

Fungicides for PA Conifer Nursery Diseases

Pennsylvania Department of Agriculture, Bureau of Plant Industry

ALWAYS READ THE PRODUCT LABEL. THE LABEL IS THE LAW. CONSULT THE LABEL TO TARGET THE MOST APPROPRIATE STAGE OF THE DISEASE. For all diseases, any recommendations for control are listed under the disease name. Any available PA Dept. of Agriculture Regulatory Horticulture disease circulars are listed near the disease name, in parentheses. (**Active Ingredient = Bio-rational Product**)

	Active Ingredients
<p>Botrytis Blight</p> <p>A gray, cottony growth starts on shaded, senescent needles and in the leaf litter at the base of seedlings. It spreads from needles to shoots and then into stems. As the disease advances, infected shoots become waterlogged and brown lesions develop. Once inside the main stem of seedlings, it can canker and girdle, eventually killing that tree. Botrytis blight is seldom a severe problem on mature trees.</p> <p>Douglas-fir, Fir, & Spruce: Keep seedlings as healthy as possible. Weak and frost-damaged trees are vulnerable to infection. Avoid overcrowding so good air circulation can be maintained. Avoid overhead watering or water early in the day so the foliage has adequate drying time. Remove dead plant material as soon as possible. Apply a fungicide when new shoots emerge. Make additional applications as necessary, especially in years with excessive rainfall.</p>	<ul style="list-style-type: none"> ▪ Extract of <i>Reynoutria sachalinensis</i> ▪ Iprodione ▪ Mancozeb ▪ Potassium Bicarbonate ▪ Thiophanate-methyl ▪ Thiophanate-methyl + Iprodione ▪ Triflumizole
<p>Cedar Apple & Related Rusts (Gymnosporangium) (#44)</p> <p>Juniper: Galls form on twigs and branches, decreasing the plant's value. Damage increases when infected, alternate hosts (i.e. crabapple & hawthorn) are in close proximity to junipers. Twig dieback occurs if disease is severe. Disease is more noticeable in the spring when galls begin producing bright yellow-orange spore horns, indicating sporulation. Carefully inspect junipers during dormancy, pruning and destroying any galls or cankers. Preventative fungicides may be applied during the summer.</p>	<ul style="list-style-type: none"> ▪ Boscalid + Pyraclostrobin ▪ Copper Hydroxide + Mancozeb ▪ Mancozeb ▪ Mancozeb + Thiophanate-methyl ▪ Myclobutanil ▪ Pyraclostrobin ▪ Thiophanate-methyl ▪ Triflumizole
<p>Needlecasts (<i>Cyclaneusma</i>, <i>Lophodermium</i>, <i>Phaeocryptopus</i>, <i>Ploioderma</i>, <i>Rhabdocline</i>, <i>Rhizosphaera</i>, <i>Stigmina</i>) (#3, 4, 8, 24, 58)</p> <p>Because many needlecasts are similar, obtain a laboratory diagnosis before implementing control measures. Contact your regional Plant Inspector or local extension agent for more information. Needlecast fungi need plentiful moisture for infection and development. With this in mind, be sure to adequately space trees at planting and maintain good air circulation, which is done through good weed control (lowers humidity and reduces needle wetness). Only irrigate when needles will be wet for the shortest amount of time. Only plant disease-free or disease-resistant plant stock. Do not shear trees when wet. Shear healthy trees first, so spores from infected trees cannot be carried to healthy trees, sterilizing pruning tools when done. Remove remaining branches from stumps of recently harvested trees. Remove and properly destroy severely infected trees early in a rotation so they do not serve as a disease source.</p> <p>Scotch Pine, other Pines (<i>Cyclaneusma minus</i>): Scotch Pines are typically infected from mid-April to late June but possible through December. Maintain proper nutrient and water levels to keep trees healthy and vigorous. Make a total of five fungicide applications throughout the growing season (late March, early May, mid-June, mid-August, and mid-October).</p> <p>Pine (<i>Lophodermium seditiosum</i>): This fungus produces significant browning of Scotch Pine and kills Red Pine seedlings. Apply a fungicide three times, starting in mid-July and continuing at three-week intervals. However, during a warm, early summer start applications in mid-June.</p> <p>Douglas-fir (<i>Phaeocryptopus gäumannii</i>): Apply a fungicide in the spring when the new shoots are between one-half and two inches long. Make a second application two to three weeks later. A third application can be made if rainfall has been unusually high. Because infected needles may remain attached to the tree and continue to produce spores for following years, chemical control may be necessary for three consecutive years to return a tree to a salable product.</p> <p>Douglas-fir (<i>Rhabdocline pseudotsugae</i>; <i>Rhabdocline weirii</i>): Apply a fungicide at first bud break, a second application one week later, and a third application two weeks after the second. A fourth application may be required three weeks after the third application if cool, wet weather persists OR if Swiss Needlecast is also present.</p> <p>Pine (<i>Ploioderma lethale</i>): This disease affects (two- or three-needled) hard pines (especially Red). Early needle drop occurs in May or June. Black structures on the dead part of the needle open, via long slits, releasing spores in May through June. Apply a fungicide three times, at three-week intervals, starting in late May.</p> <p>Spruce (<i>Rhizosphaera kalkhoffii</i>): This fungus needs at least 48 hours in order to infect new needles under moist conditions, around 76° F (longer times for cooler and warmer weather, dense foliage). Apply a fungicide when new shoots are one-half or one and one-half inches long. Make a second application three weeks later. A third application may be needed in mid-August to early September.</p> <p>Spruce (<i>Stigmina lautii</i>): This fungus develops in cool, wet, spring weather. Sporulation begins at bud break. It occurs on black spruce, Colorado blue spruce, and white spruce and most commonly affects older trees. It has similar symptoms as <i>Rhizosphaera</i>, but its spores have a dirty or fuzzy appearance. The infected needles will turn yellow, then brown and will eventually drop. There are currently no fungicides specifically labeled for control.</p>	<ul style="list-style-type: none"> ▪ Azoxystrobin ▪ Chlorothalonil ▪ Chlorothalonil + Thiophanate-methyl ▪ Copper Hydroxide ▪ Copper Hydroxide + Mancozeb ▪ Copper Oxchloride + Copper Hydroxide ▪ Mancozeb ▪ Thiophanate-methyl

