

Fungicides for Strawberry Disease Control

Most fungicides used on strawberries are directed at the control of fruit rots and foliar diseases (Table 2-2). By using resistant cultivars to control foliar diseases, the use of fungicides can be directed primarily toward controlling fruit rots. The fruit rots that are most prevalent in the Midwest are leather rot, Botrytis fruit rot (gray mold), and anthracnose fruit rot.

Leather Rot

Most fungicides currently available for use on strawberries are generally ineffective for controlling leather rot. Although Captan and Thiram are beneficial in suppressing leather rot, they will not provide adequate control if an epidemic develops. Furthermore, the use of these fungicides is severely restricted or prohibited during harvest due to re-entry restrictions or preharvest intervals.

Ridomil is registered for use on strawberries for control of red stele and leather rot. Ridomil is very effective for control of leather rot and may be applied in the spring after the ground thaws and before first growth. This early application is recommended primarily for control of red stele but may be beneficial in providing some control of leather rot. A second application is recommended specifically for leather rot and can be made during the growing season at fruit set.

Aliette 80% WDG is also registered for use on strawberries and should provide good control of both red stele and leather rot. It can be applied from the initiation of bloom through harvest on a seven- to 14-day schedule and has no preharvest restriction.

Abound (azoxystrobin), Cabrio (pyraclostrobin), and Pristine (pyraclostrobin plus boscalid) are strobilurin fungicides registered for use on strawberry for control of powdery mildew and anthracnose fruit rot.

Although leather rot is not listed on the label, Abound and Carbrio are very effective for controlling diseases caused by *Phytophthora* on several other crops; thus, Abound and Carbrio will provide some level of leather rot control.

Although these fungicides are very effective against leather rot, the emphasis for controlling leather rot

should be placed on the use of cultural practices, such as using a good layer of mulch and preventing standing water in the planting (good drainage). In many plantings throughout the Midwest and in drier growing seasons, leather rot is generally not a problem.

Phosphorous Acid (Agri-Fos, ProPhyt, Phostrol)

Several products containing phosphorous acid (PA, also called phosphite or phosphonate) are sold as nutritional supplements and plant conditioners, but only Agri-Fos, ProPhyt, and Phostrol are currently registered for control of plant diseases. These products are registered on strawberry for control of leather rot. They are essentially the same active ingredient that occurs in the fungicide Aliette (fosetyl-AL) and most have labels that are very similar to the label of Aliette.

Botrytis Fruit Rot (Gray Mold)

Several fungicides have excellent activity against Botrytis. Topsin-M has been registered for many years and is highly effective in areas where Botrytis has not developed resistance to it.

Rovral is registered for control of Botrytis on strawberry and was highly effective for gray mold control prior to some changes in the label use recommendations in 1999. At present, the label states that not more than one application can be made per year, and it cannot be applied after first fruiting flower. These label restrictions make Rovral of little value for gray mold control on strawberry.

Elevate, Switch, and Pristine are relatively new fungicides that have excellent activity against Botrytis. There are two major problems involved with using these fungicides (Topsin-M, Elevate, Switch, or Pristine) for fruit rot control — none of them have any activity against leather rot, and all of them are at risk with respect to the development of resistant strains of Botrytis. Because of differences in fungicide chemistry and previous frequency of use, the threat of resistance developing may be somewhat greater for Topsin-M than it is for Elevate, Switch, or Pristine. For these to aid in fungicide-resistance management, the use of minimal numbers of fungicide applications, alternation of fungicides, and fungicide combinations should be encouraged



Table 2-2. Efficacy of Fungicides for Strawberry Disease Management.						
Fungicide^a	Gray Mold	Leather Rot	Leaf Spot	Powdery Mildew	Anthraco-nose	Preharvest Interval Days
Alone						
Abound ^b	++	+++	++	+++	+++	0
Aliette	0	+++	0	0	0	0
Cabrio ^b	++	+++	++	+++	+++	0
Captan ^c	++	+	++	0	++	0
Elevate	+++	0	0	0	0	0
Nova	0	0	+++	+++	0	1
Ridomil	0	+++	0	0	0	0 ^a
Sulfur	0	0	0	+++	0	0
Switch	+++	0	0	0	++	0
Thiram ^d	++	+	++	0	+	0 ^c
Topsin ^c	+++	0	+++	+++	++	1
Phosphorous Acid	0	+++	0	0	0	0
Pristine ^b	++	+++	++	+++	+++	0
In Combination						
Abound + Captan	++	+++	++	+++	+++	0 ^c
Cabrio ^b + Captan ^b	++	+++	++	+++	+++	0 ^c
Elevate + Captan	+++	+	++	0	++	--
Elevate + Thiram	+++	+	++	0	+	--
Switch + Captan	+++	+	++	0	++	--
Switch + Thiram	+++	+	++	0	+	--
Topsin + Captan	+++	+	+++	+++	++	--
Topsin + Thiram	+++	+	+++	+++	++	--
Efficacy rating system: +++ = highly effective; ++ = moderately effective; + = slightly effective; 0 = not effective, ? = activity unknown.						
^a See label for harvest restrictions. ^b Abound, Cabrio, and Pristine should have good activity against leather rot. ^c Although the preharvest interval for Captan is 0 days, protective clothing must be worn for 24 hours after application when entering the planting or harvesting fruit. ^d If Thiram is applied within three days of harvest, residues must be removed by washing the fruit. ^e Always apply Topsin, Elevate, or Switch in combination with an unrelated fungicide such as Captan or Thiram, or in an alternating program with a fungicide of different chemistry.						



