Disease Management Strategies

Plant diseases are caused by a wide variety of microbial pathogens (including fungi, bacteria, viruses, and nematodes). For a plant disease to occur, three components must be present:

1. The pathogen

2. A susceptible host (the plant)

3. An environment conducive to disease.

In addition, insects spread some diseases, which makes them a fourth component of the disease cycle. Disease management strategies target one or more of those these factors to prevent and/or reduce the risk of disease. The sections below provide a broad overview of general management strategies. The crop-by-crop chapters go into much more detail for each disease.

Disease Diagnosis

Before making any management decisions, always make sure to correctly diagnose your problem first. Accurate diagnoses can save time and money because some diseases look alike but have very different management strategies.

Different pathogens have different modes of both survival and spread. Therefore, certain management practices will work for some diseases but may have no effect on others. Furthermore, disease control materials are usually effective against only a subgroup of specific diseases. For example, fungicides will have no effect on viruses.

Moreover, even among the various fungi, some materials may be effective against certain diseases but not others. In particular, the pathogens *Pythium, Phytophthora,* and the causal agents of downy mildews that we often discuss as fungi are not true fungi, they are in a different group of organisms called oomycetes. Many materials effective against true fungi are not effective for those organisms, and vice versa.

For example, numerous materials used to manage downy mildew will have no effect or a negligible effect on powdery mildew, and vice versa. A root disease may require very different management compared to a leaf spot or fruit disease.

Moreover, there are several plant health issues that mimic plant diseases (including environmental stress, nutritional problems, herbicide injuries, air pollution, and others). These are known as abiotic disorders. 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 and instructions on how to submit plants, see pages 45-46.

Healthy Plant Material

Contaminated seed or transplants can introduce diseases, so saving vegetable seeds for next year's crop is not recommended unless you are trained and equipped to handle seed sanitation (see page 26). You should not save seeds when a seedborne disease has been active. Summary of Cultural Management Strategies for Disease (page 76) lists some diseases that may be transmitted by seed to transplants.

Whether you purchase transplants or produce them yourself, you should read Transplant Production (page 23) to better understand transplant health. Be certain to inspect seedlings regularly. Examine the foliage and remove a few plants from the pots to inspect the roots. If you purchase transplants, keep newly-arrived materials away from other plants and the production area for a few days to prevent spread if a problem is found.

Talk to your supplier and ask questions about how the reduce disease risk. If a you suspect a disease on received plants, take photos and contact a diagnostic laboratory (pages 45-46), and continue to keep the plants separate. Keep good records of where plants are sourced from so that you can contact the supplier if a problem arises.

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. Summary of Cultural Management Strategies for Disease (page 76) presents information about the availability of resistant varieties.

For certain vegetables (such as tomatoes) there are rootstocks available with resistance to some soilborne pathogens. A resistant rootstock may be an option if you have a history of a known soilborne disease but wish to grow a tomato scion variety that is susceptible.

Tillage and Crop Rotation

If a disease pathogen survives from year-to-year in crop residue or soil, then crop rotation and fall tillage are very effective factors in disease management. The pathogens are unable to survive once the crop 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 crop families each year also helps control diseases by preventing the build-up of certain plant pathogens in the soil. Summary of Cultural Management Strategies for Disease provides tillage and crop rotation recommendations. A general rule is that you should not rotate a field to a crop in the same botanical family. Botanically Related Vegetables (page 61) identifies botanically related crops.

Unfortunately, there are several 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. Two such diseases are Fusarium wilt, and root-knot nematode.

Another group of diseases unaffected by crop rotation has a broad host range, so they can survive indefinitely on many host crop and weed species. Examples include Sclerotinia, Rhizoctonia, and Verticillium diseases. In addition, root-knot nematode can cause disease in multiple vegetable plant families (cucurbits, tomato, carrot, and many more) along with some field crops and even weeds.

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

In addition, certain viruses spread by highly motile insects (such as aphids), so rotation does not reduce these diseases either. Since the pathogen does not overwinter locally in the field, survival in residue is not a factor.

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. If you practice no-till or reduced tillage, you will need to be even more vigilant with other strategies in order to reduce your risk of disease.

Two publications that may be useful for no-till or reduced tillage growers are Building Soils for Better Crops: Sustainable Soil Management and Managing Cover Crops Profitably, both available from the Sustainable Agriculture Research & Education (SARE) Learning Center, www.sare.org.

Water and Humidity Management

Many bacterial and fungal pathogens thrive in wet conditions. Certain soilborne pathogens such as *Phytophthora and Pythium* species are favored by wet soils with poor drainage. Avoid planting into sites with known drainage problems. Improve drainage, and consider using raised beds.

Many leaf spot and fruit rot diseases are favored by high humidity and wet plant surfaces. Using drip irrigation instead of overhead irrigation will reduce leaf wetness. If you use overhead irrigation, irrigate in the morning so that plant surfaces dry before nighttime. Avoid overhead irrigation in the evening.

Reduce plant density to allow better airflow and sunlight to penetrate, which will decrease leaf wetness and humidity. With certain crops (such as tomato) appropriate staking or trellising will also increase airflow. Reducing weed pressure in and along the sides of the crop can also improve airflow. Align rows to maximize airflow and sun exposure.

In greenhouses and high tunnels, use passive ventilation and/or fans to reduce humidity. See Transplant Production (page 23) for details about water and humidity management in that setting. Avoid working wet fields.

Scouting and Sanitation

Depending on the disease and the size of your operation, you can and should rouge out (remove) infected plants. For example, there are no treatments for viral diseases, so you should remove infected plants to reduce the spread to other plants.

Bacterial canker of tomato is another disease where you should rogue out the infected plants and several neighboring plants. Flag the area and come back to check for further spread. Culls should be removed far from the field.

In greenhouse situations, remove the trash frequently, and always keep lids on trash cans to prevent pathogens (and insects) from building up in discarded plant materials. For some crops (such as tomato) stakes and trellises can harbor certain bacteria from one crop to the next. So always use new stakes, or at minimum disinfest them. Disinfest tools frequently, such as at the end of rows. Avoid working fields under wet conditions.

Other Cultural Practices

Insects (such as thrips, aphids, cucumber beetles, and others) spread numerous diseases, so cultural practices that reduce the insects will reduce the risk of diseases. The comments for the Summary of Cultural Management Strategies for Disease table (page 76) lists some of these practices. See the Insect Management Strategies section (pages 51-60) for guidelines about cultural controls to reduce insects that may spread diseases.

Chemical Control: Fungicides, Bactericides, Nematicides, Fumigants

Disease control products (fungicides, bactericides, and nematicides) are pesticides. Be sure to read the general section about Pesticide Information and Safety (pages 33-37) for information about safety, equipment, calibration, formulations, storage, and other important topics. For a disease control material to be effective, you must apply an appropriate material at the right time, in the right concentration, and in the right way.