Active Ingredients**Needle Rust (*Chrysomyxa* & *Coleosporium*) (#69)**

Spruce (*Chrysomyxa*): Rogue infected plant material when the tree is dormant, and during the summer and fall. Destroy infected trees. Apply a fungicide when 10% of the tree is at bud break, making a second application one week later, and a third application three weeks after the first. Remove old windrow spruce that may harbor this disease and act as a source.

Pine (*Coleosporium*): Mow weed-alternate hosts.

- Boscalid + Pyraclostrobin
- Chlorothalonil
- Myclobutanil

Pine-Pine Gall Rust (*Endocronartium*) (#7)

Pine: Inspect all plants for galls and prune as necessary. Rogue when the tree is dormant. Destroy infected trees. Apply a fungicide at bud break, making a second application two weeks later.

- Mancozeb
- Triadimefon

Red Band Needle Blight (*Dothistroma*)

This fungus infects and kills needles. Severely infected trees may become more susceptible to other diseases or die. The spores of this fungus can be spread throughout the growing season by the wind and rain. New needles cannot be affected until they have come completely out of their sheaths. Fruiting bodies develop in the fall and spores are released the next spring and summer.

Pine: Only plant disease-free trees. Do not shear trees when wet or else spores will be released and spread to other trees on shearing tools. Apply a fungicide at bud break and continue throughout the summer.

- Copper Hydroxide + Mancozeb
- Copper Octanoate
- Copper Sulfate Pentahydrate

Root Rot (*Armillaria*) (#10)

This fungus kills trees by girdling the root collar. A tree has an increased risk of infection if it is already stressed. The tree's needles will first yellow, then turn brown. Resin will appear on the bark at the root collar, where the stem and roots meet. Black fungal strands from infected stumps grown through the soil and infect nearby conifers.

