http://ipm.osu.edu/fruit/index.html

THE OHIO STATE UNIVERSITY Newsletter Extension

Fruit ICM News

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Calendar

April 2: North-Central Ohio Fruit Crops Breakfast, Vanson's Restaurant, Monroeville, OH, 8:00 a.m. Breakfast from the menu, program at 8:45 a.m. Guest presenter Dr. Celeste Welty, Ohio State University Extension Entomology, will discuss control of codling moth and other internal feeders for Ohio apple growers. One hour of credit will be given for private applicator pesticide recertification for Category 4 (fruit). Please bring your license number.

June 25: Ohio Fruit Growers Society Summer Tour, Glen Hill Orchard, 17156 Glen Road, Mt. Vernon, OH. More details later.

Timing Winter Straw Removal in Strawberries

Source: Jeff Kindhart and Tony Bratsch, University of Illinois, Fruit & Vegetable News, Volume 5, Number 4, March 25, 1999, (via March 2003 Berry Notes)

Many strawberry growers have already removed their straw mulch. Growers who have not yet done so should begin examining their plants. A common sign that mulch should be removed is the presence of new growth. Many growers delay mulch removal in an attempt to delay flowering time and avoid frost damage. Unfortunately, this delay has little effect on flowering time and may result in reduced yields.

Let's look at the whole story: To be successful with strawberries in the Midwest it is critical to apply straw over strawberry plantings in the late fall. Straw protects plants from winter cold and dessication

and guards against excessive frost heaving, which can damage the shallow, brittle roots of strawberries. Its other advantages are spring frost protection, weed suppression, and soil moisture conservation. Straw also acts as a barrier between ripening berries and the soil, keeping fruit clean and dry during harvest.

It has often been a question from growers as to ideal timing to apply and remove mulch. Recent research by Dr. Bob Skirvin and Research Specialist Alan Otterbacher at the University of Illinois has given growers solid guidelines for removal of winter straw.

The best way to gauge the timing of straw removal is by soil temperature monitoring. Because most strawberry roots are found in about an 8 inch zone, taking soil temperature to a depth of about one half of the root zone (about 4 inches) is recommended.

In a University of Illinois study, mulch removal timing was evaluated at 38, 43, 48, and 54 degrees F to determine when soils held steady at these temperatures for at least 3 days. In Champaign, these temperatures were correlated with roughly mid March, late March, mid April and late April removal timings, a range of about five weeks. Results from this study indicated that the greatest yields were obtained where mulch was removed when the 4- to 5-inch soil temperature was 40 to 43 degrees F. They also found that even between the earliest and latest dates of removal, early bloom was separated by only 11 days; and first harvest by only 3 days. Thus advantages of early mulch removal to promote early maturity were minimal. However, production was shown to increase by early removal. Late removal (a delay to 54 degrees) actually decreased yields, mainly due to leaf etiolation (elongation under shade conditions) and reduction of leaf area due to sunburning. Crowns were also killed by a delay in straw removal. Again, the ideal 4- to 5-inch soil temperature for straw removal is 40-43 degrees F; in central Illinois, these temperatures were reached by the end of March. This allowed time for leaves to begin growth with little danger of sunburning, and produced the greatest yields. (See the following article for soil temperatures in Ohio.)

Soil Temperatures at Selected Ohio Sites

Source: http://www2.oardc.ohio-state.edu/centernet/weather.htm

OARDC Branch or other Ohio Reporting Station	March 24 - 26 Average Soil Temperature at 4" (degrees F)
Columbus	49.3
Delaware	48.5
Hoytville	46.8
Jackson	52.4
Kingsville	45.5
Oxford	53.4
Piketon	58.8
South Charleston	51.8
Wooster	45.6

Spring Copper Sprays for Fruit Diseases

Source: Dave Rosenberger, Plant Pathology, Highland, Scaffolds Fruit Journal, Volume 12, No. 2, March 24, 2003

Copper sprays can be applied in early spring to control several important diseases on tree fruits. On apples, pears, and quinces, copper applied at green tip can help to suppress fire blight in orchards where blight was present in either of the two previous years. A copper spray between bud swell and bud burst can be used to control peach leaf curl on peaches and nectarines. On sweet cherry, tart cherry, and apricot, a copper spray at bud burst can help to suppress bacterial canker.