Fungicides can be broadly classified as either contact or systemic. Within those groups, however, there are many active ingredients and multiple modes-of-action. Some fungicides are allowed in organic vegetable production (see page 39), and some are designated as reduced-risk, including certain biopesticides/biological controls (see page 37).

Both contact and systemic fungicides are most effective if you apply them before disease develops. Many diseases are very difficult or impossible to control with chemicals once a severe epidemic is underway. Throughout the crop-specific sections of this book there are details about when you should apply fungicides in order to be most effective (and information about when they may be ineffective).

Pathogens usually require a specific temperature and moisture range in order to cause diseases. For some diseases, knowing those specific requirements can help you time fungicide applications to coincide with disease risk. In some cases, the guidelines are informal, and may simply make you more aware that a wet season may require more applications and a dry season may require fewer. In other cases, the pathogen life cycle is understood well enough that you can use a formal disease forecasting system (see Disease Management with the MELCAST System in the Cucubit Crops section, page 122).

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-contact on the surface of plants — hence, the name. 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. Good coverage is essential to maximize the efficacy of contact materials.

Systemic fungicides (sometimes called eradicant or curative fungicides) don't merely coat the surface, they also enter the plant. Once inside the plant, some stay relatively localized. Others move across to the opposite leaf surface, some move upward in the plants, and a few move downward into the roots. They can sometimes eradicate or cure a portion of existing infections. Most systemic fungicides have a single mode of action, so the risk of pathogens developing resistance to these products is greater. The fungicides target a very specific function of the pathogen's cells, and sometimes the fungus develops methods to evade the activity.

Powdery mildews and downy mildews are particularly prone to resistance development, but there are other examples. The crop sections in this guide flag diseases that are at risk for fungicide resistance. Always read and follow label directions that list how to alternate systemic fungicides and/or combine and rotate with contact fungicides to minimize the resistance development.

Selected Information About Recommended Fungicides (page 79) lists several fungicides and their modes of action to help in resistance management. Each fungicide label is marked with a "FRAC" (Fungicide Resistance Action Committee) code to designate a mode of action group and help growers design a rotation plan.

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. Nematicides Labeled for Use on Vegetables 2020 (page 60) describes nematode soil treatments.

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[1]	Seedborne	Rotation[2]	Resistance	Comments
Allium garlic, onion, leek	Alternaria purple blotch, Botrytis leaf blight	3	Yes	3-4	No	Thrips-damaged tissues are more susceptible
	Aster yellows	1	Yes	NE	No	Seed transmission is low, but possible; transmission from garlic bulb/cloves occurs
	Botrytis neck rot	2	No	3	No	Cure bulbs rapidly and properly and avoid injury to neck
	Downy mildew	2	Yes	3	Yes	Resistance in onion only (limited varieties)
	Fusarium basal rot	1	No	4	Yes	
	Smut	1	No	3	No	Transmitted on sets and transplants
	White rot	1	No	NE	No	Do not move *Allium* spp. into quarantine areas of the U.S. (Columbia Basin)
Asparagus	Cercospora leaf spot and rust	NA	No	NA	Yes	Remove or burn down ferns in the late fall to reduce inoculum
	Fusarium crown and root rot	NA	Yes	NA	Yes	Avoid long harvest periods to maintain vigor
	Phytophthora crown and spear rot	NA	No	NA	No	
Cruciferous vegetables	Alternaria leaf spot	3	Yes	3-4	No	
	Black leg	3	Yes	3-5		Leave 1/4-mile buffer from previously infected fields, delay plant until conditions are dry
	Black rot	3	Yes	2-3	No	
	Club root	NE	No	5 - 7	Yes	Club root pathogen survives on some grass, clover, weedy, and other plants, which influences rotation or cover crop selection
	Downy mildew	3	Yes	2-3	Yes	Resistance in broccoli only
	Fusarium yellows	2	Yes	>6	Yes	
	Powdery mildew	3	No	3	Yes	Resistance for Brussels sprout and cabbage only, avoid over applying nitrogen and drought
	Rhizoctonia diseases	3	No	NE	No	Can form disease complex with black leg pathogen for stem canker
	Sclerotinia stem rot	2	No	NE	No	Very wide host range; rotation for greater than 3 years into grasses, onions, or corn may reduce severe infestations
	White rust	NE	Yes	3	Yes	Remove crop debris from area after harvest

Summary of Cultural Management Strategies for Disease (continued)

Crop	Disease	Tillage[1]	Seedborne	Rotation[2]	Resistance	Comments
Cucurbits cantaloupe, cucumber, pumpkin, squash, watermelon	Alternaria leaf blight	3	No	2	No	
	Angular leaf spot	3	Yes	2	Yes	
	Anthracnose	3	Yes	2	No	Race 1 affects mainly cucumber, Race 2 affects mainly watermelon
	Bacterial fruit blotch	3	Yes	2	No	
	Bacterial leaf and fruit spot	3	Yes	3	No	Primarily on pumpkin and winter squash
	Bacterial wilt	1	No	NE	No	Spread by cucumber beetles
	Downy mildew	1	No	NE	Yes	Resistant varieties of cucumber and cantaloupe available
	Fusarium wilt	1	Yes	5-7	Yes	
	Gummy stem blight/black rot	3	Yes	3	No	Also affects pumpkin and watermelon
	Phytophthora blight	2	No	>4	No	Avoid excess water and rotation with solanaceous crops; good drainage is important. Treating seeds with mefenoxam may prevent seedling death.
	Plectosporium blight	3	No	3-4	No	Primarily on pumpkins; manage like black rot
	Powdery mildew	2	No	2	Yes	
	Root-knot nematode	2	No	>6	No	Wide host range will affect rotation choices
	Viruses (several)	1	No	NE	No	Spread by aphids; plant crops before insect pressure becomes severe
Leafy vegetables endive, herbs, lettuce, spinach	Botrytis gray mold	2	No	NE	No	Provide adequate spacing to reduce humidity
	Bottom rot and drop	2	No	NE	No	
	Downy mildew, white rust	NE	Yes	3	Yes	
	Lettuce mosaic virus	2	Yes	1	Yes	There are many hosts that may harbor the virus; manage aphid populations
	Powdery mildew	2	No	2	No	
Legumes cowpea, dry bean, lima bean, pea, snap bean	Anthracnose	3	Yes	3	Yes	Resistance is race-dependent
	Bacterial blights	3	Yes	2	No	
	Rust	1	No	3-4	Yes	
	Soybean cyst nematode	1	No	1-3	No	Rotation interval dependes on the cyst count in soil samples
	White mold and gray mold	2	No	NE	No	
Root crops beet, carrot, parsnip, radish, turnip	Aster yellows	2	Yes	NE	No	Seed transmission is low, but possible; destroy perennial weed hosts near high-value crops
	Cercospora leaf spot, Alternaria leaf blight	3	Yes	2	Yes	Resistance availability varies by root crop and pathogen
	Downy mildew, white rust	3	Yes	3	No	Cruciferous weeds and crops are also hosts
	Root-knot nematode	2	No	>6	No	Wide host range affects rotational options
	White mold	2	No	NE	No	Avoid rotation with beans, cucurbits, celery, and cabbage

