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THE OHIO STATE UNIVERSITY Newsletter Extension

# Fruit ICM News

Volume 4, No. 6
March 31, 2000

**In This Issue:**



## Calendar

**June 28: Ohio Fruit Growers Society Annual Summer Tour**, Vogley Enterprises, East Sparta, Ohio, Stark County. Watch for more details.

**July 27-28 (tentative): Ohio Berry Tour**, Central Ohio. Watch for more details.

## ICM News Publication Schedule

Beginning today, we plan to produce this newsletter on a weekly basis. Where have we been the last couple of weeks? The editor and his wife had the privilege of serving a medical mission based at Escuela el Sembrador Donald Hawk, Catacamas, Honduras. The Hawk family has supported a school for underprivileged Honduran boys since 1954. Of particular interest to fruit growers is a germplasm nursery for the maintenance of indigenous Honduran fruit, including citrus, tropical fruits, and many varieties of bananas.

## Insecticide News

*Source: Celeste Welty, Extension Entomologist & Associate Professor, OSU, Columbus*

A new oil product, **PF-1025 Dormant/Summer Oil'**, is now registered by EPA as an insecticide for use on fruit trees as well as ornamentals and vegetables. This is made in Ohio by Pammark Farms, Ltd. Unlike most other insecticidal oils that are petroleum products, PF-1025 is made from soybean oil and is thus a renewable resource. It might be of particular interest to organic growers who prefer not to use petroleum products.

**Danitol 2.4EC:** The registration for Danitol has just been expanded to include apples, pears, and grapes. It has been registered since 1995 for use on strawberries and tomatoes. Danitol is a pyrethroid that contains the active ingredient fenpropathrin. It is made by Valent Corp. Danitol is similar to other pyrethroids (Asana, Pounce, Ambush) in toxicity to a broad spectrum of insect pests, but is different than the other pyrethroids because it also kills European red mite and two-spotted spider mites.

On apple, Danitol is most useful when used prebloom at a rate of 10.7 fl oz per acre to control leafminer, tarnished plant bug, rosy apple aphid, and early-hatching red mites and leafhoppers. It can also be used post-bloom at a rate of 16 fl oz per acre as an alternative to organophosphate insecticides (Guthion, Imidan) for control of plum curculio, codling moth, apple maggot, and leafrollers. Its main drawback is that it is toxic to predatory mites. It is likely to be least disruptive to predators when used pre-bloom. Because it kills the pest mite as well as the predatory mites, there is a race to see which species rebounds first. Preharvest interval is 14 days.

On pears, Danitol controls pear psylla in the overwintering adult stage during the delayed dormant period, and codling moth post-bloom. Preharvest interval is 14 days.

On grapes, Danitol at 5.3 oz per acre controls leafhoppers, and at 10.7 oz per acre it controls grape berry moth and Japanese beetle. Preharvest interval is 21 days.

On strawberries, one new pest that is now on the Danitol label is strawberry sap beetle. The strawberry label had already included tarnished plant bug, spittle bug, and two-spotted spider mite.

**Esteem 0.86EC:** This new insect growth regulator was registered in Ohio in June 1999, but was overlooked in our winter pesticide updates. Esteem contains the active ingredient (a.i.) pyriproxyfen and is made by Valent Corp. The same a.i. is in Knack' which is used on cotton. Esteem is being marketed primarily for pears in the western USA. Esteem is used to control pear psylla on pears, where it is mostly ovicidal. When adults are treated, it causes them to lay sterile eggs. It should be used only once per year. For now, use is recommended pre-bloom any time between the green cluster bud to white bud stage at a rate of 13-16 fl oz per acre. Use post-bloom on the second generation of psylla might be recommended in the future after additional research is completed to work out the details.

Esteem is also registered for use on apples at a rate of 13-16 fl oz per acre. It is an excellent material for control of San Jose scale when used during the delayed dormant period. It controls rosy apple aphid when used at half-inch green, which is earlier than other aphid materials because it is most effective before eggs hatch. It controls leafminer when used at the pink bud stage. It controls codling moth somewhat earlier than other insecticides, probably best in the first cover spray.

**Surround WP:** an unusual new crop protectant is now registered for use on apple, pear, peach and other stone fruit, processing blueberries and brambles and wine grapes, as well as on several vegetable crops. Much research on the product has been done with tree fruit crops at USDA in West Virginia and the Pacific Northwest. Surround is accepted for use by growers who are meeting organic standards.

