

Table 1. Listed below are common and trade names of select fungicides currently registered in the United States representing the major fungicide groups and chemistry within these groups (chemical group), plus the mobility, activity, and risk of resistance developing to these fungicides.

Group Code ¹	Group Name (Abbreviation) ¹	Chemical Group	Common Name	Example Trade Name	Mobility	Mode of Action of Fungicide	Risk of Resistance ²
1	Methyl benzimidazole carbamate (MBC)	benzimidazole	thiophanate-methyl	Topsin M, Cleary's 3336	xylem mobile	Inhibits tubulin formation in mitosis, broad-spectrum	high
2	dicarboximide	dicarboximide	iprodione vinclozolin	Chipco 26GT, Rovral, Ronilan	contact	NADH cytochrome c reductase in lipid per-oxidation (Proposed), broad-spectrum	medium to high
3	demethylation inhibitor (DMI)	imidazole	triflumizole	Procure, Terraguard	xylem mobile	Sterol biosynthesis inhibition, broad-spectrum	medium
3	DMI	piperazine	triforine	Funginex, Saprol	xylem mobile	Sterol biosynthesis inhibition, narrow-spectrum	medium
3	DMI	triazole	myclobutanil	Eagle, Nova, Rally	xylem mobile	Sterol biosynthesis inhibition, broad-spectrum	medium
3	DMI	triazole	tebuconazole	Folicur	xylem mobile	Sterol biosynthesis inhibition, broad-spectrum	medium
4	phenylamide (PA)	phenylamide	mefenoxam,	Apron XL, Ridomil Gold, Subdue Maxx	xylem mobile	Inhibits RNA synthesis, active on oomycetes	high
7	carboxamide	oxathiin	carboxin	Vitavax	locally systemic	Inhibits respiration (MET2, succinate dehydrogenase), active on basidiomycetes	medium
9	anilinopyrimidine (AP)	anilinopyrimidine	cyprodinil	Vanguard	locally systemic	Methionine biosynthesis and hydrolytic enzymes, active on <i>Botrytis</i> , <i>Monilinia</i> , <i>Venturia</i>	medium
11	quinone outside inhibitor (QoI)	strobilurin	azoxystrobin	Abound, Quadris, Heritage	xylem mobile	Inhibits respiration (MET-III, cytochrome bc ₁), broad-spectrum	high
11	QoI	strobilurin	trifloxystrobin	Flint, Gem, Compass	locally systemic	Inhibits respiration, broad-spectrum	high
11	QoI	strobilurin	pyraclostrobin	Cabrio, Headline	locally systemic	Inhibits respiration, broad-spectrum	high
12	phenylpyrrole (PP)	phenylpyrrole	fludioxonil	Maxim, Medallion, Scholar	contact	Disrupts membrane integrity, broad-spectrum	low to medium
14	aromatic hydrocarbon (AH)	chlorophenyls	quintozene	PCNB, Blocker	contact	Thought to act on lipids, active on basidiomycetes and some ascomycetes	low to medium
14	AH	chloronitroben-zene	dicloran	Botran	contact	Acts on <i>Botrytis</i> , <i>Monilinia</i> , <i>Rhizopus</i> and <i>Sclerotinia</i>	low to medium
14	AH	triazazole	etridiazole	Truban, Koban	contact	Curative and preventative control of soil borne diseases, especially oomycetes.	low to medium