Which copper product should I use?
A recent search of the New York State pesticide registration database showed that 19 different copper products are currently registered on tree fruit crops in New York State. The crops, diseases, and application timings listed vary greatly from one product to another. **When using copper sprays, users must read the individual product label to ensure compliance with label restrictions.**

Of the 19 copper products registered for use on tree fruits, 11 products are formulations of copper hydroxide, and four are formulations of copper sulfate. Cuprofix MZ Disperss and Mankocide are copper products formulated with mancozeb. Clean Crop C-O-C-S is a mix of copper oxychloride and copper sulfate, and Tenn-Cop 5E is a mix of copper salts of fatty and rosin acids.

For tree fruit applications, "fixed" coppers usually work better than copper sulfate applied alone. The term "fixed" copper refers to copper products that are formulated or tank-mixed in such a way as to create relatively insoluble or "fixed" deposits of copper on plants. Copper ions are gradually released from these deposits when plants are wet, and it is the copper ions that control diseases. Copper ions can also cause phytotoxicity to the treated crop if the concentration of copper ions is too high. Because copper ions are released slowly from the spray deposits created by fixed copper sprays, the fixed coppers are less phytotoxic to plants and provide better residual activity against diseases than can be achieved with a non-fixed form of copper.

Copper hydroxide and copper oxychloride are both fixed coppers, whereas copper sulfate is not. If copper sulfate is mixed with spray lime to make a Bordeaux mixture, then the copper sulfate and calcium in the lime react together to form a fixed copper. Product labels for products containing copper sulfate can be confusing: The label for the new copper fungicide Cuprofix Disperss indicates that the formulation is 36.9% basic copper sulfate, so one might assume that this is not a fixed copper and that it will therefore lack the residual activity found in fixed coppers. However, Cuprofix Disperss is formulated with gypsum, a carrier that contributes the calcium ions needed to convert the copper sulfate into a fixed form of copper, and it therefore should work as well as any of the other fixed copper products.

What is the best product for any given application? Research in other cropping systems has shown that the biggest factor affecting efficacy of fixed coppers is the amount of elemental copper that is applied. This means that so far as efficacy is concerned, products can be selected based on the cost per pound of elemental copper. However, some of the liquid formulations or finely ground dry formulations may go into solution more easily in the sprayer tank than older and coarser formulations. Convenience for measuring and mixing should also be a consideration when deciding which product to purchase.

Copper sprays for pome fruits
A copper spray applied at the green-tip bud stage has been recommended for more than 40 years as part of a fire blight control strategy for apples and pears. Copper residues on the twigs and branches kill bacteria as they are released from over-wintering cankers. Cankers usually begin releasing bacteria when

trees are at the pink or bloom stages. However, copper must be applied at green tip to avoid the phytotoxicity that can occur with later applications. In years when more than three inches of rain occurs between the copper application and full bloom, the efficacy of the copper spray may be reduced because much of the copper residue will have been depleted before over-wintering cankers release bacteria.

In years when little or no rain occurs between the green-tip copper application and bloom, fruit may develop copper-induced russetting because too much copper residue will still be present at bloom. To avoid the potential for phytotoxicity on apples, the copper rate should be reduced for any applications made after green-tip, and no copper sprays should be applied to apples after half-inch green unless the block is intended for processing and fruit russetting is not a concern.

Copper sprays applied to control fire blight may also help to suppress superficial bark cankers caused by *Botryosphaeria* species. In orchards where only EBDC fungicides (mancozeb, Polyram) and SI fungicides (Rubigan, Nova, Procure) are used for prebloom scab control, trees may gradually develop a severe "rough bark" symptom that we believe is caused by *Botryosphaeria dothidea* or other *Botryosphaeria* species. These pathogens affect only the outer bark and only rarely cause necrosis that extends into the cambium. However, the superficial cankers can quickly extend into the cambium when apple trees are under extended drought stress. The effects of this rough-bark condition on productivity are not known, and the optimum spray timing for controlling this disease has not been determined. However, we know that EBDC and SI fungicides do not control *Botryosphaeria* species and that the rough-bark disease has appeared primarily in orchards where these fungicides were used in prebloom sprays. Copper, captan, Sovran, Flint, and Topsin M are all effective against *Botryosphaeria* species. An application of copper at green tip may be the most economical approach for suppressing the rough-bark disorder.