Surround is made by Engelhard Corp., which has expertise in surface chemistry and materials science.

Surround is a product of particle film technology. Surround protects crops by coating the plant with a physical barrier to pests rather than poisoning the pest. Its active ingredient (95%) is kaolin, which is a common food additive. When sprayed on a crop, Surround forms a white film that acts as a broad spectrum protectant for preventing pest damage. It is an egg-laying and feeding deterrent for insects. The film appears to act by repelling pests, or by making the host plant unrecognizable to the pest, or by interfering with the pest's ability to walk across the treated plant surface. It also protects against sunburn and heat stress, and improves fruit coloring. The microscopic particles form a semi-continuous porous film on the plant. The film does not impair transpiration or photosynthesis. The particles disperse rapidly in water and do not settle rapidly, and are non-abrasive to nozzles. Surround is not toxic to honey bees or other pollinators. When Surround is used close to harvest, the fruit need a post-harvest wash to remove residues. If washing is not possible, the use of the product can be discontinued about 6-8 weeks before harvest to avoid noticeable residue at harvest.

Surround is sold in 25-lb bags on pallets with 65 bags each, and will be distributed through United Agri Products, although none is currently in stock. The retail price is not certain but is likely to be about $15-17 per 25 lb bag. On tree fruit, Surround is used at a rate of 50 lbs per 100 gallons of water per acre for concentrate applications, or 50 lbs per 200 gallons per acre for dilute applications.

On pears, Surround controls pear psylla and suppresses pear rust mite and codling moth. For psylla control, it should be applied no later than the green cluster bud stage and repeated every 7 to 14 days until the infestation subsides.

On apples, Surround controls oblique-banded leafroller and leafhoppers, and suppresses plum curculio, codling moth, and apple maggot. It might be of particular interest to organic growers who have few options for plum curculio management. Against curculio, Surround should be applied at petalfall and 3 more sprays at 5-7 day intervals. The rate can be lowered from 50 lb per 100 gal to 25 lb per 100 gal in the third and fourth sprays.

On stone fruit, Surround controls Japanese beetle and suppresses plum curculio, June beetle, and thrips. To target Japanese beetle, it should be applied one week prior to expected infestation and followed by 3-4 additional sprays at 5-7 day intervals.

On processing brambles and blueberries, it suppresses Japanese beetle and blackberry psyllid. On wine grapes it suppresses leafhoppers, Japanese beetle, and June beetle.

A label and packet of detailed information about Surround can be requested from Engelhard at their Web site: http://www.engelhard.com/surround/.

## Apple Disease Control With New Fungicides

*Source: Wayne Wilcox and Dave Rosenberger, Plant Pathology, Cornell University, Geneva & Highland*

Apple growers have two new options for controlling diseases this season. "Sovran" from BASF and "Flint" from Novartis are broad-spectrum fungicides from the new chemistry class commonly known as strobilurins. Both materials received federal registrations for pome fruits (apple, pear, and quince) in 1999. They are welcome additions to the "tool chest", not only because of their inherent activities, but because they should take some pressure off the SI fungicides. This is important not only where the SIs have begun to "slip" due to resistance development, but also where they haven't (i.e., let's keep it that way). In an ideal world, each fungicide group would help keep the other alive.

**Origin and mode of action of strobilurin fungicides**

Strobilurin chemistry was derived from a natural anti-fungal compound that occurs in a small mushroom, Strobilurus tenacellus, which grows on fallen pine cones in Europe. Chemists in several companies modified the original compound to make it more stable and more effective as a fungicide.

The strobilurins are very active against a wide array of plant pathogenic fungi, generally at rates of only one to three ounces of active ingredient per acre. They have very low toxicity to birds, earthworms, beneficial insects, predaceous mites, and mammals (including humans). They break down quickly in soil but have good residual activity on foliage and fruit. Because of their broad spectra of activity and favorable environmental profiles, they are the most significant new group of fungicides to be developed since the sterol inhibitors.

Unlike the SI fungicides, the strobilurins are excellent inhibitors of spore germination; thus, they are excellent protectant fungicides. These materials are retained primarily within the waxy cuticle of leaves and fruit, which means that they are more rainfast than traditional protectants. This also means that they don't redistribute very well from leaf to leaf in rainwater, although they do redistribute well within the waxy layers of a given leaf (or fruit). Furthermore, a small portion of the total dose does diffuse from the surface of a sprayed leaf and, after a few days, enough accumulates on the other side so that it offers fungicidal protection on that unsprayed side (termed "translaminar" activity). This general pattern of fungicide movement is unique to the strobilurins, and different manufacturers have made up their own trademarked names to describe it, e.g., "surface systemic" for Sovran and "mesosystemic" for Flint. You'll be hearing these terms in the advertisements.

