

Using Fungicides to Control Strawberry Fruit Rots in Ohio

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The most common fruit rots on strawberry in Ohio are: Botrytis fruit rot (gray mold), caused by *Botrytis cinerea*; anthracnose fruit rot, caused by *Colletotrichum acutatum*; and leather rot caused by *Phytophthora cactorum*. Especially in wet growing seasons, successful strawberry production may depend on the simultaneous control of all of these diseases. Generally, all three diseases do not occur simultaneously in the same planting, but this can occur. Botrytis fruit rot or gray mold is the most common disease and generally requires some level of fungicide for control each year. Anthracnose is a problem in years with warm to hot temperatures combined with prolonged rainfall prior to and during harvest. Anthracnose is generally not a problem in most plantings; however, when it does develop, it can be devastating. New fungicide chemistry with good to excellent activity against anthracnose has recently been registered for use on strawberry and should be helpful in providing effective control. Leather rot is a problem in years with excessive rainfall or in fields with poor drainage that have standing water (all of these diseases are a problem in situations such as this). Many growers do a good job of controlling leather rot by planting on sites with good soil drainage and maintaining a layer of straw mulch to prevent contact of berries with soil. In years with excessively wet weather or on sites with problem soil drainage, fungicides may be beneficial for leather rot control.

As previously mentioned, Botrytis or gray mold is the most common disease and is probably the easiest to control with effective fungicide use. Most fruit infections by Botrytis occur only during bloom. Therefore, most growers that apply fungicide during bloom generally do a good job of controlling Botrytis and do not need to apply fungicides pre-bloom or during harvest. If anthracnose and leather rot **are not a problem**, fungicide sprays during bloom only are generally all that is required. Obviously this is an ideal situation in relation to reducing costs and overall fungicide use.

In plantings and in growing seasons (warm and wet) where anthracnose or leather rot are problems, the need for a more intensive fungicide program is greatly increased. The following information provides guidelines for developing an effective fungicide program for control of the major fruit rots in Ohio.

Prebloom

In most years, there is generally little or no need for fungicides prior to bloom for control of Botrytis. If weather is exceptionally wet from rain or overhead irrigation from frost protection, some early season fungicide may be required prior to bloom. If anthracnose is a concern, especially in plastic culture berries, prebloom applications of fungicide may be beneficial in reducing the buildup of inoculum in the planting. This is especially true if prebloom temperatures are abnormally warm and conditions are wet. Applications of Captan or Thiram alone at the highest rate (Captan 50WP, 6 lb/A; Captan 80WDG, 3.75 lb/A; Captan 4L, 3 qts/A, Thiram 75WDG, 4.4 lb/A) should be effective in reducing inoculum buildup of all three diseases. A seven day application interval should be sufficient.

During Bloom

This is the critical period for control of Botrytis. In addition, in fields infested with Colletotrichum (anthracnose), the fungus may be able to build up inoculum on symptomless (apparently healthy) foliage during warm, wet weather. Increased inoculum could result in increased fruit infections if weather remains favorable for disease development. The main fungicides for control of Botrytis are Topsin-M 70WSB, Elevate 50WG, and Switch 62.5WG. All of these materials have excellent efficacy for control of Botrytis, but only Switch has efficacy against anthracnose. This is an important point to remember if anthracnose is a problem in the planting. I also recommend that all of these materials be tank-mixed with Captan or Thiram during bloom. Captan and Thiram are protectant fungicides that provide some additional control against Botrytis (gray mold), anthracnose fruit rot, and leather rot. In addition, mixing the materials should also aid in reducing the risk of fungicide resistance development.

Topsin, Elevate and Switch are all at high risk for development of fungicide resistance in Botrytis. None of these fungicides should be used alone in a season long program for Botrytis control. They all have different chemistry so they can be alternated with each other as a fungicide resistance management strategy. It is wise not to apply any of these fungicides in more than two sequential sprays without alternating to a different fungicide.

For successful Botrytis control, it is important to provide fungicide protection throughout bloom. Remember that early blooms (king bloom) may be your largest and best quality fruit, so protection needs to be started early (at least 10% bloom). The number of bloom sprays required depends upon the weather. If it is hot and dry, no fungicides are required. All of the fruit rot diseases discussed here require water on the flowers and fruit in order to infect. If it is very dry and overhead irrigation is used for supplemental water, irrigation can be applied in early morning so that plants dry as fast as possible. Keeping plants dry reduces the need for fungicide application. Fortunately, most years are not this dry and fungicides are generally applied on at least a 7-day schedule through bloom. If it is extremely wet, a shorter interval (4-5 days) may be required in order to protect new flowers as they open. Although Botrytis is the primary pathogen we are trying to control during bloom, the selection of the proper fungicides should also aid in reducing the buildup of anthracnose as well. This is important to remember in plantings where anthracnose is a problem or threat.

