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Ohio Fruit ICM News

Many of our fruit crops may be in harm's way with the recent very warm weather. Crops were most dormant in recent memory as late as mid-March and then the very warm temperatures and the lack of soil frost since early February combined with somewhat less soil moisture than normal allowed fruit development to move forward at an extremely fast pace.

Cold temperatures are likely to occur in the next four weeks that could put crops in jeopardy.

Below is some information gathered from Horticultural Crisis Situations Bulletin 748 that may be helpful as we move through the next month…

Inside This Issue

If you have articles for the newsletter that you would like to have considered to be included in upcoming issues, please submit to either Howard Siegrist at siegrist.1@cfaes.osu.edu or Melissa Swearingen at swearingen.34@cfaes.osu.edu

Horticultural Crisis Situations

Bulletin 748
Ohio State University Extension

Causes of Frost:

•Radiational frost most likely occurs on calm nights with clear skies in spring, fall or winter. At night, the earth's surface no longer receives solar radiation. It acts as a heat radiator, transferring heat by conduction and convection into the atmosphere. As heat loss from the earth's surface brings the temperature to 32˚F or below, frost can occur.

•Air mass freezes can occur even under overcast skies and windy conditions. Frost results when a cold air mass with a temperature below 32˚F enters and remains in an area for a period of time.

•Some other considerations: Local frosts can occur even though official temperatures are reported to be above 32˚F. This is because official temperatures often are measured six feet above ground level. It's usually several degrees cooler at the soil surface.

Frosts also are more likely to occur in outlying areas, those removed from large cities, rather than within the city proper. Heat radiation from buildings and pavement keeps the air temperature warmer.

Also: Dry soils usually are colder than wet soils, and cultivated soil gives off more heat than soils with mulch or sod.

The Critical Temperatures for Flower Buds:

Flowers of fruit species vary by their hardiness and according to their stage of bud development. *Table 1* provides the critical temperatures for tree-fruit flower buds. The bud development stages used in *Table 1* are listed on following page…

Continued from page 1 : Horticulture Crisis Situations

Table 1 indicates that lower temperatures are required for a 90% kill of the buds of pears, cherries, peaches, plums, and apricots than are required for apple buds in the first pink stage.

At the full-bloom stage, lower temperatures are required to kill 90% of the blooms of pears, peaches and plums than are required to kill 90% of apple and cherry flowers at similar stages of development.

Stage 1, Silver tip
Stage 2, Green tip
Stage 3, Half-inch green
Stage 4, Tight cluster
Stage 5, First pink
Stage 6, Full pink
Stage 7, First bloom
Stage 8, Full bloom
Stage 9, Post-bloom

Table 1. Critical temperatures for tree fruit blossom buds (°F).

Fruit	Bud Development Stage	1	2	3	4	5	6	7	8	9
Apples	Old standard temperature	16	16	22	27	27	28	28	29	29
	Average temperature for 10% kill[2]	15	18	23	27	28	28	28	28	28
	Average temperature for 90% kill[2]	2	10	15	21	24	25	25	25	25
	Average date (Prosser)[3]	—	3/20	3/27	4/3	4/8	4/11	4/18	4/25	—
	For Red Delicious, Golden Delicious and Winesap approximately 1°F hardier; Rome Beauty, 2°F hardier. After petal fall, all varieties are equally tender.									
Fruit	Bud Development Stage	1	2	3	4	5	6	7	8	
Pears	Old standard temperature[1]	18	23	24	28	29	29	29	30	
	Average temperature for 10% kill[2]	15	20	24	25	26	27	28	28	
	Average temperature for 90% kill[2]	0	6	15	19	22	23	24	24	
	Average date (Prosser)[3]	—	3/23	3/31	4/5	4/9	4/14	4/18	4/25	
	For Bartlett. Anjou is similar in hardiness but may bloom earlier and therefore may be more tender than Bartlett at the same date.									
Fruit	Bud Development Stage	1	2	3	4	5	6	7	8	9
Cherries	Old standard temperature[1]	23	23	25	28	28	29	29	29	30
	Average temperature for 10% kill[2]	17	22	25	26	27	27	28	28	28
	Average temperature for 90% kill[2]	5	9	14	17	21	24	25	25	25
	Average date (Prosser)[3]	3/5	3/13	3/23	3/27	4/1	4/4	4/8	4/13	4/21
	For Bing. Lambert and Rainier are approximately 1-2°F hardier through Stage 6.									
Fruit	Bud Development Stage	1	2	3	4	5	6	7		
Peaches	Old standard temperature[1]	23	—	—	25	—	27	30		
	Average temperature for 10% kill[2]	18	21	23	25	26	27	28		
	Average temperature for 90% kill[2]	1	5	9	15	21	24	25		
	Average date (Prosser)[3]	3/7	3/16	3/19	3/29	4/3	4/11	4/18		
	For Elberta.									