In addition to being excellent protectant fungicides, the strobilurins are powerful antisporulants. That is, when applied beyond their period of true "kickback" activity, they allow lesions to develop but few secondary spores form on these lesions. This is particularly significant for a disease like apple scab, where economic damage (fruit scab) is usually caused by the secondary spores that develop on infected leaves. For instance, in trials conducted in Geneva in both 1996 and 1998, early infection periods were missed (unintentionally) and significantly less fruit scab developed when the first two sprays consisted of a strobilurin (Sovran in 1996, Sovran or Flint in 1998) rather than an SI plus mancozeb. This reduction in fruit scab was directly related to the reduced number of sporulating lesions produced on cluster leaves treated with strobilurins in the early sprays versus those treated with other materials.

The strong protectant and antisporulant activities of these materials are functions of their retention in the cuticle on the surface of the leaves and fruit. Conversely, good curative or kickback activity usually requires a fungicide to penetrate the cuticle and get inside the leaf, i.e., to get down where the fungus is doing its business after it has established an infection. Thus, the strobilurins generally are not as effective in a kickback mode as are compounds with a higher degree of systemic activity, such as the sterol inhibitors. However, apple scab may provide an exception to this general rule. That is, the apple scab fungus grows just beneath the cuticle, so enough fungicide to provide true postinfection control may actually "leak through" the underside of the cuticle and do the job. Both Flint and Sovran are labeled to provide approximately 4 days of postinfection control for apple scab. At this point, however, the trials that have led to these claims are extremely difficult to evaluate, and it's not clear whether postinfection sprays truly kill the incipient infections or merely keep them from sporulating (in which case, they could potentially reactivate without additional applications of the fungicide). There is no question that Sovran and Flint provide scab control when applied postinfection, but it seems risky to deliberately design postinfection control programs with these materials until more is known about the details just discussed.

Used alone without contact fungicides, Sovran and Flint will perform in the orchard similarly to SI-protectant tank mixes in their heyday. It is important to recognize that these strobilurin fungicides control scab (and many other diseases) on apple fruit at least as effectively as mancozeb and captan, and much more effectively than SI fungicides ever did when the SIs were applied alone. Sovran is labeled for use at 10-14 day intervals, whereas Flint is labeled for use at 7-10 day intervals. Based upon limited comparisons of the two (Flint has only been available to the university community since 1998), it would appear that this difference in recommended spray intervals is a result of "product positioning" by the respective manufacturers rather than differences in product activity. Spray intervals of greater than 10 or 11 days are not recommended during the primary scab season, due in part to the need to cover new tissues as they emerge.

**What about fungicide resistance?**

Strobilurin fungicides work by inhibiting a single biochemical pathway involved in mitochondrial respiration in fungal cells. Mitochondria are the energy-producing units within cells, so disrupting mitochondrial function results in death of the fungal cells as they "run out of gas". Because strobilurins inhibit a single biochemical step, resistant strains of various pathogens will develop if these fungi can utilize an alternative biochemical pathway that bypasses the step blocked by strobilurins. Resistance to strobilurins has already appeared in powdery mildews of cereal grains and cucurbit crops in Europe and Asia, as well as in Botrytis of greenhouse crops. Thus, resistance is a very real concern, and resistance management must be incorporated into plans for using strobilurin fungicides from Day 1 of their introduction.

To date, strobilurin resistance appears to follow the "Benlate model"; that is, resistant isolates are virtually immune to the fungicides and multiply rapidly if they are not controlled by some other material. Furthermore, a fungal strain that is resistant to Sovran will be resistant to Flint and vice versa. Therefore, both companies have agreed on identical labeling which requires use patterns that incorporate resistance-management principles: 1) No more than four sprays of any strobilurin may be used per season; and 2) A strobilurin fungicide can be used no more than three times in a row; if two or three sequential applications are made, an effective unrelated fungicide must be used in the next two applications before strobilurin use can resume.

