are three kinds of soilborne diseases that are unaffected by rotation.

The first group of these diseases is caused by pathogens that produce resilient survival structures that can withstand the effects of time and nonhost crops. Examples include Fusarium wilt, and root knot nematode.

The next group of these diseases has a broad host range, so they can survive indefinitely on many host crop and weed

species. Examples include Sclerotinia, Rhizoctonia, and Verticillium diseases.

The third group of these diseases overwinters in Gulf Coast states, and then spread north by wind during the growing season. Examples include sweet corn rust and downy mildew of cucurbits.

Consider all options before making management decisions. Rotation is a good general practice that improves or maintains good soil tilth. Tillage (especially fall tillage) often is not in accord with recommended soil management and conservation practices.

## Other Cultural Practices

Other practices, such as altering planting times, modifying irrigation methods or schedules, using raised beds, or altering plant density, also can make conditions less favorable for disease. Some of these practices are listed under comments in Table 24.

## Chemical Control: Fungicides, Bactericides, Nematicides, Fumigants

Fungicides can be classified as either contact or systemic.

Contact fungicides, also called protectant fungicides, provide a "coat" of protection on the plant's surface when applied properly. These fungicides are designed to kill fungi on the surface of plants on contact — hence, the name.

Systemic fungicides, sometimes called eradicant or curative fungicides, don't merely coat the surface, they also enter into the plant. They can sometimes eradicate or cure a portion of existing infections.

Both contact and systemic fungicides are most effective if they are applied before disease develops. Some worry that using fungicides may lead to pathogens becoming resistant to the chemical. Most contact fungicides have multiple modes of action, so fungal pathogens are unlikely to develop resistance to all of these different modes of action at the same time. For this reason, alternating contact fungicides is unnecessary. Most systemic fungicides have a single mode of action, so the risk of pathogens developing resistance to these products is greater. Always read and follow label directions that list how to alternate systemic fungicides and minimize the resistance development. Table 27 lists several fungicides and their modes of action to help in resistance management.

Bactericides (copper and antibiotic compounds) can help reduce the risk of early-season bacterial disease epidemics, but are most effective when used with other control methods. Copper compounds also are mediocre fungicides and are handled similar to protectant fungicides. Antibiotics serve a similar purpose in certain crops.

Nematicides and fumigants are designed to reduce nematode and soilborne fungus populations before crops are planted. Like other disease-control chemicals, they are most effective when combined with cultural control options such as extended crop rotations and resistant varieties.

## Table 24. Summary of Cultural Management Strategies for Disease

This table describes several diseases listed by crop. This list is not exhaustive, but represents important Midwest diseases. Also listed are the cultural management options available for each disease. The management options are described in more detail in the text. Note that some pathogens have races. The reaction of a particular race of fungus or bacterium will depend on the cultivar or variety grown. Rotation refers to the number of years that the field should be planted to a different crop.

