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THE OHIO STATE UNIVERSITY Newsletter Extension

Fruit ICM News

Volume 6, No. 9
April 11, 2002

In This Issue:

Calendar

May 23: Plasticulture Strawberry Field Night, Southern State Community College, U.S. Rte. 62 North, Hillsboro, Ohio. Program includes winter protection trial, date of planting study, cultivar trials, bed shaper study, specialty equipment, overhead irrigation, trickle irrigation. For more information contact Brad Bergefurd at 740-289-3727 or bergefurd.1@osu.edu.

July 10: Ohio Fruit Growers Society Summer Tour, Hirsch Fruit Farm, Chillicothe, OH. For information about the Ross County/Chillicothe area check out http://www.visithistory.com.

Options for San Jose Scale Control on Apple

Source: Celeste Welty, OSU Extension Entomologist

Scale infestations are being reported from many Ohio apple orchards. A good way to start a scale control program is with a dilute application of superior oil in the early spring. Although oil will help control scale as late as tight cluster, oil is most effective if applied much earlier, before buds swell. Once buds swell, the scale insects develop thicker layers of waxy covering and thus they become less susceptible to

suffocation by oil.

If oil is not used or is not adequately controlling the problem, then the new insecticide Esteem can be used either prebloom or when crawlers begin emerging. Esteem is an insect growth regulator made by Valent. In 2000 it was available as a liquid 0.86EC, but it is now sold as a 35WP used at 4 to 5 oz/A. For scale control, Esteem can be applied any time during the delayed dormant period through pink; when applied earlier in this period (half-inch green) it also helps control rosy apple aphid, or if it is applied later in this period (at pink) it helps control leafminer. At half-inch green it is supposed to work better when applied with oil, but it can be applied alone.

Application of Esteem pre-bloom is more likely to give good scale control than when crawlers are targeted. When crawlers begin emerging, which is usually in early June in central Ohio, they can be targeted by insecticide (Esteem or Provado or diazinon 50WP), but control of crawlers is generally less effective than control prebloom because emergence of crawlers is spread out over a period of many weeks. Note that Provado does have scale crawlers listed as a target pest on the label, but we missed listing this in our Ohio tree fruit spray guide.

New Insecticide

Source: Celeste Welty, OSU Extension Entomologist

Aventis CropScience has announced the federal registration of Assail, a new insecticide for use on apples, pears, and other pome fruit. It is a general use product, not restricted use. The active ingredient in Assail is acetamiprid. This AI is in the neonicotinoid family, which also includes Provado and Admire. Assail is similar to Provado in controlling aphids and other sucking pests, but Assail has a broader spectrum of activity that includes some caterpillars such as codling moth. Assail is formulated as a 70 WP. Assail controls tentiform leafminer at 1.1 oz/A, aphids and leafhoppers at 1.1 to 1.7 oz/A, pear psylla at 1.0-3.4 oz/A, and codling moth at 1.7-3.4 oz/A. The pre-harvest interval is 7 days and the re-entry interval is 12 hours. There is a limit of four applications per year.

Sprayable Pheromone Source

Source: Celeste Welty, OSU Extension Entomologist

The sprayable pheromone products made by 3M Canada and formerly marketed by Rohm and Haas Co. will now be marketed by Certis USA (formerly Thermo-Trilogy) of Columbia, Maryland. These pheromone mating disruption products are available to target oriental fruit moth, leafrollers, codling moth, and grape berry moth.

Weather and Winter Hardiness: Raspberries

Source: Richard C. Funt, OSU Department of Horticulture and Crop Science

Everyone is talking about the weather. November, December, and January (2001-2002) had the warmest weather on record. The average daily temperature was about 7^0F higher than normal for Ohio.

Weather is one factor in plant hardiness and cold injury. Cold injury is generally referred to when plants have not entered a stage known as rest (true dormancy). Once brambles receive a specific number of hours of chilling (32^0 to 45^0F) and overcome dormancy, they begin to grow again. Bramble cold injury can occur after warm, wet conditions in November before dormancy. Spring thaws (even a January thaw - January, 2002 had 10 days of thaw) and cold March weather can cause serious damage after dormancy. Ohio growers have reported early and mid-March 2002 low temperatures of $+3^0$F and $+18^0$F. At these temperatures some cold injury is expected, especially on black raspberries and blackberries.