Note that tank-mix combinations are NOT a part of this strategy, and that both fungicides are priced to be used alone. Thus, this strategy is to 1) minimize the selection of resistant strains by limiting the number of selection events (sprays); and 2) limit the opportunity for resistant strains to multiply, by using unrelated fungicides in rotation. Restricting the number of sequential strobilurin sprays to two might be an even more effective anti-resistance strategy, although three is legal. Economics will help enforce the limited-spray strategy, but it is important that growers and advisors not deliberately short-circuit the intent to limit the buildup of resistant fungus strains; e.g., by failing to rotate with effective unrelated materials. For instance, rotating Flint or Sovran with only benzimidazole/captan sprays would not be a good resistance-management strategy with respect to the powdery mildew fungus, because mildew is already resistant to the benzimidazoles in many orchards.

Strobilurin fungicides can be phytotoxic to some crops. Sovran is phytotoxic to a few sweet cherry varieties and therefore will not be registered for cherries. All of the foliage on Somerset, Sweetheart, Valera, Van, and Vandalay can be killed if trees are sprayed directly with Sovran. Less severe phytotoxicity (mostly leaf spotting) has been observed on Cavalier, Emperor Francis, Royalton, Schmidt, Summit, and Viva trees that have been sprayed directly. Drift (other than direct blow-through) and the concentrations resulting from residue remaining on spray tank walls are believed to pose relatively little danger. Tart cherries and other sweet cherry varieties show little or no phytotoxicity from Sovran, even when sprayed directly.

Flint is phytotoxic to Concord grapes when applied directly, and is specifically not labeled for use on that variety. Azoxystrobin (Abound, Quadris), another strobilurin fungicide which is registered for use on grapes and some vegetable crops, is extremely phytotoxic to certain apple varieties (e.g., Macs, those with Mac parentage, and Gala), even at very low concentrations resulting from drift or spray tank residue. Thus, each of these strobilurins has a problem with phytotoxicity to a few varieties of one specific crop. Fruit growers producing apples and stone fruits or apples and grapes may wish to consider the potential for phytotoxicity when selecting which of these fungicides they will use on their farm.

Sovran and Flint provide excellent control of apple diseases. In university trials, Sovran and Flint have provided excellent control of apple scab, powdery mildew, sooty blotch, flyspeck, and black rot. Both Sovran and Flint provide only marginal control of cedar apple rust and quince rust, especially when used at the lower end of labeled rates.

Which product is better, Sovran or Flint? That depends primarily on the rates of the respective products that are used in comparisons. Evidence to date suggests that Sovran and Flint provide comparable control of apple diseases when the rate of Sovran is double the rate of Flint. Thus, Sovran at 4 oz per acre will provide the same level of control as Flint at 2 oz per acre, and early indications are that the products will be priced accordingly. The Sovran label gives recommendations in rates per 100 gallons (1.0 - 1.6 oz) as well as rates per acre (4.0 - 6.4 oz) whereas the Flint label lists only rates per acre (2.0 - 2.5 oz). The minimum labeled Sovran rate of 1.0 oz/100 gallons may prove marginal under high apple scab pressure, based upon experience in our high-inoculum test orchards at both Highland and Geneva. Experience with Flint is more limited, but a rate response was also seen in the one comparative study conducted in Geneva. That is, a rate of 0.5 oz/100 gallons - presumably equivalent to the 1.0 oz/100 rate of Sovran - was less effective than a higher, unlabeled rate (1.0 oz/100).

Therefore, we suggest that apple growers in New York use Sovran at a minimum rate of 1.33 oz per 100 gallons of dilute spray for tree-row-volume applications. Technical support personnel from BASF recommend a minimum of 2.0 oz per acre even on the smallest trees, a recommendation that prudently recognizes the potential inefficiency of spray capture in small trees and the relatively high crop value in high-density plantings. We recognize that a rate of 1.0 oz per 100 gallons for Sovran may be adequate for purely protective sprays under modest pressure, but both the label and our personal experiences indicate the need for higher rates if postinfection activity is required. The minimum rate for Flint is 0.67 oz per 100 gallons dilute basis. The latter is based not only on the 2:1 formula for Sovran:Flint, but also is derived by dividing the lowest label rate (2 oz per acre) by 3, using the increasingly standard assumption that per-acre rates must be divided by 3 to arrive at rates per 100 gallons for apples in New York State. A common "fudge factor" (at least 150 gallons per acre dilute basis, even on the smallest trees) yields a minimum per-acre rate of 1.0 oz for Flint.

