scaffolds
FRUIT JOURNAL
Update on Pest Management and Crop Development

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DISEASES

Cu SOMETIME

EARLY-SEASON COPPER SPRAYS (Dave Rosenberger, Plant Pathology, Highland)

❖❖ Early season uses for copper sprays on tree fruits were reviewed in a Scaffolds article several years ago (Rosenberger, 2003). Excerpts from that article have been reproduced below along with additional information on "safe" coppers and on ecological impacts of copper fungicides.

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 apple and pear orchards where fire blight was present in either of the last two years. Copper residues on the twigs and branches release copper ions that kill bacteria oozing from overwintering 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 accumulate between the copper application and full bloom, the benefit of the green tip copper spray may be reduced or completely lost because much of the copper residue will be depleted before overwintering 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.

The green tip copper spray is aimed at reducing fire blight inoculum coming from overwintering cankers. Therefore, the green tip copper spray is not needed in orchards where no fire blight was present in either of the previous two years. Copper can still be used as an apple scab fungicide at green tip, but other fungicides are preferred in orchards where fire blight cankers are not present.

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IN THIS ISSUE...

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. Spring copper applications on peaches and nectarines may also help to suppress bacterial leaf spot, a disease that appears only after shuck split, because the copper may help to cut down on overwintering inoculum.

Dr. Dave Ritchie from North Carolina State University has provided an excellent article about using copper sprays to suppress bacterial spot on peaches (Ritchie, 2004). Bacterial spot is generally less severe in New York than in more southerly regions, so copper applications after the delayed dormant spray may not be warranted for most New York orchards, especially if higher crop values allow for several sprays of terramycin (Mycoshield, Flameout, etc.) during the period of peak susceptibility, which begins at shuck split.

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 prior to a frost at 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.

"Safe" copper sprays? Some copper formulations are marketed as being "safer" than others, meaning that they are less likely to cause phytotoxicity. Reducing phytotoxicity is especially important for fruit and vegetable diseases where copper sprays are applied repeatedly and where copper can therefore accumulate to toxic levels on plant surfaces. "Safe" coppers are of less importance for crops where a single dormant spray is applied, and there is no evidence that these formulations will actually reduce the risk of phytotoxicity on apples.

In a recent article about copper sprays on citrus, Hardy et. al. (2004) pointed out that copper fungicides that are finely ground tend to have better retention on plant surfaces. Finely ground coppers may also be promoted as "safe" coppers. For dormant sprays on tree fruits, selecting a copper fungicide with good retention properties could enhance disease control because longer residuals for copper should translate into an extended period of bacterial disease suppression after the spray is applied. That could be especially important on apples and pears where long residual activity is essential for suppressing fire blight during the prebloom period.

Acids applied to trees that were recently treated with copper can cause a massive release of copper ions, thereby increasing chances that the copper spray will cause phytotoxicity. Therefore, trees treated with a copper fungicide should NOT be sprayed with Aliette or any of the phosphite fungicides or plant nutrients for at least several weeks after the copper spray was applied. The phosphite products include ProPhyt, Phostrol, Nutriphyte, and many others.

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scaffolds
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Ecological impact of copper sprays: Copper fungicides are receiving increasing scrutiny because copper is a heavy metal that can accumulate in soils. Copper has many adverse effects on soil ecology, including damaging effects on earthworms and other soil microorganisms (Van-Zwieten et al., 2004). Most studies on copper accumulation in soils have been done in cropping systems where multiple copper sprays were applied every year for many years (e.g., grapes, bananas, avocados). Nevertheless, the spring copper spray recommended for pome fruit and stone fruit diseases may contribute to gradually increasing levels of copper in soils. Copper sprays should be used sparingly and only where we have no good alternatives for disease control.❖❖

Literature cited:

Hardy, S. Fallow, K, and Barkley, P. 2004. Using copper sprays to control diseases in citrus. Citrus Fact Sheet, New South Wales Dept. Primary Industries, Australia.

Ritchie, D. 2004. Copper-containing Fungicides/bactericides and their use in Management of Bacterial Spot on Peaches. Southeastern Regional Peach Newsletter 4(1), March 2004.

Rosenberger, D. A. 2003. Spring copper sprays for fruit diseases. Scaffolds Fruit Journal 12(2): 3-5.

Van-Zwieten, L., Merrington, G., and Van-Zwieten, M. 2004. Review of impacts on soil biota caused by copper residues from fungicide application. SuperSoil 2004: 3rd Australian New Zealand Soils Conference, 5 – 9 December 2004, University of Sydney, Australia. Website www.regional.org.au/au/asssi/.