Crop	Disease	Tillage <sup>1</sup>	Seedborne	Rotation	Resistance	Comments
Cabbage	Alternaria Leaf Spot	3	Yes	3-4	No	
	Black Rot	3	Yes	2-3	No	
	Yellows	2	Yes	>6	Yes	Fusarium fungus is soilborne.
Carrot	Alternaria Leaf Blight	3	Yes	2	Yes	
	Bacterial Blight	3	Yes	2-3	No	
Cucumber	Angular Leaf Spot	3	Yes	2	Yes	
	Anthrachnose	3	Yes	2	Yes	Race 1 affects cucumber.
	Bacterial Wilt	1	No	NE <sup>2</sup>	No	Spread by cucumber beetles.
	Phytophthora Blight	2	No	>3	No	Water management is important. Avoid rotations with solanaceous crops.
	Scab	3	Yes	3	Yes	Favored by cool (<70°F), wet weather.
Muskmelon	Alternaria Leaf Blight	3	No	2	No	
	Anthrachnose	3	Yes	2	No	
	Bacterial Wilt	1	No	NE <sup>2</sup>	No	Spread by cucumber beetles.
	Gummy Stem Blight	3	Yes	3	No	Also affects pumpkin, watermelon.
	Phytophthora Blight	2	No	>3	No	Water management is important. Avoid rotations with solanaceous crops.
	Powdery Mildew	2	No	2	Yes	
	Root Knot	2	No	>6	No	Wide host range.
Pepper	Anthrachnose	3	Yes	3	No	
	Bacterial Spot	3	Yes	2	Yes	Races.
	Phytophthora	2	Yes	3	Yes	Races.
	PVY	1	No	2	Yes	Aphid transmission (reflective mulch).
	TEV	1	No	2	Yes	Aphid transmission (reflective mulch).
	TMV	1	No	2	Yes	Mechanical transmission.
Potato	Early Blight	3	No	3-4	Partial	More disease on early maturing cultivars.
	Late Blight	1	Yes	2-3	Partial	Survives on cull piles and volunteers.
Pumpkin	Angular Leaf Spot	3	Yes	2	No	Symptoms similar to bacterial spot.
	Bacterial Spot	3	Yes	2	No	Also affects squash.
	Black Rot	3	Yes	2	No	Same as gummy stem blight on muskmelon, watermelon.
	Downy Mildew	1	No	NE <sup>2</sup>	No	The causal fungus must blow into the Midwest from the southern United States.
	Fusarium Fruit Rot	2	Yes	>4	No	See comments in cucurbit section.
	Phytophthora Blight	2	No	>4	No	Water management is an important tool. Avoid rotations with Solanaceous crops.

<sup>1</sup> 1=tillage is not effective, 2=tillage is of limited help, 3=tillage is an important control

<sup>2</sup> NE=not effective

**Disease Management Strategies** (continued)

Table 22. Summary of Cultural Management Strategies for Disease (continued)

Crop	Disease	Tillage <sup>1</sup>	Seedborne	Rotation	Resistance	Comments
Pumpkin (continued)	Plectosporium Blight	3	No	3-4	No	May be managed like black rot.
	Powdery Mildew	2	No	2	Partial	
	Virus Diseases (several)	1	No	NE <sup>2</sup>	No	Aphids spread virus. All cucurbits affected. Pumpkins planted by June 20 (southern Indiana) set fruit before disease becomes severe.
Snap Bean	Rhizoctonia Root Rot	3	No	NE <sup>2</sup>	No	Deep plow residue.
	White Mold	1	No	5-6	No	Wide host range. Manage water. Avoid rotation with soybean.
Sweet Corn	Stewart's Wilt	1	Yes	NE <sup>2</sup>	Partial	Spreads and survives in flea beetles.
Tomato	Anthrachnose	3	Yes	2-3	No	Stake and mulch.
	Bacterial Spot	3	Yes	2-3	No	
	Canker	3	Yes	3-4	No	
	Early Blight	3	Yes	3-4	Partial	Some resistance to stem canker.
	Fusarium Crown Rot	2	No	>6	No	
	Fusarium Wilt	2	Yes	>6	Yes	Three races exist.
	Late Blight	1	No	NE	No	Does not overwinter in the Midwest.
	Leaf Mold	2	No	2	Yes	Many races of the fungus exist.
	Powdery Mildew	2	No	2	No	
	Root Knot	2	No	>6	Yes	Wide host range.
	Septoria Leaf Spot	3	No	2-3	No	
	Southern Blight	3	No	>6	No	Favors high temperatures.
	Speck	3	Yes	2	Yes	
	TMV	1	No	2	Yes	Can be spread by contact.
Verticillium	2	No	>6	Yes		
White Mold	1	No	5-6	No	Wide host range.	
Vegetables (all)	Damping Off	1	No	NE <sup>2</sup>	No	Warm soils, greenhouse sanitation.
Watermelon	Anthrachnose	3	Yes	3	No	Race 2 affects watermelon.
	Bacterial Fruit Blotch	3	Yes	2	No	Volunteer watermelon and cucurbit weeds can spread disease next season.
	Fusarium Wilt	2	Yes	>6	Partial	Three races exist.
	Gummy Stem Blight	3	Yes	3	No	Also affects muskmelon, pumpkin, and squash.
	Phytophthora Blight	2	No	>3	No	Water management is important. Avoid rotations with solanaceous crops.
	Root Knot	2	No	>6	No	Wide host range.
Broadleaf Vegetables	Sclerotinia	2	No	With grasses 3-4	No	Flood. 23-45 days.