Fir & Pine: Healthy, vigorous trees are more resistant than weak, diseased ones. Reduce a tree's stress by treating for other diseases, insects, and environmental stresses. Remove dead trees, as well as infected, large roots and stumps.

- N/A

Rosellinia Needle Blight (*Rosellinia herpotrichoides*)

This fungus was originally believed to be a symptom of Rhizosphaera. A fine, white-gray web of mycelium covers the interior needles. The interior needles will turn yellow, then brown and will eventually drop. This disease develops in cool weather when conditions have been wet and there is poor air circulation at the base of the trees.

Colorado Blue Spruce, Douglas-fir, & Sitka Spruce: This disease most commonly affects seedlings but may occur on mature trees. An unusually heavy interior needle blighting or casting of Blue Spruce may be evident in the winter. If infestation is severe enough, needles may bond together and form fungal mat on top of branches. Many large black fruiting bodies (perithecia) will be easily seen on the surface of the fungal mat. Look under trees at the fallen needles on the ground. Needles may be "bonded" together and have a musty, moldy odor.

- N/A

Seedling Blight (*Diplodia*, *Phomopsis*)

Promote tree vigor by protecting from environmental stresses, insect attacks, and injuries. Do not use fertilizers containing high amounts of nitrogen on pines. Do not plant healthy, two- or three-needled pines near older, infected trees. Treat the entire crown of the tree (especially the lower branches) with a fungicide at bud break and again two weeks later. Fungicide applications are not effective at any other time.

- Copper Sulfate Pentahydrate
- Mancozeb
- Thiophanate-methyl
- Thiophanate-methyl + Etridiazole
- Thiophanate-methyl + Iprodione

Seedling Root Rot (*Phytophthora*)

Douglas-fir, Pine, & Spruce: Apply a fungicide (drench) to the infected tree at bud break, as well as during the summer and fall. Rogue in the fall.

Fir: Use a pre-plant fungicide during dormancy. Apply a fungicide (drench) at bud break, as well as during the summer and fall. Rogue in the fall.

- ***Bacillus subtilis* QST 713 Strain**
- Boscalid + Pyraclostrobin
- Dimethomorph
- Etridiazole
- Fluopicolide
- Fosetyl-Al
- Hydrogen Peroxide + Peroxyacetic Acid
- Hydrogen Peroxide + Peroxyacetic Acid + Octanoic Acid
- Mefenoxam
- Metalaxyl
- Mono- & Di-Basic Sodium, Potassium, & Ammonium Phosphites
- Mono- & Di-Potassium Salts of Phosphorous Acid
- Mono- & Di-Potassium Salts of Phosphorus Acid + Hydrogen Peroxide
- Potassium Phosphite
- Pyraclostrobin
- ***Streptomyces griseoviridis* Strain K61**

Active Ingredients

Tip Blight (*Diplodia*) (#26)

The fungus over winters in litter, cones, pine bark, or shoots, infected new shoots in the spring. Fungal spores spread during wet weather from spring to fall. This fungus kills current-year shoots on trees and will usually kill nursery seedlings within their first year. Older trees will die if they are infected over multiple years. Girdling cankers form when this fungus infects wounds of branches and stems. Stressed trees are more likely to be infected. Wounding from hail, shearing, and insects allow the fungus to enter. Mature windrow pines are often a source of inoculum and should be removed.

Arborvitae & Pine: Plant disease-free plants. Avoid shearing infected trees during wet weather. Prune infected plant material when the tree is dormant or in the fall. Control insects that can weaken the tree. Apply a fungicide at bud break.

- Azoxystrobin
- Chlorothalonil + Propiconazole
- Chlorothalonil + Thiophanate-methyl
- Copper Hydroxide + Mancozeb
- Copper Sulfate Pentahydrate
- Myclobutanil
- **Potassium Bicarbonate**
- Propiconazole
- Thiophanate-methyl
- Thiophanate-methyl + Iprodione

Twig Blight (*Kabatina, Phomopsis*) (#35, 56)

Arborvitae: Prune and destroy infected plant material when the shrub is dormant. Using a fungicide, begin applying at bud break and again during the fall. Mancozeb will protect foliage on plants with *Kabatina*. Thiophanate-methyl should be used when new growth is present on plants with *Phomopsis*.