Copper sprays for stone fruits
Copper sprays applied either at leaf fall in autumn or as a dormant spray in spring have been very effective for controlling bacterial canker (*Pseudomonas* species) on sweet cherries and leaf curl (*Taphrina deformans*) on peaches and nectarines. An application of copper at bud burst on apricots may also help to prevent the severe bud blast that can occur if apricots are colonized by *Pseudomonas* during a cool wet spring when a light frost occurs during bloom. In some years and locations, the combination of *Pseudomonas* and light frost has caused nearly 100% kill of apricot flowers and foliage. Although no research has been conducted on the efficacy of copper sprays for preventing such damage, copper residues from a spray at bud burst should help to suppress bacterial populations that contribute to spur death following frost events.

In the Hudson Valley, at least one grower has stopped using the spring application of copper on sweet cherries because of concerns that copper residues might reduce fruit set on the treated cherry trees. Copper is toxic to pollen, and the earlier flowering date for cherries as compared with apples increases the likelihood that copper residues from spring applications could interfere with pollination. Effects of copper sprays on fruit set are not a concern on apricots, peaches, and nectarines where extensive fruit thinning is usually required after bloom.

Over a Barrel

Source: Art Agnello, Entomology, Geneva, *Scaffolds Fruit Journal, Volume 12, No. 2, March 24, 2003*

After the passing of what many growers have been describing as an old-time winter, we will be fortunate if it is followed by an old-time spring that develops slowly, warms gradually, and contains a sufficient number of stretches of non-stormy weather to allow appropriate early season sprays by those who may

need them for prebloom arthropod control. This would be an optimal situation to consider using petroleum oil, a traditional option that continues to be a wise tactic, despite the fact that a number of newer and capable contact miticides are available for early season use. For as many of the blocks as you can find the time and application window to devote to a thorough treatment, oil retains a justifiably preferred position because of its effectiveness, affordability, and relative safety from a biological and resistance perspective. Exploiting the most acceptable spraying conditions to maximize tree and block coverage can be a challenge in our area, but few pest management efforts have such potentially high returns when everything falls properly into place.

Pear Psylla

It's nearly impossible to be sure your pear trees are all protected by the time the very first psylla adults start flying and (presumably) laying eggs during the first warm temperatures of the spring. However, even a few nice warm days in a row don't waken more than a small percentage of the total population, so you'll be more than adequately psylla-ready if you prepare a little ahead of time, provided your orchard floors aren't too soggy from spring snows.

Early oil applications can be useful against pear psylla all throughout the swollen bud stage. Although it's capable of killing adults and nymphs that are contacted directly, oil is recommended mainly because the residue has a repellent effect on female psyllas looking to deposit their eggs, and this lasts for an extended period after treatment. The strategy behind the use of oil is to delay the timing of any needed insecticide spray until as late as possible before (or after) bloom.

Oil rates depend on when you start: If your buds are at the dormant stage, one spray of 3% oil, or two of 2% through green cluster are recommended. If you start at swollen bud, one spray at 2% or two at 1% up to white bud should be adequate for this purpose, especially if applied as soon as the psylla become active (50°F or above). This will also give some red mite control at the same time.

European Red Mite

A delayed-dormant spray of petroleum oil from green tip through tight cluster can be a favored approach for early season mite control, both to conserve the efficacy of and to help slow the development of resistance to our contact miticides. Our standard advice has been to try for control of overwintered eggs using 2 gal/100 at the green tip through half-inch green stage, or 1 gal/100 at tight cluster; this assumes ideal spraying conditions and thorough coverage.