15	cinnamic acid	cinnamic acid	dimethomorph	Acrobat	locally systemic	Thought to act on cell wall synthesis in certain oomycetes	low to medium
17	hydroxyanilide	hydroxyanilide	fenhexamid	Elevate, Decree	locally systemic	Sterol biosynthesis inhibitor, <i>Botrytis</i> , <i>Monilina</i> , <i>Sclerotinia</i>	low to medium
18	Antibiotic	streptomycetes	streptomycin	Agri-Mycin, Agri-Step	xylem mobile	Single-site, bactericide	high
19	polyoxin	polyoxin	polyoxin D	Endorse	xylem mobile	Single-site, inhibits chitin synthetase, acts on some fungi.	medium
21 (P)	host plant defense inducers (SAR)	benzothiadiazole	acibenzolar-S-methyl	Actigard	amphi-mobile	Activates plant's systemic acquired resistance (SAR), broad-spectrum	low
21 (P)	SAR	harpin <i>Ea</i> protein	harpin	Messenger	signal xylem mobile	Elicits a hypersensitive response in plants, broad-spectrum	low
M (33)	multi-site activity	phosphonate	fosetyl-aluminum	Aliette	amphi-mobile	Inhibits oxidative phosphorylation in oomycetes	low
M (33)	multi-site activity	phosphonate	phosphorous acid	Phostrol, ProPhyt	amphi-mobile	Inhibits oxidative phosphorylation in oomycetes	low
M	multi-site activity	inorganics	copper	Kocide, Champ	contact	Disrupts function of enzymes and energy transport systems, integrity of membranes	low
M	multi-site activity	inorganics	sulfur	Microthiol Disperss, MicroSulf	contact	Inhibits electron movement, thus interferes with cellular respiration	low
M	multi-site activity	dithiocarbamate	mancozeb, maneb	Mancozeb, Maneb	contact	Reacts with protein SH groups, broad-spectrum	low
M	multi-site activity	dithiocarbamate	dimethyldithiocarbamate	Thiram	contact	Reacts with protein SH groups, broad-spectrum seed treatment	low
M	multi-site activity	chloroalkythios	captan	Captan	contact	Combines with thiols (SH groups) broad-spectrum	low
M	multi-site activity	chloronitrile	chlorothalonil	Bravo, Daconil2787	contact	Acts on fungal respiration via thiol, broad-spectrum	low
M (29)	multi-site activity	phenylpyridin-amine	fluazinam	Omega	locally systemic	Uncouples oxidative phosphorylation, broad-spectrum	low
U (27)	unknown.	cyano-acetamide oxime	cymoxanil	Curzate M-8	locally systemic	Short residual, acts on oomycetes	low to medium
U (28)	unknown	carbamate	propamocarb	Banol, Previcur F	xylem mobile	Active on oomycetes	low to medium
	biofungicide	fungal	<i>Gliocladium catenulatum</i> strain J1446	Primastop	N/A	Competitive exclusion. Competitive colonizer of soil media	unknown
	biofungicide	fungal	<i>Aspergillus flavus</i> AF-36	AF-36	N/A	Competitive exclusion. Competitive colonizer of cotton flowers. Displaces other <i>A. flavus</i> in the soil surface.	unknown
	biofungicide	fungal	<i>Coniothyrium minitans</i> strain CON/M/91-08	Contans	N/A	Pathogenic. Colonizes and kills sclerotia of <i>Sclerotinia</i> spp.	unknown
	biofungicide	bacterial	<i>Bacillus subtilis</i>	Serenade	contact	Induced resistance. Active on powdery	unknown

			strain QST 713		and induced resistance	mildew, downy mildew, <i>Phytophthora</i> , <i>Alternaria</i> and <i>Botrytis</i>	
	biofungicide	aldehyde	cinnamaldehyde	Vertigo	contact	Biofungicide, algacide	unknown
	biofungicide	oil	mineral oil	JMS Stylet-oil, SunSpray Ultra-Fine	contact	Destroys cell walls, interferes with fungus attaching to plant	unknown
	biofungicide	oil	plant essential oil	Sporan	contact	Destroys cell walls, interferes with fungus attaching to plant	unknown
	biofungicide	mineral products	potassium bicarbonate	Armicarb 100, Kaligreen	contact	Upsets potassium ion balance in powdery mildew fungal cells, cell wall collapses	unknown
	biofungicide	mineral products	monopotassium phosphate	Nutrol	contact and SAR	SAR, plasmolysis of conidia, destruction of conidiophores, antisporent	unknown
	Biofungicide	clay	kaolin	Surround	contact	Forms physical barrier to organisms, suppresses powdery mildew	unknown

¹ Group codes, names, and abbreviations used by FRAC and by the EPA Office of Pesticide Programs as part of the pesticide classification system developed for pesticide resistance management labeling (www.epa.gov/oppmsd1/PR_Notices/pr2001-5.pdf). Fungicide groups are excluded that do not have a product registered in the USA. FRAC code is listed in parentheses under the EPA Group code when the codes differ. Neither system includes biofungicides.

² Risk of resistance is considered high when mode of resistance is known (or suspected) to be qualitative or some pathogens have already developed resistance within a few years under commercial use, medium when mode of resistance is quantitative, and low when the fungicide has multi-site activity. Entries in this column were assigned by FRAC (www.frac.info/publications.html).

Labels for fungicides registered in the USA are accessible at www.epa.gov/pesticides/pestlabels/ and www.cdms.net/manuf/manuf.asp.