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Summary of Cultural Management Strategies for Disease (continued)

Crop	Disease	Tillage[1]	Seedborne	Rotation[2]	Resistance	Comments
Sweet corn	Anthracnose	3	No	1-3	Yes	
	Goss' wilt	3	Yes	1	Partial	Control grassy weeds that are hosts
	Leaf blights (southern corn leaf blight, northern corn leaf blight, northern corn leaf spot)	3	No	1	Yes	
	Rust	NE	No	NE	Yes	
	Smut	2	No	NE	Yes	Maintain balanced soil fertility
	Stewart's wilt	1	Yes	NE	Partial	Spreads and survives in flea beatles
Fruiting vegetables eggplant, pepper, tomato	Anthracnose	3	Yes	3-4	No	Stake and mulch
	Bacterial canker	3	Yes	3-4	No	Disease is systemic
	Bacterial speck	3	Yes	2	Yes	Some strains are copper resistant
	Bacterial spot	3	Yes	2-3	Yes[3]	Copper resistance reported — check with your state pathologist
	Early blight	3	Yes	3-4	Partial	Some resistance to stem canker
	Fusarium crown and root rot	2	Yes	>6	Yes	Graft to resistant root stocks; use resistant varieties
	Late blight	1	No	NE	No	Does not overwinter in the Midwest
	Leaf mold	2	Yes	2	Yes	Notably a problem in high tunnels and greenhouses; infected transplants will experience disease outdoors
	Powdery mildew	2	No	2	No	
	Root-knot nematode	2	No	>6	Yes	Wide host range
	Septoria leaf spot	3	No	2-3	No	
	Southern blight	3	No	>6	No	Favored by high temperatures
	Tobacco mosaic virus	1	No	2	Yes	Spread by contact
	Tomato spotted wilt virus	1	No	NE	Yes	Spread by thrips
	Verticillium	2	No	>6	Yes	
	White mold	2	No	5-6	No	Wide host range; rotate with grasses; flood for 23-45 days
All vegetables	Damping-off	1	No	NE	No	Avoid excess moisture, sanitize seedling trays

[1]1=tillage has limited effect, 2=tillage is of limited help, 3=tillage is an important control
[2]Numbers refer to the number of years that the field should be planted to a different crop. NE=not effective.
[3]Pepper only

Selected Information About Recommended Fungicides

This table includes selected information about the fungicides recommended in this guide. The products are listed alphabetically by the **Trade Name**. The table also lists the **Common Name** of active ingredient.

The **Signal Word** column indicates the product's possible toxicity. If the signal word is set in bold, the product is a restricted use product (RUP). See page 33.

The **FRAC Code** column indicates the product's mode of action. FRAC stands for Fungicide Resistance Action Committee. Refer to product labels for information about alternating fungicide modes of action.

The **Greenhouse Use** column has one of three listings:

yes=the product label explicitly allows greenhouse use

no=the product label explicitly prohibits greenhouse use

silent=the product label does not mention greenhouse use — states vary about whether such products are allowed in greenhouse production

The **OMRI** column, products marked with an X are listed by the Organic Material Review Institute (omri.org) and may be suitable for organic production. Check with your certifier. See page 39 for more information.

Trade Name	Common Name	Signal Word	FRAC Code	Greenhouse Use	OMRI
Actigard®	acibenzolar-s-methyl	Caution	21	silent	
Actinovate AG*	*Streptomyces lydicus* WYEC 108	Caution	48	yes	X
Aframe*	azoxystrobin	Caution	11	no	
Agri-Fos*	phosphorous acid	Caution	33	silent	
Agri-mycin 17*	streptomycin sulfate	Caution	25	yes	
Aliette WDG*	fosetyl-aluminum	Caution	33	silent	
Allegiance-FL*	metalaxyl	Caution	4	certain crops, see label	
Aproach*	picoxystrobin	Caution	11	silent	
Apron XL*	mefenoxam	Warning	4	certain crops, see label	
Aprovia Top*	difenoconazole + benzovindiflupyr	Warning	3 + 7	no	
Ariston*	chlorothalonil + cymoxanil	Caution	M5 + 27	no	
Badge SC*	copper hydroxide + copper oxychloride	Danger	M1	yes	
Basic Copper 53*	copper sulfate	Warning	M1	no	X
Blocker 4F*	pentachloronitrobenzene (PCNB)	Caution	14	silent	
Botran 75W*	dichloro-nitroaniline	Caution	14	certain crops, see label	
Bravo Ultrex*	chlorothalonil	Danger	M5	no	
Bravo Weather Stik*	chlorothalonil	Caution	M5	no	
C-O-C-S WDG*	copper oxychloride + copper sulfate	Warning	M1	yes	
Cabrio EG*	pyraclostrobin	Caution	11	no	
Cannonball WG*	fludioxinil	Caution	12	silent	
Catamaran*	potassium phosphite + chlorothalonil	Caution	33 + M5	silent	
Cercobin*	thiophanate-methyl	Caution	1	silent	
Champ DP*	copper hydroxide	Warning	M1	certain crops, see label	
Champ Formula 2F*	copper hydroxide	Warning	M1	silent	
Champ WG*	copper hydroxide	Danger	M1	Silent	X
ChampION++*	copper hydroxide	Caution	M1	certain crops, see label	X
Contans*	*Coniothyrium minitans*	Caution	-	yes	X
Copper Count N*	copper ammonium carbonate	Caution	M1	yes	
Cuprofix Ultra Disperss*	copper sulfate	Caution	M1	yes	

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Selected Information About Recommended Fungicides (continued)