QUASH MOUNTS?

THE DEAL WITH SQUASH MOUNTS

(Juliet Carroll, NYS Fruit IPM Coordinator, Geneva)

❖❖ Squash mounts to determine ascospore maturity, discharge, and depletion and their application to apple scab IPM have been the subject of many conversations during my 5 years as the Fruit IPM Coordinator. Discovering that the statement, "before your time, several bushels were collected from Geneva, the leaves were placed in locations (around) Lake Ontario, then maturity and shooting tower tests were conducted" was really WAY before my time made me feel so young that I decided to risk my neck and write an article on the subject for Scaffolds. Ascospores develop in scab-infected leaf litter during late winter and spring. Microscopic ascocarps are teased out of leaves in spring, mounted on glass slides, and squashed to expose their contents.

The apple industry is most interested in when the beginning and the end of the primary scab season occur. The Beginning of the primary scab season is defined as that point in time when the ascospores begin to be discharged from infected, over-wintered leaves, or, "I had better start the scab sprays." The End is defined as the point in time when no more ascospores are discharged, or, "I can stop scab sprays." I might add that many a plant pathologist is also keenly interested in the answer to these hotly debated questions and in defining these time points accurately (for apple scab and many other diseases.)

The Beginning: "I had better start the scab sprays." Can we determine this most effectively and accurately with squash mounts? No, but it can be used as one of the tools in the toolbox. Ascospore maturity information could reduce losses to apple scab and/or reduce fungicide sprays in one of two ways:

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Scenario 1: A squash mount at silver tip reveals mature ascospores and empty asci. Asci are the little sacs that propel the ascospores out of the ascocarps, or as scientists like to call them, pseudothecia (...pseudo what? I digress). If there are 12% or more mature asci at silver tip, then it is very likely that enough ascospores are floating through the air towards your apple trees to place them at risk. If an infection period is in the forecast for green tip, then "I had better start the scab sprays." With a high proportion of mature spores at silver tip, we know that severe green tip infection is possible because spore maturity is running ahead of tree phenology.

This is the scenario that is most in need of being "covered" for improved apple scab IPM, the reason being that the ascospore maturity degree day model uses as its biofix 50% green tip on McIntosh fruit buds. We know, of course, that no pest phenological model is perfect, but in some years ascospores are out before green tip.

Scenario 2: It is green tip and there are no mature ascospores. In this scenario, even if rain is predicted, there is no need to spray because ascospore maturity is delayed compared to tree phenology. The decision "I had better start the scab sprays" is better based on past scab history, forecasted infection events, and fungicide choice.

Plus, this is what the ascospore maturity model assumes, so we are OK with using that. However, there is no action threshold built into the model. When should we spray? ...at 2% maturity? ...maybe at 5%? If we want to save a spray because there are no ascospores flying (I've been spending too much time with the entomologists) then we still need to know what percent of ascospores are "enough-mature" to create an infection risk. Shouldn't we use squash mounts to verify the model is working? Now we are in a circular definition, because the model is based on squash mounts, isn't it? No, actually it is best fit by spore trap data, so in actuality the degree day ascospore maturity model might be better referred to as the ascospore flight simulation (is it a video game? where can I buy it?)

The End: "I can stop scab sprays." Can we determine this most effectively and accurately with squash mounts? No, it is best not to determine the end of the primary scab season from squash mounts. Most ascospore trap studies that have been done in orchards east of the Mississippi find few to no airborne ascospores after petal fall. However, mature asci can still be seen in squash mounts at this time. But, by then the leaf litter is disintegrating, the scab ascocarps are showing signs of colonization by other microorganisms, and their asci are likely unable to propel ascospores into the air. The ascospore flight-simulation by the ascospore maturity model agrees fairly well with this petal fall timeframe. In it, the supply of ascospores is considered depleted at 760 DD base 32°F following a daytime rain. Thus, the ascospore maturity model has long been recognized as the best tool for determining the end of the primary scab season.

Remember, however, one ascospore infection (or primary infection) can generate 100,000 new spores (or conidia) and these become more significant than ascospores at this stage in the season. Watch out for forecasted infection events and look back at past infection events you may have missed. And, like I always say, "if you are out assessing your thinning, keep an eye peeled for scab lesions on those cluster leaves."