**Suggested use patterns for Sovran and Flint**

What is the best timing for strobilurin fungicides? There is no single "correct" answer. However, we believe that the best timing in many locations is around the tight cluster plus pink bud stages, except in areas where quince rust is a concern. Applications at tight cluster and pink target the period of peak apple scab ascospore discharge and the beginning of the mildew season, and they will also suppress secondary spore production on lesions that managed to sneak through in earlier infection periods. Sovran or Flint applied at these early stages, before SI fungicides are used, will help "break the cycle" and limit the ability of SI-resistant scab and mildew strains to re-establish on new foliage. Using Sovran or Flint to control early-season infections will result in less selection pressure for scab and mildew strains resistant to the strobilurins because inoculum levels are lowest early in the season (an example of the old concept that X % resistant strains in a small population provides fewer problem individuals than X % resistant strains in a large population). Combinations of contact and SI fungicides can then be used at petal fall and first cover to provide continued protection against scab and mildew. Having a contact fungicide present at petal fall should reduce potential risks from a myriad of minor diseases for which we still have limited data on activity of strobilurin fungicides.

A typical apple fungicide program might therefore involve an initial application of a protectant fungicide (maybe two in very wet years), followed by two sprays of Sovran or Flint at approximately 10-day intervals starting about tight cluster. A single mancozeb spray may be needed during an extended bloom period to bridge the gap between the second strobilurin spray and the petal fall application. At petal fall and first cover, an SI-contact combination could be used to round out the scab and mildew season. If desired, a final strobilurin spray could be used to extend the period of optimal scab and mildew control and provide excellent flyspeck control, before switching to routine summer fungicide programs; or, summer programs could be initiated now. In blocks where scab pressure is low and no mildewcide is needed, the SIs might be omitted and contact fungicides used alone to provide protection through petal fall and early summer.

In blocks where quince rust is a concern, the SI-contact combination should probably be used at tight cluster and pink, the period when quince rust infections occur on fruit. Sovran or Flint could then be used at petal fall and first cover when fruit are no longer susceptible to rust. Sovran and Flint will provide acceptable (but not perfect) protection of leaves against cedar apple rust, but they will not provide adequate protection against quince rust on fruit during the tight cluster and pink stages.

Sovran and Flint are very effective for controlling flyspeck (and sooty blotch) and could be used as substitutes for benzimidazole-captan sprays during summer, especially where the four-day re-entry interval for captan creates management problems. The best timing for Sovran and Flint in summer sprays remains to be determined, as does their cost effectiveness at this time in much of the Northeast. If Sovran or Flint scab sprays are applied at tight cluster and pink, then they should not be used again until second cover. During early summer, good spray coverage is still possible whereas dense foliage, fruit clustering, and limbs drooping under heavy crop loads often compromise spray coverage in late summer. However, if Sovran or Flint scab sprays are applied at petal fall and first cover, then additional summer applications would need to be delayed until July or August because of the requirement for intervening applications with some other class of fungicides.

Sovran has a 30-day preharvest interval and the label indicates that it should not be used as the last spray of the season. This prohibition was based on the assumption that growers might apply Sovran for scab control starting at green-tip, and using it both to end the season and begin the following season would compromise resistance management. Flint has a 14-day preharvest interval, and Novartis has actively investigated the value of late-summer sprays. Both Flint and Sovran appear to have residual activity against flyspeck that is equivalent to that provided by Benlate and Topsin M.

## New Strawberry Production Systems

*Source: Richard C. Funt, Extension Specialist, Small Fruits, The Ohio State University*

Recently there has been considerable interest in new strawberry production systems, particularly those utilizing raised beds and black plastic. Ohio growers have had minimal experience with these systems as compared to those growers along the eastern coast.

For many years, the matted row production system has been the standard. In this system, dormant bare-rooted plants are shipped in early spring, planted at 12 to 18 inches apart on a flat' surface and grown to fill in the row by early September. Fruits are harvested in years 2, 3, and 4, and sometimes 5. Overhead irrigation is needed for growth and frost protection. Cultivar preference and performance can be site specific, based on markets, soils, sunlight, and temperatures, particularly within several days of harvest.