During December, January, and/or February brambles are in dormancy near the 40^0 latitude (Columbus, Ohio = 40 degrees or the same as Peoria, Illinois). Depending on type and cultivar, raspberries require 800 to 1700 hours of chilling and blackberries require 350 to 600 hours. While in dormancy, raspberries can survive temperatures of -10^0F to -20^0F. After chilling hours have been met and plants have had warm days and nights of 42^0F or higher, damage may occur below $+20^O$F.

Over a 45-year period (1951 to 1995) Illinois researchers found that in Peoria, 500 chilling hours never occurred before November 28 nor later than December 6. Based on this research it can be concluded that plants in Ohio were susceptible to cold temperatures and injury in March. Furthermore, 1,500 hours of chilling would not have been met until April 16th (Peoria data). By January 29, 2002, Wooster, Ohio had 1450 hours of chilling. Therefore, those plants in central Ohio requiring 1,500 chilling hours were probably still dormant on or about February 1, 2002. However, they could have been susceptible to cold injury as temperatures dropped below 10^0F in March, because the 1,500 chilling hours had been met and warm temperatures may have caused plants to grow resulting in injured plants.

For some blackberries that require 500 hours of chilling, cold injury could occur as early as December. For raspberries that require 1500 hours of chilling, cold injury could occur as early as mid-February.

The outside of the plant may show discolored laterals and stems when cold injury occurs. The inside of the stem (cut across) will be brown or black on one side or completely across. Healthy plants will be a normal red to reddish brown and green just inside the outer edge. As shoots emerge, some vegetable buds never grow, some grow to several inches and collapse, and some produce flowers but fruits never mature. Some shoots or new canes may grow normally. A complete assessment of cold injury is not generally made until late May or June.

Ohio Strawberry Plasticulture Advisory Newsletter Vol.1, No.1

Source: Brad Bergefurd, Editor & Extension Agent, Horticulture, Ohio State University South Centers

Why an Ohio Plasticulture Strawberry Advisory Newsletter?

The OSU South Centers began work on Plasticulture strawberries on a limited scale in the fall of 2001. Experiments went in at the OSU South Centers, Piketon Research facility and at the Hillsboro field office located at Southern State Community College. Interest in Plasticulture strawberries was sparked

by work done in North Carolina by Dr. Barclay Poling. Through Dr. Polings' work, many growers very similar in acreage size to southern Ohio farmers are generating good cash flows with the addition of Plasticulture strawberries to their farming operations.

An integral part of this success in North Carolina with Plasticulture strawberries has been Dr. Poling's use of the BERRYagent, Strawberry Advisories. These timely electronic advisories have been an excellent tool for quick and efficient communication among Extension agents, university specialists, industry and growers. The Advisories have also been an excellent tool for our Ohio growers as well as research and Extension people to educate us in the ever-changing arena of Plasticulture strawberry production.

By being the editor for the newsletter I definitely am not saying that I know ALL about the production of Plasticulture strawberries, in fact I am learning daily myself. By writing this newsletter it will hopefully facilitate communication and delivery of timely information among growers that are currently producing Plasticulture strawberries and to those who may have an interest in growing Plasticulture strawberries, as well as providing Ohio Agricultural Extension Agents a tool to be used in the field with growers who may have questions on Plasticulture strawberries.

With this being the pilot of the Ohio Plasticulture Strawberry Advisory Newsletter, we are open to and encourage your comments and feedback as to your own personal observations and how we can make this newsletter better to help you. By sharing our observations and experiences we can help each other out and learn from each other. Please feel free to contact me at <bergefurd.1@osu.edu>, at my Piketon office 1-800-297-2072, at my field office in Hillsboro 1-800-860-7232 Ext. 2737 or on my cell phone at 740-253-0998 if you have any comments, suggestions or questions. By working together, we can make Plasticulture strawberry production a success for Ohio growers!