So if squash mounts have utility in the early season, why aren't they being done? Want to tease teeny tiny ascocarps out of dead, boiled leaves, squash them on a glass slide and then count the strands of intertwined spaghetti that are slightly brown? Mature. And don't forget to count the spaghetti strands that are clear. Discharged. And you must count those that are not quite done, clear and granular or bumpy-looking. Immature. And, you must mount and squash ten ascocarps and make certain each has a minimum of 120 asci in order to have a valid count for a single location. The process requires judgment, patience and memory. "Did I already count that one?" You can't cross

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them off as you count. Three hours later and you're done. Perhaps looking for anal combs on internal lep larvae isn't so bad after all?!

Another point! There is inherent variability in the results, depending on who is doing the squash mount counts. It takes a while for a technician to learn the technique and become proficient at it. Where are the funds for applied research? Technicians are on soft money and when grants ebb and flow, so does the technical support. It is not cost-effective or logical to hire a new person each year to do squash mounts. A small amount of grant funding would pay for statewide squash mounts (3 hr/count X 10 locations X 3 counts/season), but time devoted to squash mounts coincides with other field research projects. The need for multiple counts on the same date can overwhelm a single evaluator attempting to cover multiple localities.

Squash mount info is most useful from silver tip to half inch green, timed 3 to 4 days before potential infection events and done on leaf litter collected relatively close by. Local observers can monitor bud stages and weather forecasts and collect appropriate, ascocarp-containing leaf litter to optimize squash mount timing. Shipping leaves from distant sites uses up part of the 4-day window and adds the variability of an inexperienced cooperator selecting the leaves to be counted. Before my time, when we had post-infection or pre-symptom fungicides and before widespread resistance to these types of fungicides, scab sprays could be delayed even if apple buds were at green tip or half-inch green. Serious losses can now occur from errors in the squash mount assessments or from extrapolating results to areas beyond the immediate locality where leaves were collected.

So squash mounts are a "before my time" tool that is no longer scientifically justified or economically feasible. What are the alternatives? The Tree Fruit and Berry Pathology Web pages (http://www.nysaes.cornell.edu/pp/extension/tfabp/ascospore.htm) run the ascospore maturity model. But, keep in mind, this model does not account for seasons when ascospore maturity and discharge occur before green tip. Squash mount training anyone?

Acknowledgements: This article was based on conversations with Dave Rosenberger, Kerik Cox, Wolfram Koller, Deborah Breth, David Gadoury, Bob Seem and Wayne Wilcox.❖❖

HORTICULTURE

YOU GET WHAT YOU PAY FOR

FRUIT TREE QUALITY
(Steve Hoying, Horticultural Sciences, Highland)

❖❖ Growers are now starting to receive their tree orders. Over and over again we rant about the importance of planting quality trees and rejecting those that don't meet the grade when planting a new orchard. A "quality" fruit tree is loosely defined as one with sufficient caliper and height. Preferably, it has established scaffold limbs, a healthy and fibrous rootsystem, a standard rootstock shank length, has been budded or grafted, providing a straight shank without a severe bend between the root and the scion, and is completely pest- and disease-free.

Over many years, researchers throughout the world tried to define what a quality tree is, including us. Our research has concluded that:

Large caliper, feathered trees have significantly higher early production than small caliper trees. In our tests, "Sleeping-eye" trees (ones that start in the orchard from a callused bud) performed nearly as well as 7/16" 1-yr.

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spring grafted trees or regular 1/2" whips. Based on these results, we believe that trees smaller than 1/2" should not be planted.

There is a significant difference among feathered trees as well. The more feathers, the better! Well documented research has shown trees with less than 4 feathers will only produce 61% of the early yield of those with 4–10 feathers per tree, and only 48% of those with more than 11 feathers. Early fruit yield is extremely important in the time it takes for an orchard to begin to add to cash-flow and in its overall profitability.

Using a net-present value analysis, we have found that expensive, large caliper, multi-feathered trees are the most profitable of all the tree types when planted at densities from 200–1,000 trees/acre. At the lower densities, well feathered trees are appropriate for the Slender Pyramid planting system; at moderate densities, the Vertical Axis; and at the highest densities, for the Tall Spindle system.

Tree cost rather than tree quality becomes the most important factor when planting systems such as the Super Spindle system using tree densities over 1500 trees/acre. The less expensive sleeping eye trees or 1-yr graft trees are more profitable when planted at these very high densities.