The eastern U.S. plasticulture system utilizes fumigation, raised beds, black plastic, and microirrigation (trickle). Costs are nearly twice that of the matted row system. Systems research indicates that fresh plug plants set in August will produce a larger berry and more berries than bare rooted plants set in late June. Row covers can be used to provide an earlier harvest. Generally, berries are harvested only once, but new research is trying different methods for more than one harvest. As with any new intensive management system, growers should fully understand the steps for success and try such systems in small plots.

Many systems are cultivar dependent. Some cultivars work well in one system but not another. In Ohio, Dr. Goulart reported in 1985 that the cultivar Scott' increased in root weight, but yield was less on raised beds (no plastic). However, fruit size was larger on raised beds as compared to flat. Redchief total yield was unaffected by bed height but yields were greatest in closer spaced plants. Raised beds without plastic did not increase yields sufficiently to justify the additional cost of production when grown on Chili silt loam soils.

In summary, much needs to be learned in Ohio about new strawberry production systems. However, new cultivars are being created for these new systems. In the near future, these cultivars are likely to be more productive if they match a certain production system. Other biological preplant systems without fumigation may prove to be more economical.

## Insect Growth, Growing Degree Days, and Predicting Optimal Spray Timing

*Source: Rufus Isaacs, Entomology, Michigan State Univ.*

Insects are cold blooded, so temperature plays a major role in their growth and development. The speed of this insect growth is largely driven by temperature, and so this warm spring heralds the early appearance of insect pests in Michigan fruit crops. Anyone involved in pest management needs to understand how temperature affects insect growth, so they can predict when insect pests will emerge and become active.

**Getting prepared early is the key.** Even though we are at the end of March, it's time for growers, consultants, and scouts to start thinking about monitoring for the earliest pests (for example, cutworms and flea beetles in grapes). The unusually warm days and nights of March 2000 mean not only earlier bud break in fruit crops, but earlier pest activity, too. Most insects, diseases, and weeds spend the winter in dormant states, waiting for warmer weather before starting to grow again. Insects such as the grape berry moth survive the cold weather as pupae in the leaf litter, while others, such as aphids, may survive as an egg inside a crevice of the bark. Diseases are often on the soil surface or on plant tissues, while the weeds may be seeds or dormant roots. Whatever the target of a pest management program during spring 2000 in Michigan, the times for management inputs should be adjusted to take into account this early spring. According to climate experts, we are a week ahead of even last year's early spring. A cool spell now will mean that growth stops, but then it will start again as soon as the temperatures rise.

**How temperature drives insect growth:** So why do pests appear earlier in warm springs? Insect development is almost completely driven by temperature, whereas moisture has a large impact in disease and weed growth. Because insects are cold-blooded, the growth of adults, larvae, and eggs is driven by the temperature of their surroundings. The dormant overwintering stages require a certain amount of heat before they reach the stage for emergence. During this development, there is a lower limit below which no growth happens, and as temperature increases above that, the insects grow faster and faster, up to a maximum limit. These values can be used in predicting insect activity and appearance of symptoms during the growing season.

With the accumulation of temperature varying between years, accurate pest management is difficult if control measures are based on set calendar dates rather than at a time when the insects will be susceptible to controls. It is far better, if possible, to plan insecticide applications based on the stage of development of the pest. Often this can be tied to the development of the crop, such as applications at "pink" or "bud break" or 6-inch shoot growth, because the plant is also driven by temperature. In contrast, because humans are warm-blooded, we keep our body temperature constant and so children grow at a fairly constant rate. (Just think what would happen if people in Florida grew faster than those in Michigan!) With insect growth driven so closely by temperature, researchers have developed a way to predict the appearance of insects, egg laying activity, and other important events based on the amount of heat accumulated in the vineyard, bog or orchard. This tool for predicting insect growth is a degree-day model, and is used to predict when sprays are best applied.

**Calculating growing degree days:** One degree day is accumulated when the average temperature for a day is one degree over the lower limit for development. Growing degree days (GDD) are the total number of degrees for insect growth that are accumulated during one day. At the end of every day these numbers are added to the previous daily total to create a cumulative number of GDD. This running total can be calculated very easily using a maximum and minimum thermometer, preferably placed in or on the crop where pest problems may exist. For example, if the insect to be tracked starts growing at 42ø F and the daily temperature reaches 80øF, then 80-42 = 38 growing degree days were accumulated that day. You would add 38 to the previous total and continue daily until the total for the control timing is reached. If, however, the insect has an upper limit of 70ø then only 28 GDD would be added.