<sup>1</sup> 1=tillage has limited effect, 2=tillage is of limited help, 3=tillage is an important control

<sup>2</sup> NE=not effective

**Table 25. Preharvest Intervals (Days) and Re-Entry Intervals for Fungicides Registered for Use on Midwest Vegetables in 2012<sup>a</sup>**

	acibenzolar-S-methyl	azoxystrobin	azoxystrobin/ difenoconazole	boscalid	boscalid/pyraclostrobin	chlorothalonil	cyazofamid	cymoxanil/famoxadone	cyprodinil/ difenoconazole	cyprodinil/fludioxonil	dimethomorph	fixed copper	fluopicolide	Aluminum trifosetyl-A	iprodione	mancozeb	mandipropamid	mandi./difenoconazole	myclobutanil	phosphorous acid	propamocarb	propiconazole	pyraclostrobin	quinoxifen	tebuconazole	thiophanate methyl	trifloxystrobin	triflumizole
Asparagus		100				190								110		180			180	0					180		180	
Bean, Lima		0		7		14				7		0			b					0					14	14		
Bean, Snap		0		7		7				7		0			b				0	0					14	14		
Beet		0								7		0										g			7	21	7	
Broccoli	7	0	1	0		7	0		7	7	7	0	2	3	0		1			0			0					1
Brussels Sprouts	7	0	1	0		7	0		7	7	7	0	2	3			1			0			0					1
Cabbage	7	0	1	0		7	0		7	7	7	0	2	3			1			0			0		7			1
Cabbage, Chinese	7	0	1	c		7	0		7	7	f	0	2	3			1			0			h		7			1
Carrot		0		0	0	0	14			7		0			0					0		14	0				7	
Cauliflower	7	0	1	0		7	0			7	7	0	2	3			1			0			0					1
Celery		0		0		7		1		0		0	2	3			1			0		14	0				7	
Collard	7	0	1	14			0			7	0	0		3			1			0			3		7			1
Cucumber	0	1	1	0	0	0	0	3	7	1	0	0	2	1/2		5	0		0	0	2		0		7	1	0	0
Eggplant		0	0	0		3	0				0	0	2				1			0			0				3	
Endive		0						1		0		0	2	3						0			0					0
Kale	7	0	1	14			0		7	7	0	0		3			1			0			3		7			1
Lettuce, Head	7	0		14				1		0	0	0	2	3	14		1			0	2		0	1				0
Lettuce, Leaf	7	0		14				1		0	0	0	2	3	14		1			0	2		0	1				0
Mint		7				e													30			30						
Muskmelon	0	1	1	0	0	0	0	3	7	1	0	0	2	1/2		5	0		0	0	2		0	3	7	1	0	0
Mustard	7	0	1	14			0		7	7	0	0		3			1			0			3		7			1
Onion, Bulb	7	0	7	7	7	7		3	7	7	0	0	2	7	7	7	7			0		14	7		7	0		
Onion, Green		0	7	7	7	14			14	7	0	0	2				7			0		0	7		7	0		
Parsley		0						1		0		0	2	3						0		14	0				7	70
Parsnip		0				10				7			7										0					7
Peas		0		d								0								0								
Pepper		0	0	0		3	0	3			0	0	2				1			0	5		0	3				3
Potato		14	14	10		7	7	14			4	0			14	14		14		0	14		3			21	7	
Pumpkin	0	1	1	0	0	0	0	3	7	1	0	0	2	1/2		5	0		0	0	2		0	3	7	1	0	0
Radish	7	0								7			7										0					7
Spinach	7	0	1				0	1				0	2	3			1			0			0					
Squash, Summer	0	1	1	0	0	0	0	3	7	1	0	0	2	1/2		5	0		0	0	2		0		7	1	0	0
Squash, Winter	0	1	1	0	0	0	0	3	7	1	0	0	2	1/2			0		0	0	2		0	3	7	1	0	0
Sweet Corn		7				14																14				7		
Tomato	14	0	0	0		0	0	3	0	0	4	0	2	14		5	1	1	0	0	5		0				3	
Turnip	7	0								7		0	7										0		7			7
Watermelon	0	1		0	0	0	0	3	7	1	0	0	2	1/2		5	0		0	0	2		0	3	7	1	0	0
Re-Entry Interval (hr)	12	4	12	12	12	12	12	12	12	12	12	48	12	12	24	24	4	12	24	4	12	12	12	12	e	e	12	12

