Glomerella Leaf Blotch and Fruit Rot: New Apple Diseases in the Northeast

Win Cowgill
Professor Emeritus Rutgers, Win Enterprises International, LLC

Glomerella leaf Blotch (Photo 1), was first identified in North Carolina and then in Virginia. Since then, it has been seen in New York and Pennsylvania, and it was observed in northern New Jersey in 2019. This disease can also become a fruit rot, Glomerella Fruit Rot (Bitter Rot), caused by the sexual stage of the fungus. The disease has been observed primarily in cultivars that have Golden Delicious parentage, including Gala, Pink Lady (Cripps Pink), Jonagold and of course, Golden Delicious. Symptoms have also been observed on Granny Smith. In New Jersey it was observed on Cripps Pink (see Photos 2, 3, and 4).

Photo 1. Glomerella leaf Blotch on Golden Delicious in New York. Photo courtesy of Dr. Dave Rosenberger.

Glomerella Leaf Blotch was first identified in North Carolina, and has become a serious problem there. Since it has been found in Virginia, New York, Pennsylvania, and now in northern New Jersey in 2019 in Hunterdon County. In North Carolina, Glomerella leaf spot and fruit rot have been predominantly caused by *Colletotrichum fructicola*, a member of the *Colletotrichum gloeosporiodes* species complex.

Sources of Inoculum

Research regarding the sources of inoculum for Glomerella leaf spot and fruit rot is currently being conducted at NC State University. The main source of primary inoculum for the disease appears to be infected leaves overwintering on the orchard floor. Ascospores are released from perithecia sometime around bloom to petal fall. Other sources of Glomerella leaf spot and fruit rot inoculum that are currently being investigated include wood, cankers, crevices, buds, mummified fruit, and other plant hosts.

Environmental Conditions

Hot and humid conditions favor infection by the *Colletotrichum* fungi causing Glomerella leaf spot and fruit rot and disease development. Infection by conidia occurs between 59°F and 95°F, with an optimal tem-


Photo 2. Glomerella Leaf Blotch starting to show on Cripps Pink in October in northwestern New Jersey. Win Cowgill photo.

Photo 3. Glomerella Leaf Blotch almost defoliates Cripps Pink in mid-October in northwestern New Jersey. Win Cowgill photo.

perature of 82°F. A minimum 2.76 hours of leaf wetness is required for infection to occur.

Inoculum Reduction

Reducing inoculum for Glomerella leaf blotch and fruit rot are the same as used for scab inoculum reduction. There will be a benefit, particularly for the susceptible cultivars noted above. Since Honeycrisp is very susceptible to bitter rot, it would be very appropriate to use at least one of the leaf inoculum reduction treatments. See photos 5 and 6. In general, we recommend reducing apple leaf litter and the inoculum it contains. It is a relatively inexpensive and reliable method that decreases the risk of apple scab and Glomerella leaf blotch and fruit rot.

Shredding all leaves on the orchard floor in November or April reduces the number of spores. If the strip under trees cannot be reached with shredding equipment, then flail chopping the remaining area between trees will still reduce spores. Small leaf pieces break down quicker, and are more readily consumed by earthworms. If shredding is done in April, it will flip leaves, and leaf pieces, over. Flail chopping flips probably about half the leaves or pieces over, and spores formed in those pieces of leaves cannot release into the air.

Urea sprays directed to the leaves on the ground will reduce spores. Use feed grade urea, which is 46% N, and mix a 5% solution in water. (This is 44 lb. per 100 gal.) Feed grade urea is more expensive but dissolves in water much easier than granular (fertilizer grade) urea. Thus, feed grade is recommended, though the cost is higher – app. $25/acre vs. half that price for granular urea. The nitrogen content of both is the same, so granular urea can be used, but with more effort. Spray the ground surface at a rate of 100 gal. per acre. You can use an air-blast sprayer with only the lower nozzle(s) turned on, but it's best to use a boom-type herbicide or field crop-type sprayer. Make applications approximately two to four weeks before bud break, with a longer interval being more effective. Consider that this supplies approximately 20 lbs. actual nitrogen per acre, so you will need to adjust your N fertilizer application

Photo 4. Glomerella Leaf Blotch in Cripps Pink in October in northwestern New Jersey spreads from the originally infected tree nearby trees down the row.