The starting point for accumulating degree days is decided one of two ways. Either GDD are counted from a set date, such as January 1, or they are counted from a specific biological event, called a biofix. This is often the first sustained capture of an adult in a pheromone or other trap. Using a biofix is usually more accurate and means that the numbers have to be counted for a shorter period. For many of the apple and cherry pest insects, the number of GDD from first sustained moth catch to egg-hatch is well known. This is not the case for small fruit pests, and we are working to see how these tools would work for the grape berry moth and cranberry fruitworm.

Typically, optimal timing for a spray application to control a moth pest is timed to an egg-hatching event because this is the best time to get maximum effect. At a set number of GDD after biofix, sprays aimed at the pest can be applied, and be sure to target the appropriate stage of the insect. It is therefore important to check traps often near the start of adult emergence. This allows accurate decisions on the biofix and good timing of the spray application.

All pest management decision makers should be aware that temperature conditions can vary greatly within one farm, depending on the direction of the ground's slope and if there are cold-air traps. It is not unusual for some insects to appear a week apart in different fields on the same farm. Monitoring traps should therefore be in different parts of the farm so that different timings can be followed. Variation in insect growth patterns across Michigan can also be variable, with distance from the lakes and latitude playing a part.

Your nearest MSU experiment station should be keeping a running total of GDD at both the 42 F and 50 F thresholds, and the MSU Agricultural Meteorology program has weather stations placed around the state, with their weather data accessible online. However, these sites may not be close to your farm, and so there is no substitute for temperature measurements in your crop. All you need is a min-max thermometer, and daily checking of the values to calculate GDD for your pest management. The easiest way to calculate degree days for a specific day is to add the daily high and low temperatures and divide by two. Then subtract the lower limit for growth of that insect. By making this calculation each day, you will become more accurate in your pest management, which should lead to better control through more accurate timing of applications. For a step-by-step guide to calculating GDD by Agricultural Meteorologist Jeff Andresen, see last year's May 18 fruit CAT Alert. Good luck!!

## Plum Pox Virus of Stone Fruit: Where To Get Information in Ohio

*Source: Michael A. Ellis, Department of Plant Pathology, The Ohio State University, OARDC, Wooster*

Most peach growers in Ohio are aware of the fact that Plum Pox Virus (also called Sharka) was discovered for the first time in North America in the fall of 1999. The virus was discovered in a small number of orchards in Adams County, Pennsylvania. In an attempt to eradicate the virus from North America, infected trees and/or orchards are being destroyed. Surveys will be conducted in 2000 in peach orchards across the United States in order to determine if the disease is restricted to the relatively small area in Pennsylvania. Hopefully, if the disease is restricted to a small area, infected trees can be removed and the virus can be eradicated from the U.S. Although details of the survey have not been worked out, it appears that surveys will be conducted in selected Ohio peach orchards in the year 2000.

A great deal of excellent information about the disease has been prepared by Pennsylvania State University, the USDA, and several other universities and organizations. It is important that Ohio stone fruit producers be aware of where to get this information, in order to learn more about the disease. The purpose of this note is to provide growers with sources of information.

Excellent "Fact Sheets" with good color photos of disease symptoms have been prepared by Penn State University and The American Phytopathological Society. Growers in Ohio can obtain a copy from:

Michael A. Ellis
Department of Plant Pathology
The Ohio State University, OARDC
1680 Madison Avenue
Wooster Ohio 44691
Phone: (330) 263-3849
E-mail: ellis.7@osu.edu

In addition to these fact sheets, several excellent web sites have been developed. The following sites are currently available:

http://sharka.cas.psu.edu

http://www.state.pa.us/PA_Exec/Agriculture/plum_pox

http://www.caf.wvu.edu/kearneysville/disease_descriptions/ppvresources.html

http://www.scisoc.org

The fact sheets and these web sites should provide most of the practical information about the disease that is currently available.

As mentioned previously, details of a survey to be conducted in Ohio are not currently available. It is highly likely that orchards selected for the survey will be those that have purchased stone fruit trees from Adams County Pennsylvania in the last 6 to 8 years. As information becomes available, we will make every attempt to inform Ohio stone fruit growers.

The following information about the history and distribution of the disease was taken from the Penn State Fact Sheet:

"The disease referred to as plum pox was first reported in 1915 in Bulgarian plums. Sharka is the Slavic name for plum pox and is the most widely used common name for the disease around the world. At first, the disease spread rather slowly northward through eastern Europe, reaching the former Yugoslavia in 1935 and Hungary about 1941. It spread more rapidly after about 1950, reaching Germany in 1956, Poland and Russia in 1961, and France in 1970. In 1984, Spain became the most recent western European country to be invaded by plum pox.