<sup>a</sup>Check label directions before applying any of these pesticides.<sup>b</sup>Do not apply past peak bloom.<sup>c</sup>0-day PHI for Napa Chinese cabbage. 14-day PHI for bok choy.<sup>d</sup>Succulent only. 7-day PHI.<sup>e</sup>See label.<sup>f</sup>0-day PHI for bok choy. 7-day PHI for napa.<sup>g</sup>14-day PHI for garden beets. 21-day PHI for sugar beets.<sup>h</sup>3-day PHI for bok choy. 0-day PHI for all others.

**Table 26. Common Names of Registered Fungicides**

Common Name	Trade Name	Producer	Formulation <sup>1,2</sup>
acibenzolar-S-methyl	Actigard <sup>®</sup>	Syngenta	50WG
fosetyl-Al	Aliette <sup>®</sup>	Bayer Crop Science	80WP
azoxystrobin	Amistar <sup>®</sup> , Quadris <sup>®</sup>	Syngenta	80WP, 2.08SC
azoxystrobin, chlorothalonil	Quadris Opti <sup>®</sup>	Syngenta	0.5+5.0F
azoxystrobin, propiconazole	Quilt <sup>®</sup>	Syngenta	0.62+1.04F
boscalid	Endura <sup>®</sup> , Pristine <sup>®</sup>	BASF	70WG, 38WG
<i>Bacillus subtilis</i> QST 713	Serenade Max <sup>®</sup>	AgraQuest	WP
chlorothalonil	Bravo 500 <sup>®</sup>	Syngenta	500F
	Bravo Ultrex <sup>®</sup>	Syngenta	82.5DG
	Bravo Weather Stik <sup>®</sup>	Syngenta	720F
	Bravo Zn <sup>®</sup>	Syngenta	500F
	Equus <sup>®</sup>	Griffin	DF, 720F
Echo <sup>®</sup>	Sipcam	720F	
<i>Coniothyrium minitans</i>	Contans <sup>®</sup>	Prophyta	5.3WG
copper hydroxide <sup>3</sup>	Kocide 2000 <sup>®</sup> , 3000	Griffin	53, DF, 46 DF
	Champion <sup>®</sup>	Agrol	50WP
	Champ <sup>®</sup>	Agrol	4.5F
copper sulfate basic <sup>3</sup>	Basicop <sup>®</sup>	Griffin	53WP
	Cuprofix Disperse Ultra <sup>®</sup>	United Phosphorus, Inc.	20DF, 40DF
	Tribasic Copper <sup>®</sup> Sulfate <sup>®</sup>	Citco	53WP
copper resinate	Citcop 5E <sup>®</sup>	Tennessee Chemical	5EC (5%)
cymoxanil	Curzate DF <sup>®</sup>	DuPont	60DF
cymoxanil, famoxadone	Tanos <sup>®</sup>	Dupont	50WDG
cyazofamid	Ranman <sup>®</sup>	FMC	400 SC
cyprodinil/fludioxonil	Switch <sup>®</sup>	Syngenta	62.5 WG
dichloro-nitroaniline	Botran <sup>®</sup>	Gowan	75WP
difenoconazole	Inspire Super <sup>®</sup>	Syngenta	2.09SC
dimethomorph	Acrobat <sup>®</sup> , Forum <sup>®</sup>	BASF	50WP, 4.18SC
fluazinam	Omega <sup>®</sup>	Syngenta	500F
fluopicolide	Presidio <sup>®</sup>	Valent	4SC
iprodione	Rovral <sup>®</sup>	Bayer Crop Science	50WP
kresoxim-methyl	Sovran <sup>®</sup>	BASF	50WG
mancozeb	Gavel <sup>®</sup> , Dithane M-45 <sup>®</sup> , DF	Gowan	75DF, 80WP, 80DG
	Manzate 200DF <sup>®</sup>	Griffin	80 DG
	Penncozeb <sup>®</sup>	United Phosphorus, Inc.	80WP
	Penncozeb DF <sup>®</sup>	United Phosphorus, Inc.	75DF
mandipropamid	Revus <sup>®</sup> , Revus Top <sup>®</sup>	Syngenta	2.09SC
mefenoxam	Ridomil Gold Copper <sup>®</sup>	Syngenta	65WP
	Ridomil Gold Bravo <sup>®</sup>	Syngenta	76WP
	Ridomil Gold EC <sup>®</sup>	Syngenta	47EC
	Ridomil Gold MZ <sup>®</sup>	Syngenta	68WP
myclobutanil	Rally <sup>®</sup>	Dow Agroscience	40WSP
PCNB	Terrachlor <sup>®</sup>	Uniroyal Chemical	10DG, 75WP, 40F
phosphorous acid	Agri-Fos <sup>®</sup>	AgriChem	400FL
	Phostrol <sup>®</sup>	Nufarm	53.6 DF
	Prophyt <sup>®</sup>	Luxembourg	54.5 F
propamocarb	Previcur Flex <sup>®</sup>	Bayer Crop Science	66F
propiconazole	Tilt <sup>®</sup> , Propimax <sup>®</sup>	Syngenta, Dow Agroscience	3.6F
pyraclostrobin	Cabrio <sup>®</sup> , Headline EC <sup>®</sup> , Pristine <sup>®</sup>	BASF	20EG, 2.09EC, 38WG
pyrimethanil	Scala <sup>®</sup>	Bayer Crop Science	55SC
quinoxifen	Quintec <sup>®</sup>	Dow Agroscience	2.08SC
tebuconazole	Monsoon <sup>®</sup> , Toledo <sup>®</sup>	Loveland, Rotam	3.6F
thiophanate methyl	Topsin M <sup>®</sup>	United Phosphorus, Inc.	70WSB
trifloxystrobin	Flint <sup>®</sup>	Bayer Crop Science	50WDG
	Gem <sup>®</sup>	Bayer Crop Science	25WDG, 500SC
triflumizole	Procure <sup>®</sup>	Chemtura	480SC
zoxamide	Gavel 75DF <sup>®</sup>	Dow Agroscience	75DF