Trade Name	Common Name	Signal Word	FRAC Code	Greenhouse Use	OMRI
Curzate 60DF®	cymoxanil	Warning	27	silent	
Custodia®	azoxystrobin + tebuconazole	Warning	11 + 3	no	
Dithane F45 Rainshield®	mancozeb	—	M3	silent	
Dithane M45®	mancozeb	Caution	M3	yes	
Echo 720®	chlorothalonil	Warning	M5	no	
Echo 90DF®	chlorothalonil	Danger	M5	no	
Echo ZN®	chlorothalonil	Warning	M5	no	
Elatus®	azoxystrobin + benzovindiflupyr	Caution	11 + 7	certain crops, see label	
Elixir®	chlorothalonil + mancozeb	Caution	M5 + M3	silent	
Elumin®	ethaboxam	Caution	22	no	
Endura®	boscalid	Warning	7	no	
Evito 480SC®	fluoxastrobin	Caution	11	silent	
Flint 50WG®	trifloxystrobin	Caution	11	no	
Fontelis®	penthiopyrad	Caution	7	certain crops, see label	
Forum®	dimethomorph	Caution	40	no	
Fosphite®	phosphorous acid	Caution	33	yes	
Gavel 75DF®	zoxamide + mancozeb	Caution	22 + M3	silent	
Gem 500®	trifloxystrobin	Caution	11	silent	
Headline AMP®	metconazole + pyraclostrobin	Warning	3 + 11	no	
Headline EC®	pyraclostrobin	Warning	11	no	
Headline SC®	pyraclostrobin	Warning	11	no	
Heritage®	azoxystrobin	Caution	11	silent	
Initiate 720®	chlorothalonil	Caution	M5	no	
Inspire Super®	difenoconazole + cyprodinil	Caution	3 + 9	certain crops, see label	
Iprodione 4L AG®	iprodione	Caution	2	silent	
Kenja 400SC®	isofetamid	Caution	7	silent	
Kentan DF®	copper hydroxide	Danger	M1	yes	
Kocide 2000®	copper hydroxide	Warning	M1	yes	
Kocide 3000®	copper hydroxide	Caution	M1	yes	
Koverall 75WP®	mancozeb	Caution	M3	yes	
Kumulus DF®	sulfur	Caution	M2	silent	X
Luna Experience®	fluopyram + tebuconazole	Caution	7 + 3	silent	
Luna Sensation®	fluopyram + trifloxystrobin	Caution	7 + 11	silent	
Luna Tranquility®	fluopyram + pyrimethanil	Caution	7 + 9	certain crops, see label	
ManKocide®	copper hydroxide + mancozeb	Danger	M1 + M3	silent	
Manzate Max®	mancozeb	Caution	M3	silent	
Maxim 4FS®	fludioxonil	Caution	12	silent	
Maxim MZ 0.5D®	mancozeb + fludioxonil	Caution	M3 + 12	silent	
Maxim XL®	fludioxonil + mefenoxam	Caution	12 + 4	NA	
Merivon®	fluxapyroxad + pyraclostrobin	Warning	7 + 11	no	
Mertect 340F®	thiabendazole	Caution	1	no	
Meteor®	iprodione	Caution	2	silent	
Micro Sulf®	sulfur	Caution	M2	silent	
Microthiol Disperss®	sulfur	Caution	M2	silent	X
Moncoat MZ®	mancozeb + flutolanil	Caution	M3 + 7	NA	

Selected Information About Recommended Fungicides (continued)

Trade Name	Common Name	Signal Word	FRAC Code	Greenhouse Use	OMRI
Moncut®	flutolanil	Caution	7	silent	
Monsoon®	tebuconazole	Caution	3	silent	
Muscle ADV®	chlorothalonil + tebuconazol	Caution	M5 + 3	no	
Nevado 4F®	iprodione	Caution	2	silent	
Nu-Cop 3L®	copper hydroxide	Danger	M1	silent	
Nu-Cop 50DF®	copper hydroxide	Danger	M1	certain crops, see label	X
Omega 500F®	fluazinam	Warning	29	silent	
Orius 3.6F®	tebuconazole	Caution	3	silent	
Orondis Opti A®	oxathiapiprolin	Caution	49	silent	
Orondis Opti B®	chlorothalonil	Caution	M5	no	
Orondis Opti®	oxathiapiprolin + chlorothalonil	Danger	49 + M5	no	
Orondis Ultra A®	oxathiapiprolin	Caution	49	certain crops, see label	
Orondis Ultra B®	mandipropamid	—	3	certain crops, see label	
Penncozeb 75DF®	mancozeb	Caution	M3	silent	
Phostrol®	phosphorous acid	Caution	33	silent	
Presidio®	fluopicolide	Caution	43	no	
Previcur Flex®	propamocarb	Caution	28	certain crops, see label	
Priaxor®	fluxapyroxad + pyraclostrobin	Caution	7 + 11	no	
Pristine®	boscalid + pyraclostrobin	Caution	7 + 11	no	
Procure 480SC®	triflumizole	Caution	3	silent	
Proline 480SC®	prothioconazole	Caution	3	no	
ProPhyt®	phosphorous acid	Caution	33	silent	
Propimax EC®	propiconazole	Warning	3	no	
Quadris Opti®	azoxystrobin + chlorothaonil	Warning	11 + M5	no	
Quadris Ridomil Gold®	metalaxyl + azoxystrobin	Caution	4 + 11	silent	
Quadris Top®	azoxystrobin + difenoconazole	Caution	11 + 3	silent	
Quadris®	azoxystrobin	Caution	11	no	
Quilt Xcel®	azoxystrobin + propiconazole	Caution	3 + 11	no	
Quilt®	azoxystrobin + propiconazole	Warning	3 + 11	no	
Quintec®	quinoxyfen	Caution	13	silent	
Rally 40WSP®	myclobutanil	Caution	3	no	
Ranman SC®	cyazofamid	Caution	21	certain crops, see label	
Reason 500SC®	fenamidone	Caution	11	no	
Regalia®	*Reynoutria sachalinensis*	Caution	P5	silent	X
Revus Top®	mandipropamid + difenoconazole	Caution	3 + 40	silent	
Revus®	mandipropamid	—	40	silent	
Rhyme®	flutriafol	Warning	3	silent	
Ridomil Gold GR®	mefenoxam	Caution	4	no	
Ridomil Gold MZ®	mefenoxam + mancozeb	Caution	4 + M3	silent	
Ridomil Gold SL®	mefenoxam	Caution	4	no	
Ridomil Gold/Bravo®	mefenoxam + chlorothalonil	Warning	4 + M5	no	
Ridomil Gold/Copper®	mefenoxam + copper hydroxide	Danger	4 + M1	no	
Rovral 4F®	iprodione	Caution	2	silent	

continued next page

Selected Information About Recommended Fungicides (continued)

Trade Name	Common Name	Signal Word	FRAC Code	Greenhouse Use	OMRI
Satori®	azoxystrobin	Caution	11	no	
Scala SC®	pyrimethanil	Caution	9	certain crops, see label	
Sectagon 42®	metam sodium	**Danger**	-	no	
Sectagon K54®	metam potassium	**Danger**	-	no	
Serenade Opti®	*Bacillus subtilis*	Caution	44	yes	X
Stratego®	propiconazole + trifloxystrobin	Warning	3 + 11	silent	
Sulfur DF®	sulfur	Caution	M2	silent	X
Switch 62.5WG®	cyprodinil + fludioxonil	Caution	9 + 12	silent	
Tanos®	famoxadone + cymoxanil	Caution	11 + 27	silent	
Tebuzol 3.6F®	tebuconazole	Caution	3	silent	
Telone C-35®	1,3-dichloropropene + chloropicrin	**Danger**	- + 8B (IRAC)	no	
Thiolux®	sulfur	Caution	M2	silent	X
Tilt®	propiconazole	Warning	3	no	
Toledo®	tebuconazole	Caution	3	silent	
Topguard EQ®	azoxystrobin + flutriafol	Caution	11 + 3	silent	
Topsin 4.5FL®	thiophanate-methyl	Caution	1	silent	
Topsin M WSB®	thiophanate-methyl	Caution	1	silent	
Torino®	cyflufenamid	Caution	U6	silent	
Ultra Flourish®	mefenoxam	Warning	4	no	
Unicorn DF®	sulfur + tebuconazole	Caution	M2 + 3	silent	
Uniform®	azoxystrobin + mefenoxam	Caution	11 + 4	silent	
Vangard WG®	cyprodinil	Caution	9	silent	
Velum Prime®	fluopyram	Caution	7	silent	
Viathon®	potassium phosphite + tebuconazole	Caution	33 + 3	silent	
Vibe®	tebuconazole	Caution	3	silent	
Vivando®	metrofenone	Caution	U8	silent	
Zampro®	ametoctradin + dimethomorph	Caution	45 + 40	no	
Zing!®	zoxamide + chlorothalonil	Caution	22 + M5	no	
Ziram 76DF®	ziram	Danger	M3	silent	