Post Bloom Through Harvest

As bloom ends and green fruit are present, the threat from Botrytis infection is generally over. Green fruit are resistant to Botrytis. If you got fruit infection by Botrytis during bloom, the symptoms (fruit rot) will not show up until harvest as fruit start to mature. At this point, it is too late to control it.

As new fruit form through harvest, the threat of anthracnose fruit infection increases. In

many plantings, anthracnose is not present or is not a problem. In these plantings no additional fungicide should be required after bloom through harvest. Unfortunately, you cannot determine if anthracnose is a problem until you see it. Often, this is too late to control it. In plantings with a history of anthracnose fruit rot, or if the disease is identified in the plantings, fungicides with efficacy for anthracnose control may be required from the end of bloom through harvest. Remember, anthracnose is favored by warm to hot wet weather. In addition, anthracnose appears to be a greater problem in plastic culture plantings.

Quadris 2.08F, Cabrio 20EG, and Pristine 38WG are the most effective fungicides currently registered on strawberry for control of anthracnose fruit rot. These fungicides are also registered for control of powdery mildew and they also provide good suppression of Botrytis fruit rot (gray mold). All of these fungicides are at high risk for fungicide resistance development in the anthracnose fungus. In addition, they are all in the same class of chemistry; therefore, they cannot be alternated with each other as a fungicide resistance management strategy. In order to delay the development of fungicide resistance, the label states that no more than four applications of Quadris or five applications of Cabrio or Pristine can be made per season. In addition, the label states that no more than two sequential sprays of each fungicide can be made without switching to a fungicide with a different type of chemistry. For anthracnose control, the only fungicides that currently can be used in such a rotation are Captan, Thiram, or Switch.

The following are suggestions for developing a fungicide program for simultaneous control of strawberry fruit rots.

Fungicide and (rate/A)	Comments
<p><u>Prebloom</u> Captan 50 WP (6 lb) or Captan 80WDG (3.75 lb) or Captec 4L, 3 qt or Thiram 75WDG (4.4 lb)</p>	<p>Prebloom applications should be required only if excessive water from rain or irrigation is a problem early in the season. Fungicides here could help reduce build-up of Botrytis and Colletotrichum inoculum. In dry or more “normal” seasons, fungicide is probably not required until bloom starts.</p>

During bloom

Switch 62.5WG (11-14 oz)

or

Elevate 50WG (1-1.5 lb)

or

Topsin-M 70WSB (1 lb)

plus

Captan 50WP (4-6 lb)

or

Captan 80WDG (3.75 lb)

or

Captec 4L (2-3 qt)

or

Thiram 75WDG (4.4 lb)

This is the main time to control Botrytis and if temperatures are high, Colletotrichum could build up in the planting. Switch is excellent for control of Botrytis has been reported to be good for control of anthracnose. Obviously, this is ideal. The addition of Captan or Thiram provides additional protection against both diseases and may aid in reducing fungicide resistance development. Topsin-M and Elevate are both excellent for control of Botrytis, but have no activity against anthracnose. Where anthracnose is not a threat, these fungicides will provide excellent Botrytis control. When combined with the high rate of Captan or Thiram, the combination should provide some level of anthracnose control. If anthracnose is a concern, Switch would be the fungicide of choice. None of the fungicides (Switch, Elevate or Topsin-M) should be applied more than twice before alternating with a fungicide of different chemistry. This is to aid in reducing fungicide resistance development. Quadris, Cabrio, and Pristine are the fungicides of choice for anthracnose control, and all of them provide some control of Botrytis. Although they could be used during bloom, I prefer to use them after bloom when the threat of anthracnose fruit infection is greatest.