Piketon research site observations:

At Piketon we have a winter protection study looking at the effects of using .9-mil row cover, 1.5-mil row cover, straw mulch, and no protection as our treatments. With the forecast for much warmer temperatures, all row cover treatments were removed on the afternoon of Friday March 29th. Some of the plants were beginning to show some open blooms, which were damaged from temperatures in the low 20's earlier in the week. Overall growth on this trial looks good. Note that the rows that had no protection have more "burnt" leaf edges from the cold winds, but really do not look too bad, due to the very mild winter we have had.

This week (April 1-6) at Hillsboro and Piketon, the OSU South Center's Horticulture staff are cleaning off any dead leaves and frozen blossoms from the plants, pulling any winter annual weeds that may have come up through our plastic holes (chickweed and henbit especially), spraying Poast herbicide to kill ryegrass (it has not quit growing all winter), collecting and sending leaf samples into the lab for nutrition and tissue sampling of major and minor elements, beginning injection of fertilizer through drip system (depending on outcomes of the leaf analysis) and watching the low temps forecast, to reapply our row covers for freeze protection. **(Note: We have decided to reapply the row covers this afternoon 4/3, at our Piketon site due to a forecast of 23 degrees tonight)**. We will also be scouting our fields for mites (haven't found any yet) and will be applying an application of Quadris fungicide immediately following clean up.

Hillsboro research site observations:

The field trials at our Hillsboro site seem to be 7 to 10 days behind our Piketon site. The Piketon site is

roughly 50 miles further south than Hillsboro. Everything seems to be a little further along in the southern growing areas. Since our planting at Hillsboro seemed to be lagging behind in growth, we had left our row covers on until Monday April 1st. Outside temperatures reached 60 degrees and the sun was out bright. In the afternoon we used our newly purchased digital thermometer (that Dr. Poling suggested we get) and took readings under our row covers. Outside air temperatures were at 60 degrees. To our surprise, temperatures under the .9 mil row cover had approached 85 - 89 degrees, whereas under the 1.5-mil row cover, temperatures readings were 74-76 degrees. We thought it should have been the other way around, but remembered that Mark Reddick from Reddick Fumigants in Williamston, North Carolina had told us the lighter weight row covers allow more light to penetrate, thus allowing the black plastic and temps. to be much higher. Needless to say we pulled off row covers at Hillsboro that afternoon. They are only forecasting a low of 27 degrees here tonight (4/3), so we have decided to keep the row cover off for now. We are also putting the finishing touches on the overhead irrigation systems to be ready for frost protection at both Hillsboro and Piketon sites.

Ohio Plasticulture Strawberry Field Experiments being conducted:

Following are the field experiments currently being conducted by the OSU South Centers. Funding and contributions for this research have been graciously provided by the Ohio Fruit Growers Society, Ohio Vegetable and Small Fruit Research and Development Program, Mitchell Wrenn of Strawberry Hill, Inc., David Lankford of Davon Crest, and Mark Reddick of Reddick Fumigants. A **BIG THANKS** to Dr. Barclay Poling, Extension Small Fruit Specialist, NC State. Without his assistance, suggestions, and great help we would not be where we are today with our Ohio Plasticulture Strawberry work.

Hillsboro:

- Winter Protection trial (.9, 1.5 mil row covers, straw mulch , no protection)
- Eastern and Western Plasticulture Strawberry Variety trial
- Plasticulture Strawberry Date of Planting trial
- Comparison study of 8 inch vs. 4 inch raised beds on Plasticulture strawberries
- Zip Tunnel observation trial

Piketon:

- Winter Protection trial (.9, 1.5 mil row covers, straw mulch, no protection)

Plasticulture Strawberry Field Night
6 P.M., Thursday, May 23, 2002

Program:

- Winter protection trial for Plasticulture strawberries.
- Date of planting study for Plasticulture strawberries.
- Eastern and western Plasticulture strawberry cultivar trial.
- Comparison study of two different bed shapers used for Plasticulture strawberry production.
- View specialty equipment, overhead irrigation, and trickle irrigation used for Plasticulture strawberry production.

Location:

Southern State Community College, US Route 62 North, Hillsboro, Ohio. Admission is free. Light

refreshments provided. For information, contact Brad Bergefurd at 740-289-3727 or bergefurd.1@osu.edu or Thom Harker at 740-289-3727 or harker.7@osu.edu.