Douglas-fir & Juniper: Prune the tree or shrub when dormant. Apply a fungicide at bud break and continue throughout the summer.

- Chlorothalonil + Thiophanate-methyl
- Copper Hydroxide + Mancozeb
- Copper Sulfate Pentahydrate
- Mancozeb
- Mancozeb + Thiophanate-methyl
- **Potassium Bicarbonate**
- Propiconazole
- Thiophanate-methyl
- Thiophanate-methyl + Iprodione

White Pine Blister Rust (*Cronartium*) (#42, 71)

This disease causes cankers and kills branches, eventually spreading to main stems where it will kill an entire tree. For a pine to become infected, it requires the alternate host (e.g. gooseberry or currant). Once the pine is infected, the disease will progress in the tree without the presence of an alternate host. The disease is the harshest in areas of abundant cool, wet weather from August to September.

Pine: Do not plant white pines near where alternate hosts are plentiful or at the base of a slope or in a dip. Apply an herbicide to alternate hosts or removed. Rogue when the tree is dormant. Prune infected plant material during the summer and fall. Remove and destroy all trees with trunk cankers.

- Mancozeb
- Myclobutanil
- Triadimefon

Fungicide Information

DISCLAIMER

ALWAYS READ THE PESTICIDE LABEL TO DETERMINE SPECIFIC USES AND RATES BEFORE MIXING AND APPLYING THE COMPOUND. IF ANY QUESTIONS ARISE, CONTACT THE DEALER OR MANUFACTURER. IT IS ILLEGAL TO APPLY ANY PESTICIDE IN EXCESS OF LABELED RATES. LABELED USES MAY VARY FOR EACH FORMULATION OF THE SAME CHEMICAL. PURCHASE THE FORMULATION INTENDED FOR YOUR PARTICULAR USE.

Where trade names are used, no discrimination is intended and no endorsement by the Pennsylvania Department of Agriculture is implied. There has been no attempt to rank chemicals in order of effectiveness. Every effort has been made to provide correct and up-to-date control suggestions. However, pesticide labels change constantly and human errors are possible. It is the applicator's responsibility to read the label before using any pesticide. Controls on this sheet supersede those given on sheets from previous years.

Document Key

Active Ingredient = Bio-rational Product

Active Ingredient | Chemical Class | FRAC # | Trade Names = Bio-rational Product

R = RESTRICTED USE PESTICIDE

FRAC Codes

The Fungicide Resistance Action Committee (FRAC) is a group of elected members, who are senior technical employees of R & D departments of agrochemical manufacturers. Each elected member must be experienced and influential in company fungicide resistance issues. The purpose of the FRAC is to provide fungicide resistance management guidelines to prolong effectiveness of "at risk" fungicides and to limit crop losses should resistance occur. The FRAC code uses numbers and letters to distinguish the fungicide groups according to their cross resistance behavior. For more information, please visit <http://www.frac.info/frac/index.htm>.

Classification of Pesticides Listed under Each Disease

Knowledge of pesticide classification has become increasingly important in pest management programs. Using different classes of pesticides slows the development of resistance in the target pest, thus extending the useful life of chemicals, a worthwhile goal for all growers. It is important to rotate classes or different types of chemicals, not just brand names.

Class of Chemicals and Active Ingredients

The following table is arranged by active ingredients and linked to their respective chemical class, FRAC codes, and all trade names currently registered in Pennsylvania. **AS ALWAYS, READ AND FOLLOW ALL LABEL INSTRUCTIONS BEFORE USING ANY PESTICIDE PRODUCT. NEVER USE ANY PESTICIDE IN A MANNER INCONSISTENT WITH THE US EPA APPROVED LABELING!**

<u>Active Ingredient</u>	<u>Chemical Class</u>	<u>FRAC #</u>	<u>Trade Names</u>
azoxystrobin	QoI-fungicides	11	▪ Heritage Fungicide (Syngenta Crop Protection, Inc.)
<i>Bacillus subtilis</i> QST 713 Strain	Microbial	44	▪ CEASE (BioWorks, Inc.)
boscalid + pyraclostrobin	SDHI + QoI-fungicides	7 + 11	▪ Pageant (BASF Corporation)