in the disease-management program. The benefits of these fungicide-use strategies (at least in theory) are to provide a wider spectrum of disease control and to reduce or delay the development of fungicide-resistant strains of the fungus. The strobilurin fungicides Abound and Cabrio will provide some suppression of Botrytis fruit rot.

Fungicide application timing is important for gray mold management. Sprays applied during bloom are much more effective than sprays applied after fruit set and during harvest. Bloom sprays also leave less residue on harvested berries.

Anthracnose Fruit Rot

Anthracnose fruit rot is not a common problem in many areas, but its occurrence is increasing across the Midwest. The disease is very important in plastic culture systems. Once anthracnose fruit rot is established in a planting, it is difficult to control and can be very severe, resulting in complete loss of the crop.

Captan and Thiram are protectant fungicides that have some activity against anthracnose. If used in a protectant program, they will provide some level of control. Abound, Cabrio, and Pristine are strobilurin fungicides and are labeled for control of anthracnose on strawberry. They have the best activity against anthracnose on strawberry of all currently registered fungicides. For purposes of fungicide-resistance management and increased efficacy, Abound, Cabrio, and Pristine should be used in alternation with or in combination with Captan or Thiram. Abound, Cabrio, and Pristine are the same class of chemistry so they should not be alternated with each other as a fungicide-resistance strategy. Switch has also been reported to have moderate to good activity against anthracnose fruit rot.

Leaf Diseases

Leaf Spot, Leaf Scorch, Leaf Blight

The emphasis for controlling leaf diseases should be placed on the use of resistant cultivars whenever possible (Table 2-1). If resistance is not available, highly susceptible cultivars should be avoided. Several fungicides are registered for control of strawberry leaf diseases (Table 2-2). Topsin-M, Captan, Thiram,

Nova, and Syllit (previously marketed as Cyprex) are registered for use on strawberries. The label states that Topsin-M cannot be applied before early bloom; thus, applications made very early in the season (as new growth starts) should use Syllit, Captan, Nova, or Thiram. The strobilurin fungicides (Cabrio, Abound, and Pristine) also have some activity against leaf diseases. If leaf diseases are a serious problem, post-harvest or post-renovation applications of these fungicides may be required.

Powdery Mildew

Topsin-M is labeled for use on strawberries and was very effective against mildew when it was first introduced; however, due to the development of fungicide resistance, Topsin-M generally does not provide adequate control in many production areas across the country. In areas where Topsin-M has not been used to control powdery mildew, it still might provide effective control.

Nova, Procure, Abound, Cabrio, and Pristine are all registered for control of powdery mildew on strawberry and should provide excellent control. Sulfur is also effective for powdery mildew control if used in a seven- to 10-day-interval protectant program. Sulfur has little or no activity against the other strawberry diseases.

The use of cultivars with resistance to powdery mildew should be emphasized, and the use of highly susceptible cultivars must be avoided.

Red Stele in Established Plantings

The emphasis for control of red stele should be placed on the use of resistant cultivars and good soil drainage. However, if red stele develops in an established planting, the use of Ridomil Gold may help reduce losses. Ridomil Gold should be applied in sufficient water to move the fungicide into the root zone of the plants. The label states: "Make one application at time of transplanting or in the spring after the ground thaws before first growth. Make another application in the fall after harvest."

Aliette WDG is also registered for red stele control. It is registered as a pre-plant dip and a foliar spray. The *pre-plant dip* label reads as follows: Use 2.5 lbs per 100 gallon and "Apply as a pre-plant dip to strawberry roots and crowns for 15 to 30 minutes.