Managing Fungicide Resistance in Apple Orchards

Source: Dave Rosenberger, Wolfram Koeller, and Bill Turechek, Plant Pathology, Highland and Geneva, Scaffolds Fruit Journal, Volume 11, No. 4

Over the past 30 years, the apple scab fungus has developed resistance to dodine (Syllit), the benzimidazoles (Benlate, Topsin M), and the SI fungicides (Nova, Rubigan, Procure). The first indications from orchard tests clearly indicate that the new strobilurin fungicides (Sovran and Flint) will not be exempt from resistance. This article outlines recommendations for minimizing further selection for resistance and suggests strategies for controlling scab in orchards where many of the fungicides mentioned above are no longer fully effective.

Apple scab has never developed resistance to any of the "contact" fungicides, a broad grouping that includes copper, the EBDC fungicides (mancozeb, Polyram), captan, the other carbamates (ferbam, thiram, ziram), or sulfur. The contact fungicides are multi-site inhibitors. That means that they disrupt several metabolic pathways in fungi, thereby making it difficult for the fungus to circumvent the action of the fungicide. Contact fungicides prevent spores from germinating on the surface of susceptible tissue, be it leaves or fruits. Once spores are allowed to germinate and to infect tissue beneath the surface, contact fungicides can no longer control the infections.

By comparison, dodine, the benzimidazoles, the SI's, and the new strobilurins can stop the scab fungus after apple tissue has already been infected. Therefore, these fungicides are effective when applied on a post-infection schedule (in the absence of resistance, of course). These fungicides arrest fungal development by interfering with a single critical metabolic pathway in the fungus, but resistance develops when the target fungus develops mechanisms for bypassing the blocked pathway. The mechanisms used to bypass the fungicide activity are different for the different fungicide groups. Initially, the number of resistant strains will be very low and will not compromise good control of scab. Because they survive treatment, however, they will multiply more rapidly than sensitive strains and will increase in proportion over time. At some point, they will cause scab even though the fungicide has been applied at the same rates and timings that provided good control in previous years. The goals of anti-resistance measures are to slow the build-up of resistant strains and to control existing resistant strains by using other fungicides that are still effective.

For the SI fungicides, Wolfram Koeller and Wayne Wilcox have demonstrated methods for slowing the expansion of SI-resistant populations and for controlling resistant strains that escape. SI-resistant strains are not immune, and many of them can still be controlled by using a high rate of SI fungicides. However, the level of control will still be less than for the sensitive strains and a contact fungicide must therefore be included in tank mixes to control SI-resistant strains. This strategy has worked well for more than a decade in many orchards. We have tested orchards where SI+contact fungicide tank mixes have been used in a regular program for 12 years, and scab in several of these orchards remains fully SI-sensitive. However, we have also identified orchards in which scab is fully resistant to the SI's. In the latter group of orchards, the SI's were routinely used in post-infection applications and not always in mixtures with contact fungicides. The current situation in most New York orchards is somewhere in between these two extremes, with scab populations that are neither fully SI-sensitive nor fully SI-resistant.

The new group of strobilurin fungicides (Sovran, Flint) provides an alternative for reducing selection pressure for SI resistance. Of course, two questions are important: How fast will the strobilurins develop resistance by themselves, and do they control SI-resistant strains as effectively as SI-sensitive strains? Proactive research conducted in Wolfram Koeller's lab and in cooperation with Wayne Wilcox has shown that development of resistance to strobilurin fungicides is more complex than it has been with previous classes of fungicide chemistry. Following are their essential findings and predictions:

1. There is no doubt that scab will develop resistance to the strobilurin fungicides. Lab experiments, orchard trials, and experiences from Europe suggest that development of resistance will proceed in two phases.

First, scab strains that are not entirely immune to the strobilurins will emerge. As with the SI's, these strains will still be controllable by using higher strobilurin rates. In the second phase of resistance development, strains that are totally immune to the strobilurins will slowly emerge. How long will the first phase last? The first phase lasted for five years in Europe, and it still persists in a large majority of European orchards. Preliminary laboratory tests suggest that dependence on post-infection applications (especially applications >48 hour post-infection) might speed the development of strains immune to strobilurins.