<sup>1</sup> DF=dry flowable, DG=dispersible granules, EC=emulsifiable concentrate, F=flowable suspension, LC=liquid concentrate, SC=soluble concentrate, WP=wettable powder, WSB=water soluble bag

<sup>2</sup> Fungicides are sold commercially as a mixture of active ingredient (that which kills the fungus) and other substances (i.e., carriers, diluents, solvents, wetting agents, emulsifiers, etc.). The formulation indicates the portion of the product that is active ingredient and the physical form of the product. For WP and DG formulations, the number before the abbreviation indicates the percentage of the product that is active ingredient. For example, "50WP" describes a wettable powder that is 50% active ingredient, and "4F" describes a flowable product that contains 4 lbs. of active ingredient per gallon of product.

<sup>3</sup> The number preceding the type of formulation for copper products indicates the percentage or amount of metallic copper in the product. For example, "53WP" describes a wettable powder product that is 53% metallic copper, and "4.5F" describes a flowable product containing 4.5 lbs. of metallic copper per gallon.

## Table 27. Fungicide Resistance Management

Disease-causing fungi may become resistant to fungicides if label precautions are not followed carefully. This table is designed to help growers alternate applications between fungicides with different modes of action to avoid or delay development of fungicide resistance in fungi. Many product labels use the same letters and numbers as those listed in the MOA Code column below. This list is not exhaustive, but does contain many of the fungicides used in the Midwest.