Preharvest Intervals (Days) and Re-Entry Intervals for Fungicides Registered for Use on Midwest Vegetables in 2020[a]

	Actigard®	Agri-Fos®, Fosphite®, ProPhyte®	Aproach®	Bravo®, Echo®, Equus 720®	Cabrio®	Dithane®, Manzate®, Penncozeb®	Endura®	fixed copper	Flint®	Fontelis®	Forum®	Inspire Super®	Kumulus®	Merivon®	Monsoon®, Onset®, Toledo®	Presidio®	Previcur Flex®	Pristine®	Procure®	Propimax®, Tilt®	Quadris®, Satori®	Quadris Top®	Quintec®	Rally®	Ranman®	Revus®	Revus Top®	Rovral®	Switch®	Tanos®	Topsin M®	Torino®	Zampro®
Asparagus		b		190		180			180				0		180						100			180									
Bean, Dry		0	14	14			21	0		b			0		14					7c	14							d	7		28		
Bean, Green		0	14	7			7	0		0			0		7					7c	0			0	0	1		d	7		14		
Beet		0			0			0	7	0			0	7	7	7				14c	0								7				
Broccoli	7	0		7	0	7b	0	0		0	0	7	0		7	2			1		0	1			0	1		0	7				0
Brussels Sprouts	7	0		7	0		0	0		0	0	7	0			2			1		0	1			0	1			7				0
Cabbage	7	0		7	0	7b	0	0		0	0	7	0		7	2			1		0	1			0	1			7				0
Cabbage, Chinese	7	0		7	0		b	0		0	0	7			7	2			1		0	1			0	1			7				0
Cantaloupe	0	0		0	0	5	0	0	0	1	0	7	0	0	7	2	2	0	0		1	1	3	0	0	0			1	3	1	0	0
Carrot		0		0	0		0	0	7	0			0	7		7		0		14	0	7			14			0	7				
Cauliflower	7	0		7	0		0	0		0	0	7	0			2					0				0	1			7				0
Celery		0		7	0		0	0	7	3	0		0	1		2		0		14	0					1			0				0
Collard	7	0			3		14	0		0	0	7	0		7	2			1		0	1			0	1			7				0
Cucumber	0	0		0	0	5	0	0	0	1	0	7	0	0	7	2	2	0	0		1	1		0	0	0			1	3	1	0	0
Eggplant		0		3	0		0	0	3	0	0	0	0			2					0	0		0	0	1			0				4
Endive		0			0		14	0		3	0			1		2			0		0				0	1			0	1			0
Kale	7	0			3		14	0		0	0	7	0		7	2			1		0	1			0	1			7				0
Lettuce, Head	7	0			0	b	14	0		3	0		0	1		2	2		0		0		1	3	0	1		14	0	1			0
Lettuce, Leaf	7	0			0	b	14	0		3	0		0	1		2	2		0		0		1	3	0	1		14	0	1			0
Mint		0		80									0							b	b			30									
Mustard	7	0			3		14	0		0	0	7			7	2			1		0	1			0	1			7				0
Onion, Bulb	7	0		7	7	7	7	0		3	0	7	0	7	7			7		14	0	7				7		7	7	3	b		0
Onion, Green		0		14	7		7	0		3	0	14	0	7	7			7		0	0	7				7			7	3			0
Parsley		0			0			0	7	3	0			1		2			0	14c	0				0	1			0	1			0
Parsnip		0		10	0		14		7	0				7		7					0								7				
Peas		0	14				b	0		0			0								0												
Pepper	14e	0		3	0	7	0	0	3	0	0	0	0			2	5				0	0	3	0	0	1			0	3			4
Potato		0		7		b	10	0			4		0				14				14	14			7		14	14		14	21		4
Pumpkin	0	0		0	0	5b	0	0	0	1	0	7	0	0	7	2	2	0	0		1	1	3	0	0	0			1	3	1	0	0
Radish		0			0				7	0				7		7					0								7				
Spinach	7	0			0			0		3	0			1		2					0				0	1			0	1			0
Squash, Summer	0	0		0	0	5	0	0	0	1	0	7	0	0	7	2	2	0	0		1	1		0	0	0			1	3	1	0	0
Squash, Winter	0	0		0	0	5b	0	0	0	1	0	7	0	0	7	2	2	0	0		1	1	3	0	0	0			1	3	1	0	0
Sweet Corn		0f	7	14		7		0							7					14													
Tomato	14	0		0	0	5	0	0	3	0	4	0	0			2	5				0	0		0	0		1		0	3			4
Turnip		0			0			0	7	0	b	b	0	7	7	7			b		0	b			b				7				
Watermelon	0	0		0	0	5	0	0	0	1	0	7	0	0	7	2	2	0	0		1	1	3	0	0	0			1	3	1	0	0
Re-Entry Interval (hr)	12	4	12	12	12	24	12	48	12	12	12	12	24	12	12	12	12	12	12	12	4	12	12	24	12	4	12	24	12	12	b	4	12

[a]Check label directions before applying any of these pesticides.
[b]See label.
[c]Do not use Propimax®.
[d]Do not apply past peak bloom.
[e]Chile only.
[f]Do not use ProPhyte®.

Disease Forecasting Systems

There are two types of forecasting systems. The first type tracks a disease epidemic and forecasts where the disease might show up next. The second type is based on weather.

Weather-based disease forecasting systems are based on the requirements for a particular disease or set of diseases. Each foliar disease requires the right combination of temperature and leaf wetness for infection to occur and the disease to spread. Disease forecasting systems predict the likely severity of a disease based on recent weather data. Successful weather-based disease-forecasting systems take the guessing out of fungicide application schedules.

In general, weather-based disease-forecasting systems will advise growers to apply fungicides more frequently during wet weather and allow growers to cut back on fungicide applications during drier weather. Two of these systems are briefly described below: MELCAST and TOM-CAST.