Naturally, real life doesn't always measure up, mainly because of weather and coverage challenges, coupled with the difficulty of getting to a number of blocks during this transient window. It is possible for mites to start hatching when the trees are at solid tight cluster, so the suffocating mode of action tends to be compromised if the nymphs are able to wade through or avoid the droplets. Let practicality determine how best to use the following guidelines.

- First, to be sure that mites are in the egg stage, start on your blocks as soon as the weather and ground conditions permit, even if this means using a higher rate. Snowfalls have been generally heavy in many locations, so local conditions will be a prime determinant of how easily you can get through the rows early on.
- Also, tend toward the high end of the dosage range, especially if there's been no frost during the 48-hour period before your intended spray, and no danger of one for 24-48 hours afterwards. For example, use 1.5 gal/100 if the buds linger somewhere between half-inch green and full tight cluster during your chosen spray period.

- Naturally, good coverage of the trees is critical if you're to take advantage of oil's potential efficiency; this in turn requires adequate spray volume delivered at an appropriate speed. Experience and research have shown that a 1X concentration (300 gal/A) in larger trees is clearly preferable; however, if all other conditions are optimal (weather, speed, calibration), then 3X, or 100 gal/A, is the highest concentration that should be expected to give acceptable control at any given time. Growers like to concentrate more than this to save time and the hauling of extra water, but reducing coverage too much can wipe out your efforts if you end up getting only a small fraction of the egg population under the residue.

Don't limit this mite-control tactic just to apples and pears. Talks with stone fruit growers over the winter have reminded us that many cherry, peach, and plum plantings can suffer equally seriously from European red mite infestations that weren't given the early season attention they might have needed. We don't have hard and fast threshold guidelines for these crops, but stone fruit plantings with a history of past ERM problems should be examined for presence of the red overwintered eggs. If they're numerous enough to see without a hand lens, then a prebloom application of 2% oil would be a prudent measure to help stave off this damage.

Scaling Up?

We've been discussing how some of the recent insecticide withdrawals and restrictions may induce a return to the pest profiles of the past, with direct fruit pests taking precedence over the indirect foliar feeders. San Jose scale is one of those old standbys that already has been responding to some of the regulatory actions of the last few years. The disappearance (or restriction) of products like Penncap-M and Lorsban from our list of spray materials has been at least partly responsible for the fact that SJS still presents a challenge in a number of orchards.

It's therefore worth pointing out that a 2% oil treatment at half-inch green will control the nymphs, and this is a preferred treatment if no other problem insects need to be controlled. Combining the oil with an insecticide has not been shown to be more effective than using the oil (or insecticide) alone, except in the case of one new alternative, Esteem, which has shown good efficacy when mixed with 2% oil at the pre-pink timing.

If you choose not to use oil against the scale nymphs, or if you have Rosy Apple Aphid or other early season insects to be controlled, an insecticide would be more appropriate. For both of these pests, Lorsban 4EC or Supracide have proven very effective during the green tip to tight cluster stage. The neonicotinoid Actara has a good fit in apple prebloom programs, owing to its activity against Rosy Apple Aphid in addition to leafminers. Check the opening buds for infestations of Rosy Apple Aphid; treatment would be advisable upon finding one colony per 100 clusters.

Strawberry Plant Establishment

Source: Marvin P. Pritts, Dept. of Hort, Cornell Univ., Ithaca, NY, New York Berry News, Volume 2, Issue 3

Getting plants off to a good start will pay big dividends later when strawberry plants must deal with the stresses of weather and pests. Among the most important steps in site preparation is the elimination of perennial weeds. Few herbicides are labeled for use in established strawberries, and their activity on perennial weeds is limited. Therefore, weeds are most effectively controlled before planting.

Weeds

Weeds cause a greater economic loss than diseases and insects combined. In addition, weeds also encourage the establishment of other pest populations. Eliminating weeds the year before planting is much easier than controlling them later. Too many growers plant directly into a site in which perennial weeds were not eliminated the previous summer, and then spend the next several years trying to find the right combination of herbicides to undo the damage.