There is often the perception that trees produced on the west coast perform better than those on the east coast. Terence Robinson and Warren Stiles tested this by planting a range of tree qualities from east coast and west coast nurseries. The results showed that performance was directly related to the tree's quality, not the propagation location.❖❖

COVER ALL THE BASES

SOMETHING IN THE WATER

(Art Agnello, Entomology, Geneva)

GENERAL INFO

❖❖ The brief return of winter conditions over the past week has provided us a chance to slow down in our race to get the earliest of the early season sprays applied, and a good opportunity to review some useful advice about the effect of spray water pH on pesticide activity. To review, there may be times when you don't observe the results expected from a pesticide application, even though you used the correct concentration of the recommended material and applied it in the same way that has given acceptable control at other times. Although one may suspect a bad batch of chemical or a build-up of pesticide resistance, poor results may in fact be due to alkalinity — that is, a solution with a pH higher than 7.0. A close inspection of the pesticide label will often reveal a caution against mixing the chemical with alkaline materials such as lime or lime sulfur. The reason for this is that many pesticides, particularly insecticides, undergo a chemical reaction under alkaline conditions that destroys their effectiveness. This reaction is called alkaline hydrolysis, and it can occur when the pesticide is mixed with alkaline water or other materials that cause a rise in the pH.

Hydrolysis is the splitting of a compound by water in the presence of ions. Water that is alkaline has a larger concentration of hydroxide (OH-) ions than water that is neutral; therefore, alkaline hydrolysis increases as the pH increases. Insecticides are generally more susceptible to alkaline hydrolysis than are fungicides and herbicides, and of these, organophosphates and carbamates are more susceptible than pyrethroids. A survey of fruit-growing areas in N.Y.

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some years ago showed that water from as many as half of the sites in western N.Y. had pH values above 8.0. Water at this pH could cause problems for compounds that will break down in only slightly alkaline water, such as ethephon (Ethrel). Compounds that break down at a moderate rate at this pH, such as Carzol and Imidan, should be applied soon after mixing to minimize this process in the spray tank. A smaller number of sites (less than a quarter of them) had pH levels greater than 8.5. Above this level, the rate of hydrolysis is rapid enough to cause breakdown of compounds such as Apollo, Carzol and Imidan if there is any delay in spraying the tank once it is mixed. In a few sites having a pH above 9.0, compounds such as Guthion and malathion, which would not break down in most situations, may have problems. It is also important to note that in any one site, ground water pH can vary substantially (by nearly 2 pH units) during the season.

To prevent alkaline hydrolysis, you should:

1 - Determine the pH of your spray solution; because of seasonal variability, this should be done more than once during the growing season. Measuring your spray water pH before mixing can be misleading, because the chemicals you use can raise or lower the pH of the overall spray solution. It makes more sense to take the time to run some bottle tests of your most-used spray materials after they have been mixed with your spray water. The most accurate method is by using an electronic pH meter; however, these are expensive and not very practical. Another, less accurate method uses dyes that change color in response to pH. These are available in the form of paper strips, or in solution for use in soil pH test kits. In general, the indicator is mixed with or dipped into the water, and the resulting color is compared against a standard color chart.

2 - To minimize loss of chemical effectiveness from hydrolytic breakdown in the tank, it is a good practice to make the application right after it is mixed (as quickly as allowed by the weather and other factors). If a delay occurs, a buffering agent may be added to the tank if the pH is high and the chemical you are using is susceptible to alkaline hydrolysis; these agents work by lowering the pH and resisting pH change outside of a certain range. A pH in the range of 4–6 is recommended for most pesticide sprays. Buffering agents are available from many distributors.

Growers may add technical flake calcium chloride to the tank when spraying cultivars such as McIntosh, which is susceptible to storage disorders related to inadequate levels of fruit calcium. However, research done in Massachusetts indicates that, although calcium chloride does not itself affect pH, a contaminant present as a result of the manufacturing process does increase the pH of the solution; this could in turn encourage alkaline hydrolysis. There are a few pesticide materials that should not be acidified under any circumstances, owing to their phytotoxic nature at low pH. Sprays containing fixed copper fungicides (including Bordeaux mixture, copper oxide, basic copper sulfate, copper hydroxide, etc.) and lime or lime sulfur should not be acidified. But if the product label tells you to avoid alkaline materials, chances are that the spray mixture will benefit by adjusting the pH to 6.0 or lower.