Active Ingredient	Chemical Class	FRAC #	Trade Names
chlorothalonil	Chloronitriles	M5	<ul style="list-style-type: none"> ▪ Chlorothalonil 720, Chlorothalonil 720 SC, Chlorothalonil 82.5 (Arysta LifeScience North America, LLC); ▪ Ensign 720 Flowable Fungicide, Ensign 82.5% Turf & Ornamental Fungicide, ENSIGN 90DF, Initiate ZN (Loveland Products, Inc.); ▪ Equus 500 ZN, Equus 720 SST, Equus DF, Quali-Pro Chlorothalonil 500 ZN, Quali-Pro Chlorothalonil 720 SFT, Quali-Pro Chlorothalonil DF (Makhteshim Agan of North America, Inc.); ▪ LESCO Manicure 6FL, LESCO Manicure Ultra, Nufarm CTN SPC 720 (Nufarm Americas Inc.); ▪ Mainsail 6.0 F, Mainsail WDG (PROKoZ, Inc.); ▪ Echo 720 Agricultural Fungicide, Echo 720 Turf & Ornamental Fungicide, Echo 90 DF, Echo Ultimate, Echo Zn Agricultural Fungicide, PrimeraOne Chlorothalonil 720 SFT, PrimeraOne Chlorothalonil DF (Sipcam Agro USA, Inc.); ▪ Bravo Ultrex, Bravo Weather Stik, Chloronil 720, Daconil Ultrex, Daconil Zn, Docket DF, Docket WS (Syngenta Crop Protection, Inc.); ▪ Phoenix Pegasus 6L, Phoenix Pegasus DFX, Phoenix Pegasus HPX (United Phosphorus, Inc.); ▪ ArmorTech CLT 720 FL, ArmorTech CLT 825 DF (United Turf Alliance, LLC)
chlorothalonil + propiconazole	Chloronitriles + DMI-fungicides	M5 + 3	<ul style="list-style-type: none"> ▪ Concert II (Syngenta Crop Protection, Inc.)
chlorothalonil + thiophanate-methyl	Chloronitriles + MBC – fungicides	M5 + 1	<ul style="list-style-type: none"> ▪ Spectro 90 WDG (Nufarm Americas, Inc.)
copper hydroxide	Inorganic	M1	<ul style="list-style-type: none"> ▪ KOP-Hydroxide 50W (Drexel Chemical Company); ▪ DuPont Kocide 101, DuPont Kocide 2000, DuPont Kocide 3000, DuPont Kocide 4.5LF, DuPont Kocide DF (E.I. du Pont de Nemours & Company); ▪ Kentan DF (Isagro USA, Inc.); ▪ Champ Dry Prill, Champ Formula 2 Flowable, Champ WG (Nufarm Americas, Inc.); ▪ CuPRO 2005 T/N/O (SePRO Corporation)
copper hydroxide + mancozeb	Inorganic + Dithiocarbamates & Relatives	M1 + M3	<ul style="list-style-type: none"> ▪ Junction (SePRO Corporation)
copper octanoate (copper soap)	Inorganic	M1	<ul style="list-style-type: none"> ▪ Camelot O (SePRO Corporation)
copper oxychloride + copper hydroxide	Inorganic	M1	<ul style="list-style-type: none"> ▪ Badge SC, Badge X₂ (Isagro USA, Inc.)
copper sulfate pentahydrate (copper sulphate pentahydrate)	Inorganic	M1	<ul style="list-style-type: none"> ▪ Phytan-27, Phytan 35 (Phyton Corporation)
dimethomorph	CAA-fungicides	40	<ul style="list-style-type: none"> ▪ Stature SC (BASF Corporation)
etridiazole	Heteroaromatics	14	<ul style="list-style-type: none"> ▪ Terrazole 35WP (Chemtura Corporation); ▪ TERRAZOLE L (OHP, Inc.)
extract of <i>Reynoutria sachalinensis</i>	Plant Extract	P	<ul style="list-style-type: none"> ▪ Regalia PTO (Marrone Bio Innovations, Inc.)
fluopicolide	Benzamides	43	<ul style="list-style-type: none"> ▪ Adorn Fungicide (Valent U.S.A. Corporation)
fosetyl-al (aluminum tris)	Phosphonates	33	<ul style="list-style-type: none"> ▪ Aliette WDG Fungicide (Bayer Environmental Science); ▪ Quali-Pro Fosetyl-Al 80 WDG (Makhteshim Agan of North America, Inc.); ▪ Fosal Select (Prime Source, LLC); ▪ Flanker WDG Fungicide (Tessenderlo Kerley, Inc.)