Continued from page 2 : Horticulture Crisis Situations: *Table 1*

Table 1. Critical temperatures for tree fruit blossom buds (°F).

Fruit	Bud Development Stage	1	2	3	4	5	6	7	8
Plums	Old standard temperature[1]	—	—	—	—	23	27	27	30
	Average temperature for 10% kill[2]	14	17	20	24	26	27	28	28
	Average temperature for 90% kill[2]	0	3	7	16	22	23	23	23
	Average date (Prosser)[3]	3/13	3/20	3/27	4/3	4/8	4/12	4/16	4/23
	For Italian prunes and Early Italian prunes.								

Fruit	Bud Development Stage	1	2	3	4	5	6	7	8
Apricots	Old standard temperature[1]	—	23	—	25	—	28	—	31
	Average temperature for 10% kill[2]	15	20	22	24	25	27	27	28
	Average temperature for 90% kill[2]	—	0	9	14	19	22	24	25
	Average date (Prosser)[3]	—	—	3/8	3/16	3/22	3/28	4/4	4/18

[1] Critical temperatures as previously published.
[2] Average temperatures found by research at the WSU Research and Extension Center, Prosser, to result in 10% and 90% bud kill.
[3] Average date for this stage at the WSU Research and Extension Center.

The Flower Bud Hardiness of Small Fruit Plants:
Strawberries are more susceptible than other small fruits to frost injury simply because they're closer to the ground.

Occasionally, grape blossoms are frost-damaged. But in general, losses of grapes and brambles are due to winter-kill of vines or canes, rather than frost damage to the buds. Currants, gooseberries and blueberries seldom bloom early enough in Ohio to incur frost damage.

Strawberry plants grow close to the ground where the coldest air settles on clear, calm, cold nights in early spring. Thus, blossoms are subject to injury by late-spring frosts. Early blooming varieties, unmulched plants and plants on a southern exposure are most susceptible. Mulched plants bloom later, which reduces the risk of frost damage.

Loss of an entire crop is less common with strawberries than with most tree fruits for two reasons:
•blossoms don't all appear at once, and
•buds are in different stages of development

Strawberry flower buds are susceptible to frost anytime after bud break. Cultivars that develop flower buds early, such as Earliglow, are more susceptible to frost before first bloom. As flower buds develop from tight buds to open flowers, they become more sensitive to freezing temperatures between 14-28˚F.

Economically, the first flowers that open produce the largest berries. When 5-7% of the flowers are lost, 10-15 % of the total crop is lost.

The duration of temperature required for damage can be 20 minutes to 2 hours, depending on wind, humidity and cultivar.

Table 2. Critical air temperatures for strawberry buds, flowers and fruit.

Stage of Development			
Buds Emerged	Buds Closed	Flowers Open	Small, Green Fruit
10°F	22-27°F	30°F	28°F

Looking for 4 Hosts Vineyards for a Dicamba/2, 4-D Workshop

David Scurlock, Viticulture Outreach Specialist
The Ohio State University Extension

Most grape growers are aware of the effect 2, 4-D has on the grapevine. The leaf symptoms appear twisted and contorted and the terminal growth is curled with the potential death of the vine. Grape growers should be aware that 2, 4-D resistant soybeans and soybeans that are resistant to the closely related herbicide dicamba (BanvelTM/ClarityTM) are on the horizon (2011) for weed control in the soybean crop. These herbicides will be used in the same manner as Roundup (glyphosate) is for Roundup-ready soybeans.

If you are a grape grower who is surrounded by soybeans we would like to ask if you would be willing to host an educational workshop. The workshop will be a venue to get fellow farmers, both grape and grain, together to learn of the potential effects and solutions to co exist through coordination of spray materials and communication. We will teach farmers how to identify 2, 4- D, dicamba, and glyphosate injury, and the prognosis for their vines.

We will help you take the first steps to develop your own program to reach out to neighbors and surrounding farmers about the special risks involved in growing soybeans around grapes and how you can help to minimize the risks involved.

We are looking for 4 Hosts to hold a workshop in all 4 quadrants (NE, NW, SW & SE) of Ohio. If you are surrounded by soybeans and herbicide drift could be or has been a problem for you and would be willing to have us hold an educational workshop at your place please contact Dave Scurlock or Doug Doohan as soon as possible. (tentative time will be late April to early May).