For further information on water pH and pesticide effectiveness, refer to N.Y. Food & Life Sci. Bull. No. 118, “Preventing decomposition of agricultural chemicals by alkaline hydrolysis in the spray tank”, by A. J. Seaman and H. Riedl, from which much of this information was adapted (online at: http://www.nysaes.cornell.edu/pubs/fls/OCRPDF/118.pdf).❖❖

JOTS & TITTLES

TINY SINS
(Art Agnello,
Entomology, Geneva)

❖❖ Having had a chance to thumb through my copy the 2007 Pest Management Guidelines for Commercial Tree-Fruit Production, I have naturally identified (with help from some attentive readers) a number of little errors that managed to survive our relentless editorial process. No doubt more will surface, but get out the red pen if you want to make the following changes now:

p. 35: Add "etoxazole – (Zeal) Valent (A)" just after "esfenvalerate"

Change "hexythiazox" formulations to "(Savey, Onager)"

p. 37: Add "Onager – (hexythiazox) Gowan (A)" just before "Orbit"

p. 38: Add "Zeal – (etoxazole) Valent (A)" just before "Ziram"

- Under "Restricted Highly Toxic Pesticides", change endosulfan formulation to "*Thionex"

p. 50, Pheromones section: Delete "3M Sprayable Pheromone for OFM". Add the following to list of products available for codling moth: "Checkmate CM-F (Suterra): 56336-37", and "For CM/OFM: Checkmate CM-OFM Duel (Suterra): 56336-49; Isomate CM/OFM TT (CBC): 53575-30"

p. 52: Add following to end of "Hexythizox (Savey, Onager)" entry, for formulations available: "Onager (Gowan) 1EC: 10163-277"

p. 53, 2nd paragraph: Change "OMNI Supreme" to "OMNI Oil 6E"

p. 147: Under comment 12.2, change rates in 2nd last sentence to: "Esteem may be applied once prebloom at 5 oz/A, or once prebloom and once at petal fall at 4-5 oz/A." [NOTE: The same changes should be made to the 4th paragraph of the article on early season pear psylla strategies in last week's issue.]

- Add "[12.3]" to the beginning of next paragraph, just before "M-Pede can provide..."

p. 151, Pear psylla section, M-Pede entry: Enter "[12.3]" in last column

p. 162: Crop stage at top of table (under "Pest") should be "White Bud"

p. 172, Comment 17.1: Add: "Use 200 Isomate-L ties/acre if (greater) peachtree borer is the predominant species."

p. 178, Tarnished plant bug section: Add asterisk for "*Proaxis 0.5CS"

- Western flower thrips section: Add "§" for "§Entrust 80WP"

p. 210, hexythiazox entry: Add "Onager 1EC" after "Savey 50WP"

p. 219: Add following entries after Checkmate OFM-F (// = space):

§Checkmate CM-F 14.3S // 56336-37 // pheromone // 4 // abc // bcd

§Checkmate CM-OFM Duel // 56336-49 // pheromone // 0 // fh // -

§Cyd-X 0.06SC // 70051 // granulosis virus // 4 // bck // bck

- Add following entry after Isomate-M:

§Isomate CM/OFM TT // 53575-30 // pheromone // 0 // - // -

p. 220: Add following entry after Nexter:

Onager 1EC // 10163-277 // hexythiazox // 12 // abc // abc

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PHENOLOGIES

Geneva:

	4/9	4/16 (Predicted)
Apple(McIntosh):	silver tip	green tip
Apple(Red Delicious):	dormant	silver tip – green tip
Pear:	swollen bud	swollen bud
Sweet cherry:	dormant	swollen bud
Tart cherry:	dormant	swollen bud
Peach:	dormant	swollen bud

Highland:
Apple (McIntosh/Ginger Gold): green tip
Apple (Golden Delicious, Red Delicious, Honeycrisp): silver tip
Pear (Bartlett/Bosc): swollen bud
Peach (early): early green tip
Peach (late): dormant
Plum: dormant
Apricot: dormant

UPCOMING PEST EVENTS

	43°F	50°F
Current DD accumulations (Geneva 1/1–4/9/07):	108	41
(Geneva 1/1–4/9/2006):	131	45
(Geneva "Normal"):	112	49
(Geneva 1/1–4/16/2007, Predicted):	124	44

Coming Events:	Ranges(Normal±StDev):	
McIntosh at green tip	64–163	19–74
Red Delicious at green tip	92–173	36–78

NOTE: Every effort has been made to provide correct, complete and up-to-date pesticide recommendations. Nevertheless, changes in pesticide regulations occur constantly, and human errors are possible. These recommendations are not a substitute for pesticide labelling. Please read the label before applying any pesticide.

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