MELCAST is a weather-based disease-forecasting system for Alternaria leaf blight, anthracnose and gummy stem blight of cantaloupe and watermelon. The MELCAST system was developed by Rick Latin at Purdue University. Growers can learn more about MELCAST from these Purdue Extension publications: BP-67-W, *Foliar Disease Control Using MELCAST and BP-64-W, MELCAST: Melon Disease Forecaster* (both available from the Purdue Extension Education Store, www.edustore.purdue.edu).

MELCAST is available for selected sites in some of the states covered by this guide. In season, growers can obtain MELCAST values at MELCAST.info or 800-939-1604. Interested growers can contact Dan Egel at 812-886-0198 or egel@purdue.edu.

TOM-CAST, hosted by Cornell University, was originally developed to help manage fungal foliar diseases of tomatoes. More recently, Michigan State University researchers have validated this system for use at with asparagus and carrot.

Slugs and snails prefer moist soils and plenty of organic matter.

To manage purple spot of asparagus and Alternaria and Cercospora foliar blights of carrot, use the TOM-CAST system with 15 disease severity values (DSVs) to schedule sprays instead of a calendar-based program. For best results use a tolerant or resistant cultivar in combination with the TOM-CAST System. TOM-CAST is available for selected sites for some states at newa.cornell.edu/index.php?page=tomato-diseases-tomcast.

For TOM-CAST reports in West-Central Michigan asparagus and carrot fields, contact Ben Werling at 231-873-2129 or werlingb@msu.edu.

Forecasting systems that are based on tracking a disease epidemic usually map a particular disease online. For example, The Cucurbit Downy Mildew Forecast site tracker is available at cdm.ipmpipe.org. And USABlight tracks late blight of tomato and potato at usablight.org.

For more information about either system, contact the vegetable disease specialist in your state.

Slug and Snail Control

Occasionally, slugs and snails seriously damage seedlings; tender, low-growing leafy vegetables; or ripening fruit that are on the ground. Slug and snail feeding damage (hollowed-out areas) can be found anywhere on fruit, but is usually concentrated near the stem. Slugs leave behind telltale slime trails (silvery trails) on the surfaces of fruit or leaves. Slugs and snails are active at night or cloudy days.

Slugs and snails favor continuously moist soil and organic mulch. They lay eggs in groups in moist soil, and overwinter in organic mulch. Slugs can complete their entire life cycle in a field.

If slugs are a problem, their hiding places (i.e., boards, stones, weedy areas), should be eliminated. Heavy mulching creates favorable slug habitats, so should be thinned so the soil can become warm and dry. Raised beds that can dry out more readily than flat beds reduce slug problems. Using black plastic mulch discourages slug build-up because it causes the soil to heat up and dry out.

As a last resort, metaldyhyde bait (e.g., Clean Crop, 3.5G® at 30-40 lbs./A or Clean Crop 7.5G® at 15-20 lbs./A) can be used and is usually very effective. Follow label instructions carefully for application methods for each particular vegetable crop. Apply bait in evening after a rain or irrigation. An organic alternative to metaldehyde is iron phosphate. Baits containing iron phosphate are sold under the trade name Sluggo® (and others) and are only slightly less effective than metaldehyde baits.

Common and Scientific Vegetable Pest Names

The names in this table represent the common and scientific (Latin) names of all the pests represented in this guide. The names are provided to help users interpret information presented in pesticide labels and other sources.

Insects		
Common Name	**Scientific Name**	**Order**
armyworm	*Mythimna (Pseudaletia) unipuncta*	Lepidoptera
asparagus aphid	*Brachycorynella asparagi*	Hemiptera
asparagus beetle	*Crioceris asparagi*	Coleoptera
asparagus miner	*Ophiomyia simplex*	Diptera
aster leafhopper	*Macrosteles quadrilineatus*	Hemiptera
bandedwinged whitefly	*Trialeurodes abutiloneus*	Hemiptera
bean aphid	*Aphis fabae*	Hemiptera
bean leaf beetle	*Cerotoma trifurcata*	Coleoptera
bean seed maggot	*Delia florilega*	Diptera
beet armyworm	*Spodoptera exigua*	Lepidoptera
black cutworm	*Agrotis ipsilon*	Lepidoptera
brown marmorated stink bug	*Halymorpha halys*	Hemiptera
brown stink bug	*Euschistus servus*	Hemiptera
cabbage aphid	*Brevicoryne brassicae*	Hemiptera
cabbage looper	*Trichoplusia ni*	Lepidoptera
cabbage maggot	*Delia radicum*	Diptera
carrot weevil	*Listronotus oregonensis*	Coleoptera
celery leaftier	*Udea rubigalis*	Lepidoptera
Colorado potato beetle	*Leptinotarsa decemlineata*	Coleoptera
corn earworm bollworm tomato fruitworm	*Helicoverpa zea*	Lepidoptera
corn flea beetle	*Chaetocnema pulicaria*	Coleoptera
corn leaf aphid	*Rhopalosiphum maidis*	Hemiptera
cross-striped cabbageworm	*Evergestis rimosalis*	Lepidoptera
crucifer flea beetle	*Phyllotreta cruciferae*	Coleoptera
diamondback moth	*Plutella xylostella*	Lepidoptera
eastern field wireworm	*Limonius agonus*	Coleoptera
eggplant flea beetle	*Epitrix fuscula*	Coleoptera
European corn borer	*Ostrinia nubilalis*	Lepidoptera
fall armyworm	*Spodoptera frugiperda*	Lepidoptera
flower thrips	*Frankliniella tritici*	Thysanoptera
garden webworm	*Achyra rantalis*	Lepidoptera
golden tortoise beetle	*Charidotella (Metriona) sexpunctata bicolor*	Coleoptera
green cloverworm	*Hypena (Plathypena) scabra*	Lepidoptera
green peach aphid	*Myzus persicae*	Hemiptera
green stink bug	*Acrosternum hilare*	Hemiptera
harlequin bug	*Murgantia histrionica*	Hemiptera
horseradish flea beetle	*Phyllotreta armoraciae*	Coleoptera
imported cabbageworm	*Pieris rapae*	Lepidoptera
melon aphid/cotton aphid	*Aphis gossypii*	Hemiptera
Mexican bean beetle	*Epilachna varivestis*	Coleoptera
northern corn rootworm	*Diabrotica barberi*	Coleoptera
onespotted stink bug	*Euschistus variolarius*	Hemiptera
onion maggot	*Delia antiqua*	Diptera
onion thrips	*Thrips tabaci*	Thysanoptera
palestriped flea beetle	*Systena blanda*	Coleoptera
pea aphid	*Acyrthosiphon pisum*	Hemiptera
potato aphid	*Macrosiphum euphorbiae*	Hemiptera
potato flea beetle	*Epitrix cucumeris*	Coleoptera
potato leafhopper	*Empoasca fabae*	Hemiptera