David Scurlock
Viticulture Outreach Specialist
Dept. of Horticulture and Crop Science
216 Gourley Hall, OARDC
Wooster, Ohio 44691

Doug Doohan
Professor and Weed Specialist
Dept. of Horticulture and Crop Science
205 Gourley Hall, OARDC
Wooster, Ohio 44691

Upcoming Events:

April 06: 2010 Pennsylvania Winery Conference and PWA Annual Meeting held at the Penn Stater Conference Center, State College, PA Contact Mark Chien at mlc12@psu.edu or 717-394-6851

May 10-12: Ohio Wine Competition. Contact Todd Steiner at Steiner.4@osu.edu or 330-263-3881

Source: Ohio Grape-Wine Electronic Newsletter, March 29, 2010 Issue

The Ohio Fruit ICM News is also available in color online at:

http://licking.osu.edu/topics/agriculture-and-natural-resources/ohio-fruit-icm-news

Insect Bytes

Dr. Greg Krawczyk and Dr. Larry Hull, FREC Entomologists
Penn State University

Early Spring Pear Psylla Control

According to observations in our Penn State FREC pear research plots, pear psylla (PP) adults have been active since mid-March and the number of eggs observed on twigs is significantly higher this year than observed at the same time during the 2009 season (LAH observations). Since no new insecticide products active against pear psylla (PP) were added to our assortment during the past year, in general this year's recommendations for PP control are similar to our suggestions from previous years. In the early spring, applications of oil and pyrethroids still remain the best (and probably the most economical) choices. In orchards with a history of pear psylla problems the first sprays should include oil in order to suppress egg deposition and an adulticide to eliminate overwintering adults. Depending on when you start your control program, use the following oil rates: 3% oil at dormant bud, 2% oil at budburst, and 1% up to white bud. You can make two applications of oil (plus pyrethroid), or replace the second application of oil with an application of Delegate at the green cluster bud to white bud stage. In our research programs, an application of Delegate at the rate of 6-7 oz/acre at about the green cluster bud or white bud stage has provided good control of pear psylla. At least 0.5-1.0 gal of oil should be added to the Delegate. We do not recommend more than a single application of Delegate before bloom on pears. Thorough coverage is required for good control of psylla during each application. Another option for PP control before bloom includes the use of Surround (multiple applications). It is crucial for effective PP control that each application of PP materials provide excellent coverage of trees.

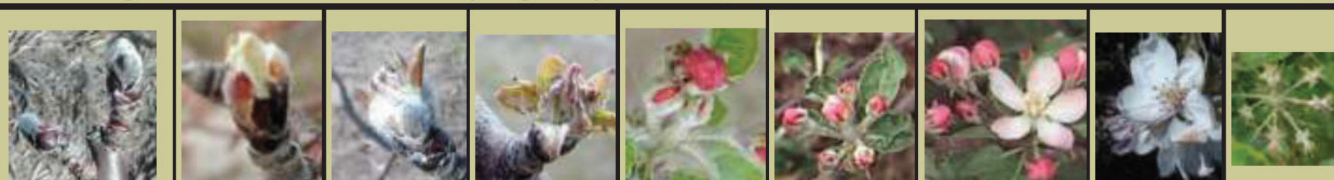
Rosy Apple Aphid Hatch

Rosy apple aphid (RAA) egg hatch occurs between silver tip and half-inch green on apples. The young, as soon as they hatch, seek out the opening buds of apple trees, seeming to prefer the fruit buds. The first young develop into stem mothers when apple trees are coming into the early pink stage. The production of young usually begins 2 or 3 days after the last molt and continues without interruption for over a month. A single female produces an average of about 185 live young. While searching for RAA please make sure that other aphids such as apple grain aphid (AGA) are not mistakenly identified as RAA. The AGA hatch about 7 to 10 days before RAA, just around silver tip on apples. The AGA nymphs are dark green with a light colored stripe running down the back, with antennae less than half the body in length and very short cornicles.

Optimum timing for early season control of rosy apple aphid is at the green tip to half-inch green stage. Two close-interval alternate row middle sprays or one complete spray should be applied by that time. When using Asana XL, Battalion, Baythroid, chlorpyrifos, Danitol, Decis, Esteem, permethrin, Proaxis, or Warrior in alternate row middle sprays, the first spray should be applied at green tip and the alternate row middle spray no later than half-inch green tissue. Only a gallon or less of oil per acre is needed when using these products for aphid control. However, this low rate of oil will not control European red mite and also please note that in most situations oil alone will not adequately prevent RAA injury.

Apple Bud Stages and Associated Critical Spring Temperatures (from http://web1.msue.msu.edu/vanburen/crittemp.htm)

Apple Bud Stage



Bud stages and critical temperatures for other fruit are also available at http://web1.msue.msu.edu/vanburen/crittemp.htm

	Silver tip	Green Tip	½ inch green	Tight Cluster	First Pink	Full Pink	First Bloom	Full Bloom	Post Bloom
°F	Old temp—16	16	22	27	27	28	28	29	29
	10% kill— 15	18	23	27	28	28	28	28	28
	90% kill— 2	10	15	21	24	25	25	25	25

Blueberry Pollination - Revisited

Information from a Cornell Berry Webinar given by Sonia Schloemann, compiled by Molly Shaw, Molly Shaw, South Central Fruit and Vegetable Program, Tioga County Cooperative Extension, 56 Main Street, Owego, NY

There are roughly 1.8 million blueberry flowers in an acre of highbush blueberries, every one of which needs good pollination to make a nice berry. How does this get accomplished?