2. Do the strobilurins control SI-resistant strains as effectively as SI-sensitive strains? Not necessarily. Scab isolates that are resistant to SI fungicides are somewhat less sensitive to post-infection activity of strobilurin fungicides. Where minimum label rates of strobilurin fungicides were applied in fully SI-resistant orchards, SI-resistant strains were not controlled as well as the SI-sensitive strains. At maximum label rates, the strobilurins controlled both SI-resistant and SI-sensitive strains equally well. This means that using low rates of strobilurins at post-infection timings will maintain selection pressure for SI resistance and that post-infection sprays of strobilurins may not perform well in orchards with SI resistance.

3. The strobilurin fungicides remain fully effective against SI-resistant scab when the strobilurins are used as protectants. This means that the strobilurins are not cross-resistant to the SI's because only the post-infection activity of strobilurins is compromised when they are applied to SI-resistant populations of apple scab.

The discovery that there is some linkage between strobilurin activity and SI resistance impacts the usefulness of strobilurins as tools for managing SI resistance. To conserve their usefulness, strobilurins should be applied at rates in the upper half of the rate ranges indicated on the product labels whenever they are used in post-infection timings.

Increased emphasis on resistance management for apple scab is warranted, because in orchards where dodine, benzimidazoles, and SI's are no longer effective, the strobilurins represent the last currently known chemistry that can provide any post-infection control of scab. Strobilurin resistance that resulted in total loss of post-infection activity would leave some growers with nothing but contact fungicides to control scab. Contact fungicides used alone are very unforgiving, precisely because they lack post-infection activity. Thus, growers have a great incentive for preserving strobilurins (and SI's where they are not already compromised). These chemistries represent the only remaining tools that have the post-infection activity necessary for emergencies and for suppressing "escapes" (i.e., those few infections that escape control by protectant fungicides or by strobilurins and SI's used in preventive programs).

Key strategies for avoiding problems with fungicide resistance include the following:

1. *Emphasize preventive fungicide timing*. Over the past decade, various "IPM strategies" have been developed to reduce fungicide use by omitting early sprays in low-inoculum orchards, by using a 4-spray SI program that often stretched the interval between pink and petal fall sprays, or by using electronic scab predictors to time post-infection SI sprays. In retrospect, we believe that these programs often contributed to rapid selection for SI resistance, especially when they were used in high-inoculum orchards. The party is over: We now need to revert to more conservative scab-management programs to preserve fungicide activity.

Spraying preventively means the first scab spray should be applied early enough to ensure that no infections become established on young foliage. Sprays should be applied ahead of predicted infection periods rather than regularly depending on post-infection activity of the fungicides. Spraying preventively utilizes the strength of the strobilurin fungicides as spore germination inhibitors and the strength of the contact fungicides in SI+contact tank mixes. It also ensures that pathogen populations will remain low and that resistant strains will be controlled rather than left to "run wild". When used in post-infection spray timing, however, contact fungicides in tank mixes will not reduce selection pressure for resistance, nor will they control resistant strains.

The most rigorous preventive timing would involve spraying on a regular 5-7-day interval to ensure that new leaves are always protected ahead of any infections. In orchards with SI resistance, this level of preventive spraying may be needed unless growers believe that higher label rates of the strobilurin fungicides are more cost-effective than reducing the spray intervals. In orchards where the SI fungicides are still working, we believe that a 10-day spray interval is still OK when using strobilurin and SI+contact fungicides in rotations or alternations. However, remember that protection from these fungicides only lasts about 6-7 days. (The last 3-4 days in a 10-day schedule are dependent on the post-infection activity of the strobilurin or SI.) Therefore, if scab is still active when switching from a 10-day program to a contact fungicide, the contact fungicide should be applied within 6-7 days of the last strobilurin or SI+contact application.

2. *Plan to use strobilurin or SI+contact fungicides beginning at tight cluster or pink*. This is another aspect of preventive spraying that will help to ensure complete control of primary scab and mildew. Beginning mildew control at petal fall worked well in the early years of SI use, but it is no longer recommended.