Throughout Europe, plum pox is considered the most devastating disease of stone fruits. It has been estimated that over 100 million European trees are infected. Plum pox continues to spread eastward in Eurasia and southward along the Mediterranean coast of Africa. In 1992, plum pox symptoms were first detected in the Western Hemisphere, in Chile.

At this time, the only identified occurrence of plum pox in North America is localized in a small number of orchards in Adams County, Pennsylvania. Because of the localized nature of this infection, it is hoped that eradication may be successful in eliminating this pocket of plum pox virus in North America."

## Elevate 50WDG - A New Fungicide For Botrytis Fruit Rot Control (Gray Mold) on Strawberry

*Source: Michael Ellis, Department of Plant Pathology,The Ohio State University, OARDC, Wooster*

Botrytis fruit rot (gray mold) can be a very serious disease of strawberry. Fungicide applications during bloom are highly effective for control. Two of the most effective fungicides for Botrytis control have essentially lost their registration for use on strawberry. These are Ronilan and Rovral. The registration for Ronilan was withdrawn by the company, and Ronilan cannot be applied to strawberries after January 30, 2000. Although Rovral is still registered for use on strawberry, the new label states "Do not make more than 1 application per season, and do not apply Rovral after first fruiting flower." Due to the fact that applications during bloom are critical for control of Botrytis, the new Rovral label makes it ineffective for control. The loss of these fungicides could pose a serious threat to strawberry production. Fortunately, a new fungicide with good efficacy against Botrytis fruit rot was registered in 1999 for use on strawberry. Elevate 50% water dispersable granules (fenhexamid) is currently registered for use on strawberry. I am recommending that Elevate replace Ronilan and Rovral in the strawberry spray program for control of Botrytis Gray Mold. It is registered for use at 1.5 lbs per acre. The label states, "Do not apply more than 6 pounds of product per acre per season." Elevate can be applied up to and including the day of harvest (0-day PHI), and has a 4 hour re-entry period.

As was the case with Ronilan and Rovral, it is important that Elevate be combined with a protectant fungicide such as Thiram or Captan in each application. This is primarily to help prevent the development of fungicide resistance in Botrytis to Elevate. In addition, the combination provides a wider spectrum of disease control.

Benlate and Topsin-M are both still registered for Botrytis control in strawberry, and I feel they should be incorporated into the spray program. It is important to remember that bloom is the critical time to spray for Botrytis control. Especially in wet years, thorough coverage of all blooms is important. I recommend applications of Benlate or Topsin-M plus a protectant (Captan or Thiram) alternated with applications of Elevate plus a protectant (Captan or Thiram) throughout bloom. If conditions are wet during bloom, sprays should be made on "at least" a 7-day interval. If conditions are dry, the interval can be lengthened. If conditions are very dry, no fungicide is generally required.

These recommendations are available in Bulletin 506B-2, "Ohio Commercial Small Fruit and Grape Spray Guide" and can be obtained through your county extension agent.

**Special Note:** Old product of Ronilan cannot be used on strawberry under any circumstances. To the best of my knowledge, old product of Rovral (with the old label) can be still used on strawberry. Rovral and Ronilan are still registered for use on brambles for Botrytis control.

## Fruit Observations

**Site: Waterman Farm, Columbus**
*Source: Dr. Celeste Welty, OSU Extension Entomologist*
*Traps used: STLM=wing traps, others=Multiphers*

**Apple:** 3/22 - 3/29

Redbanded leafroller: 13
Spotted tentiform leafminer: 348

**Peaches:**

Oriental fruit moth: 0

Fruit Development:
3/22: Delicious and Liberty were at 1/4 inch green, Melrose and Jonafree at early green tip.
3/29: Delicious and Liberty were at tight cluster, Melrose and Jonafree at 1/2 inch green.

**Site: Wayne County**
*Source: Ron Becker, Program Assistant, Agriculture & IPM, Ohio State University Extension*

**Apple: 3/22 - 3/29**

Redbanded leafroller: 62
Spotted tentiform leafminer: 40

The monitor showed no scab infection periods with a low of 33 degrees. Apples are still at half inch green, with peaches at pink (a few blossoms open here and there).

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