Insects		
Common Name	**Scientific Name**	**Order**
purplebacked cabbageworm	*Evergestis pallidata*	Lepidoptera
rhubarb curculio	*Lixus concavus*	Coleoptera
saltmarsh caterpillar	*Estigmene acrea*	Lepidoptera
seedcorn maggot	*Delia platura*	Diptera
serpentine leafminer	*Liriomyza brassicae*	Diptera
soybean thrips	*Neohydatothrips variabilis*	Thysanoptera
spinach flea beetle	*Disonycha xanthomelas*	Coleoptera
spinach leafminer	*Pegomya hyoscyami*	Diptera
spotted asparagus beetle	*Crioceris duodecimpunctata*	Coleoptera
spotted cucumber beetle southern corn rootworm	*Diabrotica undecimpunctata howardi*	Coleoptera
squash bug	*Anasa tristis*	Hemiptera
squash vine borer	*Melittia cucurbitae*	Lepidoptera
stalk borer	*Papaipema nebris*	Lepidoptera
striped cucumber beetle	*Acalymma vittatum*	Coleoptera
striped flea beetle	*Phyllotreta striolata*	Coleoptera
sugarbeet wireworm	*Limonius californicus*	Coleoptera
sweetpotato flea beetle	*Chaetocnema confinis*	Coleoptera
sweetpotato weevil	*Cylas formicarius elegantulus*	Coleoptera
tarnished plant bug	*Lygus lineolaris*	Hemiptera
tobacco hornworm	*Manduca sexta*	Lepidoptera
tomato hornworm	*Manduca quinquemaculata*	Lepidoptera
turnip aphid	*Lipaphis pseudobrassicae*	Hemiptera
twospotted spider mite	*Tetranychus urticae*	Acari
variegated cutworm	*Peridroma saucia*	Lepidoptera
vegetable leafminer	*Liriomyza sativae*	Diptera
western bean cutworm	*Striacosta (Loxagrotis) albicosta*	Lepidoptera
western corn rootworm	*Diabrotica virgifera virgifera*	Coleoptera
yellow woollybear	*Spilosoma virginica*	Lepidoptera
zebra caterpillar	*Melanchra picta*	Lepidoptera

Weeds		
Common Name	**Scientific Name**	**Family**
barnyardgrass	*Echinochloa crus-galli*	Poaceae
black nightshade	*Solanum nigrum*	Solanaceae
common lambsquarters	*Chenopodium album*	Chenopodiaceae
common purslane	*Portulaca oleracea*	Portulacaceae
common ragweed	*Ambrosia artemisiifolia*	Asteraceae
common waterhemp	*Amaranthus rudis*	Amaranthaceae
crabgrass	*Digiteria sanguinalis*	Poaceae
eastern black nightshade	*Solanum ptycanthum*	Solanaceae
entireleaf morningglory	*Ipomoea hederacea*	Convolvulaceae
fall panicum	*Panicum dichotomiflorum*	Poaceae
giant foxtail	*Setaria faberi*	Poaceae
giant ragweed	*Ambrosia trifida* L.	Asteraceae
goosegrass	*Eleusine indica*	Poaceae
green foxtail	*Setaria viridis*	Poaceae
hairy galinsoga	*Galinsoga quadriradiata*	Asteraceae
ivyleaf morningglory	*Ipomoea hederacea*	Convolvulaceae
jimsonweed	*Datura stramonium*	Solanaceae

Weeds		
Common Name	**Scientific Name**	**Family**
ladysthumb	*Polygonum persicaria*	Polygonaceae
Pennsylvania smartweed	*Polygonum pensylvanicum*	Polygonaceae
redroot pigweed	*Amaranthus retroflexus*	Amaranthaceae
smooth pigweed	*Amaranthus hybridus*	Amaranthaceae
tall morningglory	*Ipomoea purpurea*	Convolvulaceae
velvetleaf	*Abutilon theophrasti*	Malvaceae
yellow foxtail	*Setaria pumila*	Poaceae
yellow nutsedge	*Cyperus esculentus*	Cyperaceae

Diseases		
Disease	**Pathogen**	**Host Crop**
Alternaria leaf blight of cucurbits	*Alternaria cucumerina*	cucurbits
Alternaria leaf spot of beet	*Alternaria alternata, A. brassicae*	beet
Alternaria leaf spot of carrots	*Alternaria dauci*	carrot
Alternaria leaf spot of cole crops	*Alternaria brassicae*	cole crops
Alternaria leaf spot of parsnip, turnip	*Alternaria* spp.	parsnip, turnip
Alternaria leaf spot of radish	*Alternaria raphanin*	radish
angular leaf spot	*Pseudomonas syringae* pv. *lachrymans*	cucurbits
anthracnose of cucurbits	*Colletotrichum orbiculare*	cucurbits
Anthracnose of celery	*Colletotrichum acutatum*	celery
Anthracnose of corn	*Colletotrichum graminicola*	sweet corn
Anthracnose of legumes	*Colletotrichum lindemuthiana*	Legumes
Anthracnose of pepper/ tomato	*Colletotrichum* spp.	pepper, tomato
Ascochyta leaf spot	*Ascochyta rhei*	rhubarb
aster yellows of carrot, parsnip	*Phytoplasma* sp.	carrot, parsnip
aster yellows of potato	*Phytoplasma* spp.	potato
bacterial canker	*Clavibacter michiganensis subsp. michiganensis*	tomato
bacterial flower stalk and leaf necrosis	*Pantoea agglomerans*	onion
bacterial fruit blotch	*Acidovorax citrulli*	cucurbits
bacterial leaf blight of carrot	*Xanthomonas campestris* pv. *carotae*	carrot
bacterial leaf blight of celery	*Pseudomonas syringae* pv. *apii*	celery
bacterial leaf blight of onion	*Xanthomonas axonopodis* pv. *allii*	onion
bacterial leaf and fruit spot	*Xanthomonas cucurbitae*	cucurbits
bacterial speck	*Pseudomonas syringae* pv. *tomato*	tomato
bacterial spot	*Xanthomonas campestris* pv. *vesicatoria*	pepper, tomato
bacterial wilt	*Erwinia tracheiphila*	cucurbits
basal rot of garlic, onion	*Fusarium culmorum*	garlic, onion
bean yellow mosaic	*Bean yellow mosaic virus*	legumes
black dot	*Colletotrichum coccodes*	potato