Active Ingredient	Chemical Class	FRAC #	Trade Names
hydrogen peroxide + peroxyacetic acid			<ul style="list-style-type: none"> 4.9% PAA (Harrell's, LLC)
hydrogen peroxide + peroxyacetic acid + octanoic acid			<ul style="list-style-type: none"> X³ (Phyton Corporation)
iprodione	Dicarboximides	2	<ul style="list-style-type: none"> Iprodione Pro 2SE (BASF Corporation); 26 GT Fungicide, CHIPCO 26019 brand Fungicide, Chipco 26019 FLO brand Fungicide, CHIPCO 26019 N/G Fungicide (Bayer Environmental Science); Quali-Pro Ipro 2SE (Makhteshim Agan of North America, Inc.); ArmorTech IP 233, Nufarm Iprodione SPC (Nufarm Americas Inc.); OHP CHIPCO 26019 N/G (OHP, Inc.); PrimeraOne Iprodione 2SE (PrimeraTurf, Inc.); Phoenix Raven, Tazz (United Phosphorus, Inc.)
mancozeb	Dithiocarbamates & Relatives	M3	<ul style="list-style-type: none"> KOVERALL (Cheminova, Inc.); Dithane 75DF, Dithane DF, Dithane F-45 Rainshield, Dithane M45, Fore 80WP (Dow AgroSciences LLC); LESCO 4 Flowable Mancozeb, LESCO Mancozeb DG (Nufarm Americas Inc.); PENTATHLON DF, Pentathlon LF (SePRO Corporation); Manzate Max, Manzate Max T&O, Manzate Pro-Stick T&O, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP, Phoenix WingMan 4L (United Phosphorus, Inc.)
mancozeb + thiophanate-methyl	Dithiocarbamates & Relatives + MBC – fungicides	M3 + 1	<ul style="list-style-type: none"> Zyban WSB (Everris NA, Inc.)
mefenoxam	PA – fungicides	4	<ul style="list-style-type: none"> Subdue GR, Subdue Maxx, Subdue WSP (Syngenta Crop Protection, Inc.)
metalaxyl	PA – fungicides	4	<ul style="list-style-type: none"> Vireo MEC (United Phosphorus, Inc.)
mono- & di-basic sodium, potassium, & ammonium phosphites	Phosponates	33	<ul style="list-style-type: none"> Phostrol (Nufarm Americas Inc.)
mono- & di-potassium salts of phosphorous acid	Phosponates	33	<ul style="list-style-type: none"> Quanta (Helena Chemical Company); FOSPHITE (JH Biotech, Inc.); Rampart Fungicide, Rampart T&O Fungicide (Loveland Products, Inc.); ALUDE (Nufarm Americas Inc.); KPHITE 7LP (Purple Label) (PLANT FOOD SYSTEMS INC.); Phoenix Jetphiter (United Phosphorus, Inc.); Confine Extra (Winfield Solutions, LLC)
mono- & di-potassium salts of phosphorus acid + hydrogen peroxide	Phosponates	33	<ul style="list-style-type: none"> OxiPhos (BioSafe Systems, LLC)
myclobutanil	DMI-fungicides	3	<ul style="list-style-type: none"> Quali-Pro Myclobutanil 20 EW T&O (Makhteshim Agan of North America, Inc.); MYCLOTTECT, ORTHO DISEASE CONTROL T&O (Rainbow Treecare Scientific Advancements); ArmorTech MYCLO 20 EW (United Turf Alliance, LLC)
potassium bicarbonate	Diverse	NC	<ul style="list-style-type: none"> MilStop (BioWorks, Inc.); ECO-MATE ARMICARB O (Helena Chemical Company)
potassium dihydrogen phosphate	Phosponates	33	<ul style="list-style-type: none"> Nutrol (LidoChem, Inc.)
potassium phosphite	Phosponates	33	<ul style="list-style-type: none"> Helena ProPhyt (Helena Chemical Company); ProPhyt (Luxembourg-Pamol, Inc.); Vital (United Phosphorus, Inc.)