<p>Post bloom Through Harvest Quadris 2.08F (6.2-15.4 fl oz) or Cabrio 20EG (12-14 oz) or Pristine 38WG (18.5 - 23 oz) or Switch 62.5WG (11-14 oz) tank-mixed or alternated with Captan 50WP (3-6 lb) or Captan 80WDG (3.75 lb) or Captec 4L (1.5-3 qt)</p> <p>If more than two applications of Quadris, Cabrio, or Pristine are required, Switch can be considered as an alternating fungicide.</p>	<p>As green fruit develop, the threat of anthracnose infection increases, especially under warm, wet conditions. Quadris, Cabrio, or Pristine are the most effective materials for anthracnose control. If anthracnose is a problem, the highest label rate should be used. This may be the best time to use Quadris, Cabrio, or Pristine. Switch also has some activity for control of anthracnose. If the risk of anthracnose is high or the disease has been observed in the planting, Quadris, Cabrio, or Pristine plus Captan should be applied 7 days after the last bloom spray for Botrytis. If anthracnose remains a threat, sprays should probably be repeated on a 7 day interval through harvest. As harvest approaches, Captan should be removed from the program. Captan applied close to harvest could result in visible residues on fruit and this can be a big problem. Quadris, Cabrio, Pristine or Switch applied alone should result in minimal visible residues on fruit and can be applied on the day of harvest (0-day PHI). Remember, <u>these preharvest sprays are required only if anthracnose is a threat or problem.</u></p>
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The extensive use of Captan in this program could result in problems with visible residues on fruit. This needs to be considered, but under heavy disease pressure for anthracnose a high level of Captan usage may be required. The Captec 4L (flowable) should result in less visible residue than the Captan 50W (wetttable powder) or Captan 80WDG formulation. The use of Quadris, Cabrio, Pristine or Switch alone in the last spray or two before harvest should aid greatly in reducing visible residues.

Leather Rot

As mentioned previously, leather rot should be controlled by good soil drainage (no standing water) and a good layer of straw mulch to prevent berries from soil contact. If leather rot is a threat or a problem, fungicides may be required. Quadris, Cabrio, and Pristine have excellent activity against Phytophthora diseases on other crops. Although not on the label, Quadris, Cabrio, and Pristine should have good activity for control of leather rot in addition to anthracnose and Botrytis gray mold. If applied at the time suggested here (green fruit through harvest) for anthracnose, Quadris, Cabrio, and Pristine may be beneficial for control of leather rot as well. Recent research at Ohio State indicated that these materials have good to excellent activity against

leather rot.

Fungicides for Leather Rot Control

As previously mentioned, emphasis for leather rot control should be placed on the use of cultural practices such as planting on well drained sites or improving water drainage in the planting and a good layer of straw mulch to prevent berry contact with the soil. When needed, the following fungicides are labeled specifically for control of leather rot.

Ridomil Gold is labeled for control of Red Stele (caused by *Phytophthora fragariae*) and Leather Rot (caused by *Phytophthora cactorum*). The label for perennial strawberries reads as follows: “Established Plantings: Apply Ridomil Gold EC at 1 pt. per treated acre in sufficient water to move the fungicide into the root zone of the plants. Make one application in the spring after the ground thaws and before first bloom. A second application may be applied after harvest in the fall. **Note:** Although not labeled for leather rot control, the early spring application for red stele control should provide some control of leather rot. **For supplemental control of leather rot**, an application may be made during the growing season at fruit set. This application at fruit set (as green fruit are present) has been very effective for leather rot control.

Aliette 80WDG is labeled for control of Red Stele and Leather Rot. For Leather Rot, apply 2.5 to 5 lb/A. Apply as a foliar spray between 10% bloom and early fruit set, and continue on a 7-14 day interval as long as conditions are favorable for disease development. Applications can be made the same day as harvest (PHI=0 days). Do not exceed 30 lb product per acre per season.

Phosphorous Acid (Agri-Fos) is labeled for control of Red Stele and Leather Rot on strawberries. This material has essentially the same active ingredient as Aliette and the use recommendations for red stele and leather rot are very similar to those of Aliette; however, Aliette is a wettable powder and Agri-Fos is a liquid. Agri-Fos is recommended at the rate of 1.25 quarts per acre in 90 gallons of water or 2.5 gallons per acre in 200 gallons of water. For leather rot, apply at 10% bloom and early fruit set, then at 1 to 2 week intervals as needed. Several Phosphorous acid fungicides are currently being registered for use on several crops in the U.S. and others will probably be registered for use on strawberry in the near future.

Remember these are only suggested guidelines for a fruit rot control program. It is always the grower's responsibility to read and understand the label. For the most current pesticide recommendations in Ohio, growers are referred to Bulletin 506-B “Ohio Commercial Small Fruit and Grape Spray Guide”.

*If growers have questions regarding the information covered here, they should contact:
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