Blueberry blossoms are high maintenance flowers—no simple wind pollination here. Every flower needs personal visits from a pollinating insect to make it happy. Blueberries have “perfect” flowers, which (botanically speaking) means that the flowers have both actively functioning male and female parts. The glitch is that pollen from a single blueberry flower is usually unable to pollinate its own ovary—think of it as a blueberry’s way of preventing inbreeding. Many varieties can still make a small second-rate berry that ripens late with less flavor from unpollinated flowers (called parthenocarpic fruit). But the largest, best quality berries form when pollen from a different blueberry variety is used to fully pollinate a flower. Full pollination entails every one of the roughly 65 ovules in the flower getting its own pollen grain. With about 2,000 blooms per bush and close to 900 bushes per acre, that requires 117 million pollen grains to be moved to fully pollinate every acre. Puts a new emphasis on busy bees, huh?

Because of the structure of the flower, the pollen that sits up deep inside the top of the tubular corolla doesn’t make contact with the stigma (pollen receiver) unless an insect bumbles around the flower, scraping its pollen-dusted tummy on the stigma that sticks out the end. The flower makes nectar deep inside the top of the corolla, enticing the bees to push past the stigma and reach their tongues way up into the top of the flower. Honeybees have traditionally been used to pollinate large blueberry fields because we’ve long known how to raise them and move them from place to place, but really these bees of European decent have rather short tongues and struggle to reach the blueberry flowers’ nectar (remember, blueberries are one of the few fruits native to north America). They’d rather visit the dandelions carpeting the row middles. If using honeybees to pollinate blueberries, you must wait for the blueberries to reach 25% bloom before moving the bees in, so they’re less likely to get distracted by better nectar sources before they find the blueberry flowers you want them to work.

But wait, most of us have small blueberry plantings, we don’t hire honeybees, and we still get blueberries every year. Who’s doing the work?

One study surveyed insects which were found pollinating blueberry flowers on 15 blueberry farms and identified a whopping 112 native species that contribute to pollination. They included many species of bumble bees, Osmia bees (orchard mason bees, hornfaced bees, others), leafcutter bees, and the affectionately-named “shaggy fuzzyfoot bee.” These pollinators can be amazingly efficient when compared to honeybees. A Japanese study comparing hornfaced bees to honeybees for pollinating apples found that 60-120 *thousand* honeybees are needed to do the job, while 300-800 hornfaced bees can accomplish the same task. Native pollinators are adapted to work in cooler weather (an endearing trait for blueberry plantings in NY!), and they evolved with blueberry flowers so they “know” how to handle them. Bumblebees actually perch on the bottom of the tubular blueberry blossom and shake loose the pollen by vibration, effectively dusting their stomachs with pollen in the process.

Carpenter bees, although commonly found in blueberry plantings, aren’t helping to pollinate fruit. These guys are lazy; instead of reaching into the flower to reach the nectar from the bottom, they cut a hole into the top and sip the nectar without getting close to the stigma which needs to receive the pollen. You can commonly see these slits on the top sides of blueberry corollas. Carpenter bees have black shiny behinds, unlike the fuzzy back sides of the many species of bumble bees.

Now then, all this pollinator talk is well and good, but how do you know if you’re getting enough pollination done to set a good berry crop?

One method is to asses the “buzz” level in the field. During sunny warm periods of the day during bloom (> 60F), there should be an audible “buzz” in the field. Another rule of thumb is that 4-8 bees should be foraging on each blueberry plant at any one time during the warmest part of the day during bloom. You could also watch and see if at least 20 pollinators (any species) are entering blueberry flowers in a 10 minute period.

Interestingly, some varieties of blueberries are more attractive to bees than others. Bluetta, Blueray and Bluecrop are listed as “moderately attractive,” while bees find Elliot, Berkeley, Jersey, Coville and Earliblue unattractive. Blueberry flowers are open and receptive to pollen for 5-8 days, and are most likely to set fruit if pollinated within the first 2-3 days after opening. Once pollinated, the white corolla separates from the ovary. If good pollination is happening, a carpet of white petals should be on the ground under the bush. You can gently shake a couple branches to see if the corollas will fall off. If the corollas stay white for about 24 hours after

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they drop, it means the flowers were fully pollinated. If the corollas on the plant or on the ground are brown, it usually means there was frost damage. Once the green fruit begin to swell, you can look for any tan berries that stay tiny have aborted—they didn't get pollinated.