Active Ingredient	Chemical Class	FRAC #	Trade Names
propiconazole	DMI-fungicides	3	<ul style="list-style-type: none"> ▪ AmTide Propiconazole 41.8% EC Fungicide (AmTide, LLC); ▪ Fitness Fungicide, ProCon-Z Fungicide (Loveland Products, Inc.); ▪ Quali-Pro Propiconazole 14.3 Fungicide (Makhteshim Agan of North America, Inc.); ▪ LESCO SPECTATOR Turf & Ornamental Fungicide, Nufarm Propiconazole SPC 14.3 MEC (Nufarm Americas Inc.); ▪ ProPensity 1.3ME (Sipcam Agro USA, Inc.); ▪ Banner MAXX, Banner MAXX II (Syngenta Crop Protection, Inc.); ▪ Kestrel, Kestrel MEX (United Phosphorus, Inc.); ▪ ArmorTech PPZ 143 MC (United Turf Alliance, LLC)
pyraclostrobin	Qol-fungicides	11	<ul style="list-style-type: none"> ▪ Insignia (BASF Corporation)
<i>Streptomyces griseoviridis</i> Strain K61	Glucopyranosyl Antibiotic	25	<ul style="list-style-type: none"> ▪ Mycostop Mix (Verdera Oy)
thiophanate-methyl	MBC – fungicides	1	<ul style="list-style-type: none"> ▪ T-Methyl 4.5F AG (Arysta LifeScience North America, LLC); ▪ AllBan 50 WSB, AllBan Flo (Everris NA, Inc.); ▪ Quali-Pro TM 4.5, Quali-Pro TM 85 WDG, Thiophanate Methyl 85 WDG (Makhteshim Agan of North America, Inc.); ▪ ArmorTech TM 462, Nufarm T-Methyl 4.5 F, Nufarm T-Methyl 70 WSB, Nufarm T-Methyl SPC 4.5 F, Nufarm T-Methyl SPC 50 WSB, Nufarm T-Methyl SPC Granular Fungicide (Nufarm Americas Inc.); ▪ OHP 6672 4.5 F, OHP 6672 50 WP (OHP, Inc.); ▪ Tee-Off 4.5F (Sipcam Agro USA, Inc.); ▪ Phoenix T-Bird 4.5L, Phoenix T-Bird 85 WDG, Topsin 4.5FL, Topsin M 70WDG, Topsin M 70WP, Topsin M WSB (United Phosphorus, Inc.)
thiophanate-methyl + etridiazole	MBC – fungicides + Heteroaromatics	1 + 14	<ul style="list-style-type: none"> ▪ Banrot 40 WP, Banrot 8G (Everris NA, Inc.)
thiophanate-methyl + iprodione	MBC – fungicides + Dicarboximides	1 + 2	<ul style="list-style-type: none"> ▪ 26/36 Fungicide, LESCO TwoSome Fungicide, Nufarm TM+IP SPC Fungicide (Nufarm Americas Inc.); ▪ Phoenix Dovetail (United Phosphorus, Inc.); ▪ ArmorTech TMI 2020, ArmorTech TMI 2020 XL (United Turf Alliance, LLC)
triadimefon	DMI-fungicides	3	<ul style="list-style-type: none"> ▪ BAYLETON 50 Turf & Ornamental Fungicide, BAYLETON FLO Turf & Ornamental Fungicide (Bayer Environmental Science); ▪ Strike 50 WDG Greenhouse & Nursery Systemic Fungicide (OHP, Inc.)
triflumizole	DMI-fungicides	3	<ul style="list-style-type: none"> ▪ Terraguard SC (Chemtura Corporation)