Rotation, coupled with the use of a broad-spectrum post-emergent herbicide the summer before planting, is an effective approach. Cover cropping the site again after the herbicide application will further suppress weed growth. Repeated cultivation or covering a site with black plastic for several months are also effective approaches. Growers should begin site preparation 2 or 3 years before the crop is planted to eliminate perennial weeds, especially if organic methods are to be used.

Fumigation at high rates will suppress weeds, although its use worldwide will likely be restricted because of environmental concerns, availability, and expense. In some situations, nematodes, soil diseases, soil insects, or intense weed pressure may justify fumigation. The soil should be friable, warm (>50F) and without decomposing plant material for fumigation to work properly. The best time to fumigate a strawberry field is late summer or early fall of the year prior to planting.

Nutrient amendments

Test the soil for pH, potassium, phosphorus, magnesium, calcium, and boron. Sample soil in a V-shaped pattern within the field, collecting from at least 10 locations. The sample should represent the profile of the top 10-12 inches. Plow the site, add the recommended amount of nutrients, then disc. Because soil testing procedures are not standardized across the region, follow the recommendations from the laboratory where the samples were analyzed. Do not use the test results from one laboratory and the sufficiency ranges from another.

pH. It takes one year for lime to raise, and for sulfur to lower the soil pH, so it is necessary to apply these one year in advance of planting. The more finely ground the sulfur or lime, the faster it will react with the soil. If the soil pH must be increased, a liming agent such as calcite or dolomite should be applied. Liming agents differ from one another in two important characteristics which influence their effectiveness:

- chemical composition, which affects acid neutralizing potential and fertilizer value and
- particle size, which determines liming efficiency and ease of application.

Consider the relative importance of these when selecting a liming agent. For example, even though dolomite has a lower neutralizing value than calcite, it is often used at sites which require supplemental magnesium for adequate fertility. Moreover, finely ground lime is more difficult to apply than coarse particles, but it changes the soil pH more quickly.

Sulfur is effective at lowering soil pH, but time is required for bacteria to oxidize the sulfur into a usable form. Sulfur comes as a wettable powder or prills, with the former reacting faster to lower the soil pH. Aluminum sulfate is sometimes recommended for acidification because it provides an already oxidized form of sulfur, but it is expensive and six times as much is required to do the same job as sulfur. Also, aluminum toxicity can occur with large amounts of aluminum sulfate, so we do not recommend it.

Nitrogen and Phosphorus. Certain nutrients, like phosphorus, are very insoluble in water and move very slowly through the soil. It may take years for phosphorus applied to the soil surface to reach the root zone of the plant and be taken up. For this reason it is imperative to apply a sufficient amount prior to

planting and mix it into the root zone. Animal manures and legumes offer a good source of slowly released nitrogen when incorporated prior to planting. Animal manures are a potential source of weed seeds, however. Manure applied to fields should be well-composted and worked into the soil prior to planting to minimize any risk of fruit contamination from pathogenic bacteria.

Irrigation

The irrigation system should be in place prior to planting because transplants probably will require immediate watering. Any pre-emergent herbicide applied after transplanting will need to be watered in by rain or irrigation to be effective. For these reasons, the irrigation system should be operational prior to planting. Also, in early spring, the irrigation system will be a necessary tool for frost protection.

Preplant cover crops

Seeding a cover crop on the site the year before planting is an excellent way to improve soil structure, suppress weeds, and if the proper cover crop is grown, suppress nematode populations. Benefits of a cover crop are greatest when the soil is sandy and/or the soil organic matter content is low. Most cover crops grow under the same soil conditions as strawberries. Except for additional nitrogen (40 lb/A prior to seeding) and perhaps phosphorus, other amendments are not likely to be required.

Minimum seeding rates are used when the objective is to supply an acceptable stand for harvesting the grain or straw. But when a vigorous, dense stand is desired for weed suppression and organic matter, higher seeding rates are recommended.