Diseases		
Disease	**Pathogen**	**Host Crop**
black leg of cole crops	*Phoma lingam*	cole crops
black rot of sweet potato	*Ceratocystis fimbriata*	sweet potato
black rot of cole crops	*Xanthomonas campestris* pv. *campestris*	cole crops
blackleg	*Erwinia carotovora* subsp. *atroseptica*	potato
Botrytis leaf blight	*Botrytis squamosa*	onion
Botrytis neck rot	*Botrytis allii*	onion
Botrytis gray mold	*Botrytis cinerea*	lettuce, spinach, tomato, legumes
bottom rot/damping-off	*Rhizoctonia solani*	lettuce
buckeye rot	*Phytophthora* spp.	tomato
canker/black scurf	*Rhizoctonia solani*	potato
cavity spot	*Pythium violae, Pythium* spp.	carrot
Cercospora leaf spot of beet	*Cercospora beticola*	beet
Cercospora leaf spot of carrot	*Cercospora carotae*	carrot
Cercospora leaf spot of parsnip, turnip	*Cercospora* spp.	parsnip, turnip
chlorotic dwarf	*Maize chlorotic dwarf virus*	sweet corn
club root	*Plasmodiophora brassicae*	cole crops
common bacterial blight	*Xanthomonas campestris* pv. *phaseoli*	legumes
common rust	*Puccinia sorghi*	sweet corn
crater rot	*Rhizoctonia solani*	celery
cucumber mosaic	*Cucumber mosaic virus*	cucurbits, pepper,
cyst nematode disease	*Heterodera glycines*	legumes
damping-off	*Pythium* spp.	cilantro, dill, legumes, lettuce, onion, parsley, parsnip, spinach, and other vegetables
damping-off (greenhouse)	*Pythium* spp.	celery
downy mildew of basil	*Peronospora belbahrii*	basil
downy mildew of cole crops	*Hyaloperonospora parasitica*	cole crops
downy mildew of cucurbits	*Pseudoperonospora cubensis*	cucurbits
downy mildew of dill/ parsnip	*Peronospora umbellifarum*	dill, parsnip
downy mildew of garlic/onion	*Peronospora destructor*	garlic, onion
downy mildew of lettuce	*Bremia lactucae*	lettuce
downy mildew of spinach	*Peronospora farinosa*	spinach
downy mildew of turnip	*Bremia parasitica*	turnip
drop (Sclerotinia rot)	*Sclerotinia sclerotiorum*	lettuce
dry rot	*Fusarium solani*	potato
dwarf mosaic	*Maize dwarf mosaic virus*	sweet corn

Diseases		
Disease	**Pathogen**	**Host Crop**
early blight of celery	*Cercospora apii*	celery
early blight of tomato	*Alternaria solani*	potato, tomato
foot rot of tomato	*Fusarium solani*	tomato
foot rot of sweet potato	*Plenodomus destruens*	sweet potato
fruit rot of cucurbits	*Fusarium solani f. sp. cucurbitae*	cucurbits
Fusarium crown and root rot	*Fusarium oxysporum f.* sp. *asparagi, F. proliferatum*	asparagus
Fusarium wilt of basil	*Fusarium oxysporum* f. sp. *basilicum*	basil
Fusarium wilt of watermelon	*Fusarium oxysporum* f. sp. *niveum*	watermelon
Fusarium wilt of sweet potato	*Fusarium oxysporum* f. sp. *batatas*	sweet potato
Fusarium wilt of tomato	*Fusarium oxysporum* f. sp. *lycopersici*	tomato
Fusarium wilt of legumes	*Fusarium oxysporum* f. sp. *phaseoli*	legumes
Fusarium wilt of okra	*Fusarium oxysporum* f. sp. *vasinfectum*	okra
gray leaf spot	*Cercospora zeae-maydis*	sweet corn
gummy stem blight/ black rot	*Didymella bryoniae*	cucurbits
late blight	*Phytophthora infestans*	potato, tomato
leaf mold	*Fulvia fulva*	tomato
lettuce mosaic	*Lettuce mosaic virus*	lettuce
northern corn leaf spot	*Bipolaris zeicola*	sweet corn
northern leaf blight	*Exserohilum turcicum*	sweet corn
Phytophthora blight	*Phytophthora capsici*	cucurbits, solanaceous
Phytophthora crown and spear rot	*Phytophthora asparagi*	asparagus
pink root	*Setophoma terrestris*	onion
Plectosporium blight	*Plectosporium tabacinum*	cucurbits
potato virus X	*Potato virus x*	potato
potato virus Y	*Potato virus y*	potato
powdery mildew of lettuce	*Erysiphe cichoracearum*	lettuce
powdery mildew of cole crops	*Erysiphe cruciferarum*	cole crops
powdery mildew of pepper/tomato	*Leveillula taurica*	pepper, tomato
powdery mildew of cucurbits	*Podosphaeria xanthii*	cucurbits
purple blotch	*Alternaria porri*	onion, garlic, leek
purple spot	*Stemphylium vesicarium*	asparagus
Rhizoctonia diseases	*Rhizoctonia solani*	cole crops
ring rot	*Clavibacter michiganensis subsp. sepedonicus*	potato
ringspot	*Papaya ringspot virus*	cucurbits
root and crown rot	*Phytophthora* spp.	rhubarb
root-knot	*Meloidogyne* spp.	beet, carrot, cucurbits, potato,
root lesion	*Pratylenchus* spp.	potato
rust of asparagus	*Puccinia asparagi*	asparagus
rust of legumes	*Uromyces appendiculatus*	legumes

Diseases		
Disease	**Pathogen**	**Host Crop**
scab of cucurbits	*Cladosporium cucumerinum*	cucurbits
scab of potato	*Streptomyces scabies*	potato
scurf	*Monilochaetes infuscans*	sweet potato
Septoria blight of parsley	*Septoria petroselini*	parsley
Septoria leaf blight of tomato	*Septoria lycopersici*	tomato
Septoria leaf spot of radish	*Septoria lycopersici*	radish
Septoria leaf spot of mint	*Septoria menthae*	mint
silver scurf	*Helminthosporium solani*	potato
slippery skin	*Pseudomonas gladioli* pv. *alliicola*	onion
smut of onion/leek	*Urocystis colchici*	onion, leek
smut of corn	*Ustilago maydis*	sweet corn
sour skin	*Pseudomonas cepacia*	garlic, onion
southern blight	*Sclerotium rolfsii*	eggplant, pepper, tomato
southern corn leaf blight	*Bipolaris maydis*	sweet corn
southern rust	*Puccinia polysora*	sweet corn
spearmint rust	*Puccinia menthae*	mint
squash mosaic	*Squash mosaic virus*	cucurbits
Stemphylium leaf blight and stalk rot	*Stemphylium vesicarium*	garlic, leek, onion
Stewart's wilt	*Erwinia stewartii*	sweet corn
tobacco mosaic	*Tobacco mosaic virus*	potato, tomato
tomato spotted wilt	*Tomato spotted wilt virus*	tomato
Verticillium wilt	*Verticillium dahliae, Verticillium albo-atrum*	eggplant, mint, potato, tomato
watermelon mosaic	*Watermelon mosaic virus*	cucurbits
wheat streak mosaic	*Wheat streak mosaic virus*	sweet corn
white mold (timber rot)	*Sclerotinia sclerotiorum*	carrot, cole crops, eggplant, legumes, mint, pepper, potato, tomato
white rot	*Sclerotium cepivorum*	garlic, leek, onion
white rust	*Albugo candida*	cole crops, radish
yellows	*Fusarium oxysporum* spp.	cole crops
zucchini yellow mosaic	*Zucchini yellow mosaic virus*	cucurbits