Some of the native bees are actually available to buy commercially—honeybees, hornfaced bees, and leafcutter bees are some. You can also increase your own pollinators by providing them with nests (often as simple as holes drilled in a block of wood, or boxes filled with straws—instructions are easy to find on-line, you can start with ATTRA http://attra.ncat.org/attra-pub/nativebee.html). Make sure there is access to clean water nearby (without pesticide residues). Don't spray insecticides during bloom. If traps for cranberry fruitworm followed by egg-scouting show that an insecticide is needed, choose one less toxic to bees and spray it in the evening.

Generic Fungicide Option

Annemiek Schilder, Plant Pathology
Michigan State University Extension

Following the trend in human medicines, "generic" versions are now available for some common fungicides used to treat plant diseases. This is due to the expiration of patents on various proprietary fungicide products. Generic products by law have to have the same amount of active ingredient as the original fungicides. However, there may be differences in inert ingredients or formulations.

Generic products tend to be more economical than brand name products, but most have not have been separately evaluated for disease control efficacy in Michigan and may not be mentioned in the crop sections of E-154 (Michigan Fruit Management Guide). However, most of them are briefly described in the "Fungicides and Bactericides for Fruit Crops" section of the guide. For more information on individual products, check out their labels or material safety data sheets on the following website: www.cdms.net . Generic products are presumed to be similar in disease control efficacy to their brand name counterparts. However, minor variations in efficacy, behavior or even phytotoxicity may occur due to formulation differences.

Do not assume that the labels of generic products are exactly the same as the brand name fungicides that you are used to. Sometimes there are differences in the crops that the product is labeled for or in the label instructions or restrictions. An example is Iprodione (iprodione), which is labeled for blueberries, whereas the brand name product Rovral (iprodione) is not. Also, Tebuzol (tebuconazole) is labeled for apples and pears, but other tebuconazole products such as Elite, Tebustar, and Orius are not. The table below lists generic versions of common fungicides. Read the fungicide label carefully before use as you would for any new product.

Brand name	Active ingredient	Generic versions
Aliette	fosetyl-Al	Legion
Aliette	phosphites (same breakdown product as fosetyl-Al)	ProPhyt, Phostrol, Agri-Fos, Rampart, Fosphite, Fungi-Phite, Topaz
Elite	tebuconazole	Orius, Tebuzol, TebuStar, AmTide Tebuconazole
Rally/Nova	myclobutanil	AgriStar Sonoma
Orbit	propiconazole	Bumper, PropiMax, Propiconazole E-AG, AmTide Propiconazole,
Ridomil	metalaxyl	MetaStar, Metalaxyl
Bravo	chlorothalonil	Chlorothalonil, Echo, Equus
Rovral	iprodione	Iprodione, Nevado
Topsin M	thiophanate methyl	Thiophanate Methyl, T-Methyl
Agri-Mycin	streptomycin	Ag Streptomycin, FireWall
MycoShield	tetracycline	FlameOut

Optimizing Fungicide Programs for Apples

Dave Rosenberger, Plant Pathology
Cornell University and Cornell Cooperative Extension

Optimizing fungicide programs for apple scab gets more complicated every year as new fungicides gain registrations, fungicide resistance diminishes the reliability of some key chemistries, and changes in fungicide pricing necessitate annual reassessment to determine the most cost-effective programs. The difficulties are compounded by the fact that scientists still do not fully understand all of the intricacies of how new products work. Additionally, we cannot accurately predict when and where fungicide resistance will occur and how fungicide-resistant populations will respond to various mixtures and seasonal alternations in fungicide chemistry.

Despite these uncertainties, this article will summarize some factors to consider in selecting apple fungicides to control scab, rust, and mildew during the period between green tip and first cover. We start by reviewing broad categories of fungicides and then suggest some early season strategies at the end of the article.

Contact fungicides include the mancozebs (Dithane, Penncozeb, and Manzate), Polyram, Captan, Ziram, sulfur, and copper. They are sometimes called "protectant fungicides" because they protect leaves by killing spores before or during germination. They do not penetrate leaves and therefore cannot arrest infections after fungi have entered leaves or fruit. However, they are still effective when applied after the start of a wetting period, so long as they are applied before a Mills infection period has been completed. Thus, these products are sometimes listed as having a "kickback" of 12–24 hr from the start of a rain, depending on temperature. However, their reach-back is directly correlated with the times required for completing a Mills infection period.

Copper is both a bactericide and a fungicide, but its usefulness on apples is limited because applications after quarter-inch green tip can cause phytotoxicity to apple fruit. Except for sulfur, none of the contact fungicides control powdery mildew. Mancozeb, Polyram, and Ziram are effective against rust diseases, but Captan and sulfur are not. Both Ziram and sulfur are rapidly removed by rainfall, so these are not the best choices for scab control where residual activity through rains is important. Captan controls black rot, whereas the other contact fungicides are less effective.

