Fungicides for Early-Season Disease Control in Apples  
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I spoke with Dave Rosenberger this afternoon about scab, mildew and the new SDHI fungicides. There was a great deal of mildew in CT orchards last year that needs to be controlled this year. It is true that powdery mildew infected buds have a greater tendency to be killed in winters with extreme cold, such as we experienced from time to time this past winter. But not all, so there is a high level of inoculum going into the growing season. The following from Dave and Kerik Cox is long but well worth the read and also deals with scab.

Fungicides for Early-Season Disease Control in Apples

Dave Rosenberger and Kerik Cox, Cornell University

Fungicide strategies may need to be adjusted to compensate not only for increasing levels of fungicide resistance in the apple scab pathogen, but also for resistance problems in apple powdery mildew.

By now, most apple growers know that the DMI fungicides (Rally, Procure, Indar, Inspire Super, Topguard, etc.) no longer control apple scab in some orchards. Initially, we felt that Indar and Inspire Super might continue to control scab in orchards where Rally and other first-generation DMI fungicides were no longer effective. In fact, trials at Geneva clearly showed that Indar and Inspire Super provided control of scab on Empire apples where Rally was no longer effective. However, those same trials showed that the advantage of Inspire Super over Rally was less apparent on the more scab-susceptible Cortland cultivar.

When McIntosh growers attempted to control DMI-resistant scab with Inspire Super, disastrous levels of scab often develop very quickly. Therefore, we strongly recommend that growers completely avoid Indar and Inspire Super during the spring scab season if they know (based on lab tests) or suspect (based on control failures) that Rally, Procure, or other DMI fungicides are no longer effective against apple scab in their orchards.

Many Michigan and Pennsylvania orchards have apple scab populations that are also resistant to the QoI or strobilurin fungicides (Flint, Sovran, Cabrio, Pristine). So far as we know, the QoI fungicides are still effective against scab in most orchards in New York and New England, although a shift toward resistance has been noted in lab tests for some orchards. To maintain the effectiveness of the QoI fungicides against scab, they should be used only in protectant spray programs wherein products are applied at roughly 7-day intervals during the peak scab and mildew period between tight cluster and first cover.

More recently, both DMI and QoI fungicides have been showing weaknesses against apple powdery mildew. For reasons that are not entire clear, Inspire Super has always been weaker against mildew than Rally or Topguard. However, even Rally used at 6 or 8 oz/A is no longer controlling mildew in some orchards, and we must therefore assume that mildew is fully resistant to DMI fungicides in these orchards. Dr. Keith Yoder at the Winchester fruit research station in Virginia has also shown the mildew activity of QoI fungicides such as Flint has gradually decreased in his test orchard in recent years. Some growers have also been reporting more mildew than would be expected where Flint or other QoI fungicides had been applied several times during the key mildew control period between tight cluster and first cover.

Apple growers must now face the possibility that both the DMI and QoI fungicide groups may fail to provide acceptable control of mildew, especially if they are applied in only a few sprays per year as was the common practice after DMIs were introduced. Growers should consider incorporating sulfur into their spray programs in orchards where DMIs and/or QoIs were used last year and mildew was still a problem. There is no evidence that mildew will ever become resistant to sulfur.
Sulfur lacks post-infection activity against mildew and therefore must be applied earlier in the season than was typical when mildew was controlled with DMI fungicides. Sulfur at 3 to 8 lb/A (depending on tree size, inoculum levels, cultivar susceptibility, and the brand of sulfur used) should be incorporated into every spray starting at half-inch green if other fungicides are no longer working against mildew. Where other fungicide chemistries are still working, their useful life might be prolonged by including sulfur in at least two or three sprays between tight cluster and second cover, thereby reducing selection pressure for fungicide-resistant mildew both by using different chemistries in successive sprays and by avoiding inoculum build-up that occurs if no mildewcides are applied until petal fall.

In New England, apple growers have some new options this year. Four new products, Fontelis from DuPont, Merivon from BASF, and Luna Sensation and Luna Tranquility from Bayer have all been registered by EPA for use on apples. These new products all contain the SDHI chemistry (SDHI = succinate dehydrogenase inhibitors) and therefore block a different biochemical pathway than either the DMI or QoI fungicides.

None of these new products will provide “silver bullet” solutions for controlling fungicide-resistant scab and mildew. The new products are relatively expensive (as new chemistries always are), and they will need to be mixed with a contact fungicide (captan or mancozeb) for scab control. The SDHI fungicides should never be used as “bail out” sprays to arrest scab epidemics after lesions are visible because doing so may lead to very rapid development of resistance to the SDHI fungicides.

Merivon and the Luna products have excellent activity against mildew. Fontelis, though slightly less effective against mildew than the others, is still quite good. However, SDHI-resistant mildew may develop quickly if the new SDHIs are used as a stand-alone chemistry to control mildew. That scenario could develop where the DMIs and QoIs have failed or are failing against mildew. Thus we may need to start including sulfur at various timings in all spray programs as a resistance management strategy for powdery mildew.

In summary, key points for effective scab and mildew control in 2013 include the following:

1. **Keep inoculum levels low:**
   - Use urea sprays or leaf shredding (fall or spring before green tip) to reduce over-wintering scab populations where scab was a problem last year.
   - Maintain tight scab spray schedules during the prebloom period to prevent primary scab that would otherwise produce huge quantities of conidia during late bloom and petal fall.
   - Including a mildewcide in all sprays between tight cluster (or half-inch green if using sulfur) and second cover to prevent mildew from getting a head start as will occur if no mildewcides are applied until petal fall.

2. **Avoid using fungicides that are no longer effective in your specific orchard:**
   - The first warning sign for fungicide resistance is decreasing effectiveness of products or chemistry groups that always worked well in the past. Heed the early warning signs by switching to different chemistries BEFORE resistant pathogens create disastrous losses.
   - If necessary, plan to control scab and mildew by using combinations of mancozeb, captan, and sulfur. A tank-mix that includes all three of these fungicides will provide excellent protection against scab, rust, and mildew so long as there are no gaps in coverage.

3. **Where dodine, DMIs, and/or QoI fungicides are still effective, continue to use them judiciously:**
   - When they are working, programs that include these fungicides are more powerful than those that consist of only captan, mancozeb, and sulfur.
   - Dodine (Syllit) can provide valuable added protection against scab in high-inoculum orchards if it is tank-mixed with mancozeb or captan in one or two applications between green tip and tight cluster. However, the manufacturer has specified that Syllit should never be mixed with copper or chlorpyrifos because, under some conditions, those tank mixes have generated nozzle-clogging coagulates in the spray tank.
   - QoI fungicides (or one of the new SDHI fungicides if/when they are available) provide extra protection against both scab and mildew when used in two applications sometime between tight cluster and first
cover. However, both the QoIs and the SDHI products must still be tank-mixed with captan or mancozeb for scab control.

- Where they are still working against mildew, DMIs (other than Inspire Super) are best used at petal fall and first cover to target the peak risk periods for mildew and rust diseases. Inspire Super may still be useful in prebloom sprays where DMIs are still working against scab or in summer sprays targeted at sooty blotch and flyspeck.