Trade Names	Common Name	Risk of Resistance	MOA Code <sup>1</sup>
Acrobat <sup>®</sup> , Forum <sup>®</sup>	dimethomorph	medium-high	40 <sup>2</sup>
Actigard <sup>®</sup>	acibenzolar-S-methyl	none-low	21
Agri-Fos <sup>®</sup> , Phostrol <sup>®</sup>	phosphorous acid	low	NA
Aliette <sup>®</sup>	fosetyl-A1	low	33 <sup>2</sup>
Amistar <sup>®</sup> , Quadris <sup>®</sup>	azoxystrobin	high	11 <sup>2</sup>
Bravo <sup>®</sup> , Echo <sup>®</sup> , Equus <sup>®</sup>	chlorothalonil	none-low	M <sup>3</sup>
Cabrio <sup>®</sup> , Headline <sup>®</sup>	pyraclostrobin	high	11 <sup>2</sup>
copper (several)	copper	none-low	M <sup>3</sup>
Curzate <sup>®</sup>	cymoxanil	medium-high	27 <sup>2</sup>
Dithane <sup>®</sup> , Manzate <sup>®</sup> , Penncozeb <sup>®</sup>	mancozeb/maneb	none-low	M <sup>3</sup>
Endura <sup>®</sup>	boscalid	medium	7
Flint <sup>®</sup> , Gem <sup>®</sup>	trifloxystrobin	high	11
Gavel <sup>®</sup>	mancozeb (M) + zoxamide (22)	low-medium	M <sup>3</sup> , 22
Inspire Super <sup>®</sup>	cyprodinil/difenoconazole	medium	9, 3
Microthiol <sup>®</sup> , Thiolux Jet <sup>®</sup>	sulfur	none-low	M <sup>3</sup>
Monsoon <sup>®</sup> , Toledo <sup>®</sup>	tebuconazol	medium	3
Omega <sup>®</sup>	fluazinam	low	29
Presidio <sup>®</sup>	fluopicolide	medium-high	43
Previcur Flex <sup>®</sup>	propamocarb	low-medium	28
Pristine <sup>®</sup>	boscalid (7) + pyraclostrobin (11)	medium-high	7, 11
Procure <sup>®</sup>	triflumizole	medium	3
Quadris <sup>®</sup>	azoxystrobin	high	11
Quadris Top <sup>®</sup>	azoxystrobin (11) + difenoconazole (3)	medium-high	11, 3
Quintec <sup>®</sup>	quinoxifen	medium	13
Rally <sup>®</sup>	myclobutanil	medium	3
Ranman <sup>®</sup>	cyazofamid	medium-high	21
Reason <sup>®</sup>	fenamidone	high	11
Revus <sup>®</sup>	mandipropamid	medium-high	40
Revus Top <sup>®</sup>	mandipropamid difenoconazole	low-medium	40 3
Ridomil <sup>®</sup>	mefenoxam	high	4
Rovral <sup>®</sup>	iprodione	medium	2
Scala <sup>®</sup>	pyrimethanil	medium	9
Sovran <sup>®</sup>	kresoxim-methyl	high	11
Switch <sup>®</sup>	cyprodinil (9) + fludioxonil (12)	low-medium	9, 12
Tanos <sup>®</sup>	cymoxanil (27) + famoxadone (11)	medium	27, 11
Tilt <sup>®</sup>	propiconazole	medium	3
Topsin M <sup>®</sup>	thiophanate-methyl	high	1
Ziram <sup>®</sup>	ziram	none-low	M <sup>3</sup>

<sup>1</sup> MOA=mode of action, or FRAC code

<sup>2</sup> Fungicides with a numbered MOA code have very specific activity sites and may cause resistance to develop in fungi. These fungicides should be alternated with fungicides with different MOA codes. Read product labels to determine resistance management strategies.

<sup>3</sup> M=multi-site activity. Fungicides with mode of action code M are contact fungicides. It is not necessary to alternate these fungicides for resistance management.

<sup>4</sup> NA=not available