Fungi cannot develop resistance to any of the contact fungicides because these fungicides attack multiple metabolic sites in germinating spores. As a result, fungi would need to develop simultaneous mutations to bypass all of these action sites, and that has not occurred during the more than 60 years that some of these chemistries have been in use. Fungicides in all of the other groups discussed below work by arresting fungal metabolism within a single pathway, and they have therefore been called single-site inhibitors. Fungi can develop resistance to all single-site inhibitors.

Strobilurin fungicides include Sovran, Flint, and the pyraclostrobin component found in Pristine. Sovran and Flint are often called stroby fungicides and are very effective for controlling scab, mildew, and black rot. They provide adequate control of rust diseases when applied ahead of rains, but they have very little post-infection activity against rust diseases. For apple scab, they can provide roughly 48 hr of post-infection activity, but they are not effective for arresting apple scab after lesions are visible on foliage.

All stroby-containing fungicides carry labels stating that combined usage for any product in this group is limited to four applications per year. Thus, one can apply a maximum of four sprays per year that contain Sovran, Flint, or Pristine. For example, if Flint is applied three times to control scab, then Pristine can be used only one time during summer.

Anilinopyrimadine or AP fungicides include Scala and Vangard. These fungicides are useful for apple scab, but not for mildew, rust, or black rot control. They do not protect fruit, do not redistribute very well, and work best in cool weather. As a result, they are most useful from green tip to bloom. They provide 48 to 72 hr of post-infection activity, counting from the start of rains and depending on temperatures during the wetting period. This attribute makes them especially useful where post-infection activity is needed during the very early part of the season. The AP fungicides should always be combined with a protectant fungicide, because the latter is needed to maintain coverage on expanding leaf surfaces during the week following the application.

DMI or SI fungicides can be subdivided into 1st generation products (Rally, Rubigan/Vintage, Procure) and 2nd generation products (Inspire Super, Indar, Tebuzol). The 1st generation products were very active against scab, mildew, and rust diseases, but they provided very weak protection against fruit scab and were ineffective against black rot. The 2nd generation group generally has greater toxicity against scab and black rot, but slightly reduced activity against mildew. The 2nd generation group is moderately effective for protecting fruit from scab and black rot, and they also suppress early season flyspeck infections, whereas the 1st generation DMIs did not. Some of the differences between these two groups of DMIs may be attributable to

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differences in actual toxicity of the products to various pathogens. However, I suspect that much of the difference in the way that these two groups of DMIs perform is attributable to how quickly the products penetrate host tissues after they are applied. The 2nd generation DMIs tend to remain more “surface active”, whereas the 1st generation products are rapidly translocated through leaves after application.

Syllit (dodine) is an older fungicide that really does not fit well within any of the categories noted above. Syllit is primarily a protectant scab fungicide. It was widely used in the 1960s until fungicide-resistant strains of scab reduced its effectiveness.
Although Syllit was rated as having only about 48 hr of kickback activity, it proved very effective for arresting early season scab infections even when applied more than 48 hr after the start of rains. Its ability to arrest scab development was probably attributable to the fact that it redistributed very well, it moved into leaves to arrest mycelial growth within leaves, and it inhibited sporulation on leaves. Syllit can still be useful as a prebloom spray in many orchards, but it should always be combined with mancozeb or captan as a precaution for cases where dodine-resistant scab may be present. For post-infection activity, Syllit rates must be adjusted to above the mid-point of the rate range listed on the product label.

Designing a coherent scab program requires careful selection of the best combinations and sequences of fungicides based on past weather, predicted weather, and the diseases expected in specific orchard sites.

1. For early season sprays, combinations of mancozeb plus captan are highly recommended, except where the captan component interferes with oil sprays. (Oil and captan are not compatible!) Mancozeb fungicides will stick to trees better during heavy rains, whereas captan will redistribute better than mancozeb during periods of light, misty rain. The latter capability is especially critical when warm temperatures cause rapid leaf expansion between sprays. However, if sprays are applied just ahead of weather fronts that are predicted to bring 3–4 inches of rain (such as the current wetting period), then higher rates of mancozeb alone may perform better than lower rates of mancozeb mixed with captan.

2. Mancozeb plus Vangard or mancozeb plus Scala should be used if there is a need for 48–72 hr of reach-back activity at the time the sprays are applied. Based on trials conducted at the Hudson Valley Lab, it appears the lower rates of Vangard and Scala listed on product labels for tank-mix combinations will provide about the same level of reach-back activity as the high end of the label rates. The higher rates are needed for protectant activity if Vangard and Scala are applied alone, but we do not recommended using these products alone because of their limited redistribution capabilities.

3. Work in Michigan more than 20 years ago showed that 1st generation DMI fungicides sometimes provide disappointing results when applied under cool conditions at the green tip to half-inch green bud stages. This probably occurs because there is very little green tissue available to absorb the fungicides at those early growth stages. We don’t know if 2nd generation DMIs will show the same limitations. However, Inspire Super may work better at low temperatures than the other products because Inspire Super contains both a DMI (difenoconazole) and Vangard, and the latter works well early in the season.