3. *When post-infection activity is needed, use higher rates*. This is true for both strobilurin and SI fungicides. Using the low label rates on a post-infection basis is a recipe for disaster. ("High rates" mean at least the middle of the rate range given on the SI and strobilurin product labels.)

4. *High rates of strobilurins may reduce selection for resistance more effectively than low strobilurin rates mixed with contact fungicides*. Koeller points out that the high rates of strobilurins provide the best post-infection and protection activity. Low rates plus a contact fungicide may provide equal or better protectant activity, but the contact fungicide cannot compensate for the selection pressure exerted by the low rate of the strobilurin. However, Rosenberger suspects that a contact fungicide such as mancozeb or captan may redistribute to new foliage more effectively than strobilurin fungicides. If that suspicion is correct, then the redistribution of the contact fungicide applied as part of a tank mix would prevent infections on newly-emerged (and therefore unsprayed) foliage that would otherwise be controlled only via post-infection activity of the next SI or strobilurin spray. The jury is still out on whether growers should spend the extra dollars to buy a higher rate of a strobilurin used alone or whether they should buy a contact fungicide to use with the strobilurin.

5. *Alternating strobilurin and SI+contact sprays is better than using blocks of two or three sprays* before switching to the alternative chemistry. We are not certain why that is true, but we seem to get more

effective disease control. More effective disease control means less selection pressure because there is less chance of generating secondary inoculum in trees. In orchards where SI's are no longer effective, the key to effective scab control will be preventive timing, a tighter spray interval, and higher rates of strobilurin fungicides any time that post-infection activity is needed. Using a delayed-start program followed by low rates of strobilurins on a 10-day schedule will likely result in control failures where SI-resistant scab strains are present at high numbers. It will also speed the development of resistance to the strobilurins.

Resistance management strategies for apple powdery mildew are based on the same principles as those used for apple scab. The only problem with mildew is that none of the contact fungicides have mildew activity. Therefore, there is even more reason to start early and use higher rates of SI and strobilurin fungicides where mildew is a problem. "Starting early" with mildew means including a mildewcide beginning at about tight cluster and certainly no later than at pink. For apple growers, managing resistance and selecting appropriate fungicides is difficult because there is no way to predict existing levels of resistance to the various fungicides within individual orchards. The proportion of fungicide-resistant scab strains varies from region to region and from orchard to orchard within regions. Even where resistant strains are present, the fungicides may still appear effective if the size of the resistant population is still low. Diagnosis of resistance problems is largely based on field experience. However, fungicide resistance can be implicated in control failures only in those cases where growers can verify that sprays were well timed, that spray coverage was excellent, and that appropriate rates of the fungicide were used.

Pest Phenology

Coming Events	Degree Day Accum. Base 50F
Pear psylla adults active	0 - 49
Pear psylla 1st oviposition	1 - 72
Redbanded leaf roller 1st catch	5 - 251
Green fruitworm 1st catch	9 - 101
Spotted tentiform leafminer 1st catch	17 - 251
Tarnished plant bug active	34 - 299
Oriental fruit moth - 1st adult catch	44 - 338
Rosy apple aphid nymphs present	45 - 148
Green apple aphids present	54 - 156

Thanks to *Scaffolds Fruit Journal* (Art Agnello)

Trap Report

Site: Waterman Lab, Columbus

Dr. Celeste Welty, OSU Extension Entomologist

Apple: 4/3 to 4/10/02
Half-inch green on April 10, 2002

Redbanded leafroller: 5
Spotted tentiform leafminer: 9

Peach:
Pink bud stage on April 10, 2002

Oriental fruit moth: 0

Degree Day Accumulations for Ohio Sites April 10, 2002

Location	Degree Day Accumulations Base 50F	
	Actual	Normal
Akron-Canton	32	61
Cincinnati	82	127
Cleveland	20	59
Columbus	73	88
Dayton	46	87
Kingsville Grape Branch	13	42
Mansfield	16	62
Piketon	98	142
Toledo	7	47
Wooster	38	54
Youngstown	28	52

SkyBit® Apple Scab Prediction for North-Central Ohio

Observed:
April 8 & 9 - possible infection & damage

Predictions based on weather forecasts:
April 11 - active but no infection

April 12 to 20 - possible infection & damage

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