Photo 5. Bitter Rot on fruit. Jon Clements photo.

Photo 6. Bitter Rot on fruit. Jon Clements photo.

rates later in the season. Shredding and urea treatments can be combined, for even greater spore reductions.

Fungicide Applications

Infection by conidia of *Colletotrichum fructicola* causing Glomerella leaf blotch and fruit rot (GLS/GFR) occurs in a temperature range of 59F to 95F and requires a relative humidity near 100%. If a standard apple scab program with a protectant fungicide (i.e. mancozeb) is being applied through bloom, programs for GLS/GFR should be initiated around the petal fall growth stage.

Dr. Sarah Villani, NC State Fruit Pathologist did an extensive fungicide trial for Glomerella in 2017. See the full results results at: https://apples.ces.ncsu.edu/2018/04/preparing-for-glomerella-leaf-spot-and-fruit-rot-in-2018/ The following points were taken from Dr. Villani's recommendations:

- Apply a full rate of a FRAC 11 containing fungicide (e.g. Flint or Merivon) plus mancozeb (1/2 rate) at petal fall and first cover.
- Flint does not have as high of level of efficacy as Merivon when used as a curative fungicide. Thus, for resistance management and for any kick-back activity, consider a fungicide containing pyraclostrobin (Merivon or Pristine) over a fungicide containing trifloxystrobin (Flint or Luna Sensation), particularly if the weather has been warm and humid, or there has been a lot of precipitation.
- Tighten up spray intervals from petal fall through second cover. Maintaining fungicide residues on the foliage and developing fruit is important for GLS/GFR control.
- For summer covers applications, consider rotating Ziram 76DF (3 lb) + ProPhyt (4 pt) with Captan 80WDG (3.75 lb) + ProPhyt (4 pt).
- Fungicides from FRAC Groups 3 (S.I.'s) Group 7 (SDHI's) and Group 1 (Tmethyl) have shown moderate to no activity against *Colletotrichum fructicola* in the NC State research orchard. However, against flyspeck and sooty blotch, they are good, so you may want to consider incorporating them as tank mixture of the protectant fungicide + ProPhyt.
- Do not extend beyond a 10-day spray interval from petal fall through harvest on cultivars susceptible to GLS.
- Manage weeds under the canopy to reduce alternate hosts/secondary inoculum, and humidity.

In Summary, begin sprays at petal fall for the GLS/GFR control program. Always use a protectant fungicide in combination with a systemic fungicide (best protectants = Captan, Mancozeb, and Ziram; best systemics = pyraclostrobin (Merivon or Pristine) and phorsphoric acid. Start with Mancozeb at 3lbs./ + ProPhyt or Merivon or Pristine. At 77 Days (phi for

Mancozeb), switch to Captan plus a pyraclostrobin (Merivon or Pristine).

Phosphorus acid products are used worldwide to prevent certain diseases of grapes and apples. These include ProPhyt, Rampart, Agri-Phos, Aliette, and Phostrol. They work as fungicides by interrupting the metabolic processes of the fungus. Phosphorous acid (H_3PO_3) is also known as phosphite or phosphonate and is not the same thing as phosphoric acid (H_3PO_4) or phosphate, which is a source of phosphorus fertilizer. Check the label to make sure your phosphorous acid product is labeled on apple.

Check the pH of the spray solution, especially when using alkaline well water. While most fungicides are stable over a range of pH values, some fungicides, like captan, mancozeb, can degrade under alkaline conditions. For instance, the half-life of captan is 32 hours at pH 5, eight hours at pH 7, and 10 minutes at pH 8. The half-life of mancozeb is 32 hours at pH 5, 17 hours at pH 7, and 34 hours at pH 9 (insecticides in general are more sensitive to pH than fungicides). The pH can be adjusted with an acidifying/buffering agent. Avoid letting the spray sit overnight in the spray tank. Fungicides should, whenever possible, be mixed and sprayed as soon after mixing as possible.

Phosphorous acid also effectively lowered the pH of the spray solution. The pH of the well water was 7.07. Additions of ProPhyt reduced the pH to 6.14 at 0.375 percent, 6.04 at 0.625 percent.