4. The DMI and stroby fungicides should always be used in combinations with either mancozeb or captan to slow selection for resistance to the at-risk fungicides and to ensure some degree of protection where resistance may already be present in the population. Where Inspire Super is used, this means that three fungicides will be combined in the tank, since Inspire Super itself is composed of two active ingredients.

5. There is ongoing debate about how to position DMI and stroby sprays during the interval between tight cluster and first cover. My initial thinking was that DMI applications should be delayed until petal fall and first cover because of concerns about using them during the peak scab season (tight cluster to bloom) in orchards that may have DMI resistant scab. However, Inspire Super is more effective against scab than first generation DMI fungicides and field experience last year in western NY showed that the best scab control was obtained where Inspire Super plus mancozeb was applied at tight cluster and pink, with stroby fungicides (plus mancozeb) being used in later sprays. The benefit of this approach is that the power of the DMI fungicide is applied before any scab infections missed in early sprays can begin to produce conidia. When DMIs are applied before bloom, they will be acting on a smaller population of spores than would occur if applications are delayed until petal fall when at least a few sporulating lesions are often present.

6. The strategy of using prebloom sprays of Inspire Super plus mancozeb will probably work in most orchards, but it should NOT be applied in blocks of highly susceptible cultivars (e.g., McIntosh) with known resistance to DMI fungicides. For those cases, Flint or Sovran should be used with mancozeb in prebloom sprays and then a DMI plus contact can be used in petal fall and first cover sprays to control mildew and rust.

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7. Using DMIs at petal fall and first cover may also be desirable where maximum protection against quince rust and cedar apple rust is needed.In some cases, it might make sense to apply Inspire Super plus mancozeb at tight cluster and pink, and then follow up with Rally plus mancozeb or Rubigan plus mancozeb at petal fall and first cover, to get maximum activity against mildew and rust diseases with those post-bloom sprays.

8. As noted earlier, the 2nd generation DMIs are slightly less effective against mildew than the 1st generation DMIs. In western NY last year, several consultants noted that Inspire Super failed to provide the mildew control expected of a DMI fungicide. It seems likely that populations of powdery mildew in some orchards have shifted toward DMI resistance. This fits with the observation that Bayleton was initially effective at 1.5 oz/A, whereas rates of 4 oz/A were required in the last years that Bayleton was available. Thus, Rally at 5–6 oz/A may still control mildew, but Inspire Super, with slightly less activity, may perform less well. Given this scenario, it makes sense to use Inspire Super during the prebloom, when there is less mildew pressure, and then use stroby fungicides at petal fall and first cover when mildew pressure reaches its peak.

9. Inspire Super MP is sold as a unit that contains one jug of Inspire (difenoconazole) and one jug of Vangard. The label requires that both of these products be combined in the tank. Separating these two products and using them at different times is a violation of pesticide law and also negates the built-in resistance management strategy that derives from using the products together.

A New Paradigm for Controlling Apple Scab

Dave Rosenberger, Plant Pathology
Cornel University and Cornell Cooperative Extension

Many apple growers in the northeastern United States had difficulty controlling apple scab in 2009 due to the cool, wet summer that allowed scab to remain unusually active right up until harvest. As a result, the average NY apple orchard probably has more scab ascospore potential this spring than anytime during the previous 40 years. A wet spring in 2010could cause disastrous losses to apple scab if corrective strategies are not implemented for the 2010 season.

Even though the “average” NY orchard had scab problems last year, there were still some orchards where scab was well controlled (i.e., virtually no leaf scab at the end of summer). In orchards where scab was not a problem last year, the same control programs that worked in 2009 will probably work again in 2010. Growers who had clean orchards last fall can stop reading here because they probably have better things to do (and they already know what is working in their orchards!).

If scab was not well controlled last year and one of the DMI fungicides (Rubigan, Rally, Procure, Inspire Super, or Indar) was applied twoor more times after bloom, then there is a high probability that resistance to DMI fungicides played a role in the scab control failure. Where DMIs are still active, back-to-back applications of a DMI fungicide anytime after bloom almost always arrest further scab development, provided the applications are made in a way that ensures complete coverage of the tree canopy. Furthermore, resistance testing conducted by Kerik Cox over the past three years has shown that 78% of the 93 orchards that he tested contained populations of DMI-resistant scab that would be expected to trigger control failures. Note that this was not a random sampling of orchards since most samples presumably came from “problem orchards.” But orchards that had scab last year are now “problem orchards,” so generalizing the results from Cox’s resistance testing may be appropriate.

In orchards with DMI resistance and a high level of overwintering scab inoculum, new paradigms for scab control must be explored. None of the other fungicides that are currently available can fill the gap that occurs when scab becomes resistant to the DMI fungicides because none of the remaining fungicides can stop scab development after infection with the same effectiveness as the DMIs.