Preplant cover crops are usually plowed under in the late fall or early spring prior to planting. Those with low nitrogen contents (grains and grasses) should be plowed under early in the fall to allow adequate time for decomposition, unless the soil and site are prone to erosion. Legumes contain more nitrogen and decompose quickly, so they can be turned under within a month of planting. Many plant species are suitable as preplant cover crops, and each has certain advantages. In some cases, mixtures of crops are used to realize the benefits of both.

Critical Temperatures for Tree Fruits

Source: 1996-1997 Pennsylvania Tree Fruit Production Guide, Penn State Cooperative Extension

The temperature at which fruit buds are injured depends primarily on their stage of development. As flowers begin to swell and expand into blossoms, they become less resistant to freeze injury.

Not all blossoms on a tree are equally tender. Resistance to freeze injury varies within trees as it does between orchards, cultivars, and crops. Buds that develop slowly tend to be more resistant. As a result, some buds are usually killed at higher temperatures, while others are resistant at much lower temperatures. The following shows the average temperatures required to kill 10 percent and 90 percent of buds. Consideration should also be given to weather conditions preceding cold nights. Prolonged cool weather tends to increase bud hardiness during the early stages of bud development.

Stage of	**10% kill**	**90% kill**
Development	**°(F)**	**°(F)**
Apples (Red Delicious)		

Silver tip	15	2
Green tip	18	10
½ inch green	23	15
Tight cluster	27	21
First pink	28	24
Full pink	28	25
First bloom	28	25
Full bloom	28	25
Post bloom	28	25
Golden Delicious and Winesap are approximately 1 degree hardier. Rome Beauty is 2 degrees hardier, except after petal fall, when all cultivars are equally tender.		
Peaches		
First swelling	18	1
Calyx green	21	5
Calyx red	23	9
First pink	25	15
First bloom	26	21
Full bloom	27	24
Post bloom	28	25
Pears (Bartlett)		
Scales separating	15	0
Blossom buds exposed	20	6
Tight cluster	24	15
First white	25	19
Full white	26	22
First bloom	27	23
Full bloom	28	24
Post bloom	28	24
D'Anjou is similar but may bloom earlier and therefore may be more tender than Bartlett at the same date.		
Sweet Cherries		

First swelling	17	5
Side green	22	9
Green tip	25	14
Tight cluster	26	17
Open cluster	27	21
First white	27	24
First bloom	28	25
Full bloom	28	25
Post bloom	28	25

Degree Day Accumulations for Ohio Sites March 26, 2003

Location	**Degree Day Accumulations Base 43 F**	
	Actual	Normal
Akron-Canton	91	72
Cincinnati	176	153
Cleveland	78	70
Columbus	150	102
Dayton	142	101
Kingsville Grape Branch	54	50
Mansfield	86	70
Norwalk	72	60
Piketon	168	168
Toledo	54	54
Wooster	112	68
Youngstown	74	64

Pest Phenology

Coming Events	**Degree Day Accum. Base 43 F**
Green fruitworm 1st catch	36 - 173

Pear psylla adults active	2 - 121
Pear psylla 1st oviposition	25 - 147
Redbanded leafroller 1st catch	32 - 480

Thanks to *Scaffolds Fruit Journal* (Art Agnello)

Fruit Tree Phenology Normal Degree Days (base 43F)

Source: Scaffolds Fruit Journal, September 9, 2002

McIntosh Apple - green tip	93 to 147
Half-inch green	148 to 198
Tight cluster	213 to 251
Pink	273 to 311
Bloom	346 to 420
Petal fall	441 to 529
Red Delicious Apple - green tip	108 to 184
Half-inch green	146 to 208
Tight cluster	221 to 275
Pink	292 to 386
Bloom	368 to 500
Petal fall	470 to 648
Bartlett Pear - bud burst	122 to 212
Green cluster	211 to 265
White bud	255 to 341
Bloom	300 to 400
Petal fall	387 to 497
Sweet Cherry - bud burst	143 to 195
White bud	192 to 244
Bloom	236 to 296

Petal fall	340 to 434
Fruit set	407 to 493
Montmorency Tart Cherry - bud burst	169 to 247
White bud	239 to 297
Bloom	301 to 401
Petal fall	404 to 512
Fruit set	484 to 606

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