Where DMI resistance is documented or suspected, apple growers MUST take extra precautions to protect green tissue ahead of rains. An important corollary is that all fungicides, but especially protectant fungicides, provide better disease control in low-inoculum orchards than in high-inoculum orchards. Therefore, growers with DMIresistant scab now have a critical incentive for using inoculum reduction strategies to control scab. A triple whammy consisting of a high-inoculum orchard, a wet prebloom period, and resistance to DMI fungicides will very likely result in sub-par scab control. Fortunately, there are a number of documented methods for converting high-inoculum orchards into low-inoculum orchards, or at least lower inoculum orchards.

For high-inoculum orchards, growers should employ one of seven options noted below, all of which have been shown to reduce ascospore production by 50 to 90 percent:

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1. Apply a urea spray (42 lb/A in 100 gal of water/ A) to leaves on the trees just prior to leaf drop in autumn.
2. Apply a urea ground spray (same rate as #1) to fallen leaves in late autumn (mid-November or later).
3. Apply dolomitic limestone at 2.5 to 3 tons/A to fallen leaves in late autumn.
4. Shred leaf litter with a flail mower in late autumn after leaves are blown or brush-raked from beneath trees.
5. Shred leaf litter as described above in spring.
6. Apply a urea ground spray in spring (same rate as #1).
7. Rake or vacuum up leaves and physically remove them from the orchard.

Option 7 is most useful for homeowners and small orchards where a riding mower with a leafbagging attachment can be used to collect leaves weekly as they fall in autumn. Of course, it will prove effective only if leaves beneath trees are raked or blown into the sodded row middles where they can be accessed by the riding mower.

Growers who employed one of options 1–4 noted above should not require any additional inoculum- reduction treatments in spring. Where an inoculum reduction strategy was applied last fall, the next critical component of the scab control program is to ensure that buds are protected with copper or a fungicide prior to the first scab infection period.

Where nothing was done last fall to reduce scab inoculum, growers can still employ options 5 or 6. The treatments suggested in options 1–4 generally work (i) by softening leaves so as to enhance removal of leaf litter by earthworms; (ii) by providing nitrogen to enhance growth of saprophytes that degrade fallen leaves; and (iii), in the case of flail mowing, by enhancing breakdown via better soil contact and more leaf edges that can be invaded by microbes. Given those factors, one might assume that inoculum-reduction strategies implemented in spring would be less useful because there is less time for leaf degradation to occur following treatment and prior to the time that ascospores are released. Fortunately, some additional mechanisms come into play when leaf shredding or urea sprays are applied in spring.

Research has shown that urea applied in spring causes direct toxicity to the apple scab fungus in the leaf litter. Ascospores in leaves treated with urea in spring either fail to develop or fail to discharge. Thus, urea ground sprays can suppress ascospore production even if the urea is applied after green tip. However, if urea is applied via airblast sprayer after green tissue is present on trees, the uptake of urea into the green tissue may “soften” the tissue and make it more susceptible to subsequent damage from oil, copper, sulfur, or captan sprays that are applied within a week of the urea application. Thus, if a urea ground spray is applied after green tip, it might be safer to apply the urea with a boom sprayer rather than with an airblast sprayer, because the latter would also deposit the urea throughout the tree canopy.

Leaf shredding applied in spring can still speed leaf degradation prior to peak ascospore discharge, which usually occurs when trees reach the pink bud stage. More importantly, however, leaf shredding in spring re-orients the pieces of leaf litter so that about half of the leaf litter will be upside-down. In our region, the scab fungus begins in late winter to form the pseudothecia that eventually hold ascospores that are ejected into the air in spring. The fungus orients the ascospores to shoot out of the upper surface of the leaves as they are positioned on the ground. If the leaf litter is turned over in late March or April, ascospores in those pieces of leaf litter will discharge harmlessly into the soil surface, and this mechanism probably explains why spring leaf shredding was effective when it was tested in New Hampshire in the early 1990s.

Using an inoculum reduction technique does not negate the need for regular fungicide sprays beginning at the green tip bud stage. Rather, inoculum reduction should be viewed as a necessary supplementary tool for keeping scab in check where DMIs are no longer effective and where scab was not controlled the previous year. Inoculum reduction should be viewed as a policy to insure against failure of normal protectant fungicide programs.

Until we find a replacement for DMI fungicides, inoculum reduction will become part of the standard paradigm for controlling apple scab in commercial orchards where scab was not well controlled the previous year.

Editor: Howard J. Siegrist, Extension Educator, Ohio State University – Licking County
771 E. Main Street, Suite 103, Newark, OH 43055. Phone: 740-670-5315
Email address: siegrist.1@cfaes.osu.edu

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Central Ohio Poison Control Number

(800) 222-1222
TTY # is (614) 228-2272