Even as minute organisms of a different sort have been intruding on our routines and schedules recently, other long-established components of the biological world continue to function essentially as they have for as long as we can recall. The oncoming hatch of European red mite eggs in the orchard is one modest example. Accordingly, as has been the case for the past 100 years or so, now would be an appropriate time to consider the uses of horticultural mineral oil against this and other spring pests, a traditional option that continues to be a wise tactic, despite the fact that a number of newer and capable contact pesticides are available for early season use today.

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 pesticide 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.

**European Red Mite and the Chronicles of Chapman**

The following advice is pretty much unchanged from what I print every spring, which shows the durability of not only the information developed from Paul Chapman’s original research, but also of a crop protectant that’s still as good as it used to be:

A delayed-dormant spray of petroleum oil in apples from green tip through tight cluster can be a favored approach for early season mite control, both to conserve the efficacy and 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, this is not always achieved in real life, mainly because of weather...
and coverage challenges, coupled with the difficulty of getting to a number of blocks during a fairly brief 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 pick their way through the droplets, or else avoid them entirely. 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. Depending on how wet the winter months have been, local conditions will be the 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, cold snaps and overnight frosts are always a wild card possibility, so be aware of any imminent changes in weather patterns that could result in tissue damage in oil-treated trees.

Obviously, good coverage of the trees is critical if you’re to take advantage of oil’s potential efficacy; this in turn requires adequate spray volume delivered at an appropriate speed. Back when "standard-size" truly were the industry standard, experience and research showed that a 1X concentration (300 gal/A) in these large trees was clearly preferable; however, given the shift to high-density dwarf plantings in modern systems, and with all other conditions being optimal (weather, speed, calibration), then 100 gal/A is an acceptable volume of water that should provide the desired level of control at any given time. Although this spray volume has traditionally been considered a 3X concentration, the oil should NOT be concentrated; because of its physical mode of action, it should be mixed at, e.g., 2 gal oil per 100 gal of water to achieve a 2% rate. Growers like to reduce their spray volume more than this to save time and the hauling of extra water, but reducing coverage too much can undermine your efforts if you end up covering only a small fraction of the egg population with the residue.

Don’t limit this mite control tactic just to apples and pears. Talks with stone fruit growers have reminded us that many cherry, peach and plum plantings can suffer equally serious European red mite or San Jose scale 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 problems should be examined for the presence of red overwintered ERM eggs or characteristic SJS scale infestations on the bark, and if they’re numerous enough to see without a hand lens, then a prebloom application of 2% oil would be a prudent tactic to help ward off this damage, particularly if your fungicide program at this time doesn’t present any compatibility problems.

Finally, we do hear of concerns each year that prebloom use of oil might be damaging to the...
crop or even the trees, so why even consider it? I would note that, as with any crop protectant, it's certainly possible to use oil improperly and end up with poor or even detrimental results, so it's wise to stay away from using oil if any of the following conditions apply:

- occurrence of sub-freezing temperatures less than 48 hr before or after an oil application
- presence of active captan residues when oil is applied. It's generally wise to allow 7–10 days before or after applying oil to use this material, as the combination can cause phytotoxicity to the buds and woody tissues when combined with oil's penetrant activity.
- poor drying conditions, which can promote spotting and burning damage to sensitive foliar and bud tissue.

BLACK STEM BORER SURVEY

Black stem borer is a destructive pest of apple trees that is becoming more problematic around New York and other eastern states, particularly in high-density dwarf plantings. We are working with a regional IPM Working Group (based in Georgia) focused on these ambrosia beetles to gain a better understanding of their biology, behavior, and ultimately effective management around the country, not only in apples, but also in other commodities such as nursery ornamentals, pecans, avocados, and forest/shade trees. We are making available an online survey on Black Stem Borer ambrosia beetles to document their impact, and to use in grant proposals to support further research on these pests. If you are having problems with this pest, we ask that you please fill it out to assist us in this effort; responses will be anonymous, and it should take no more than 5 minutes of your time. You can access the survey at: https://ugeorgia.ca1.qualtrics.com/jfe/form/SV_0ojFgygi2BFmQ1n

NOT WHEN, BUT WEATHER

2020 EARLY SEASON DISEASE MANAGEMENT FOR APPLE POWDERY MILDEW IN NEW YORK

(David Strickland & Kerik Cox, Plant Pathology & PMB; das574@cornell.edu & kdc33@cornell.edu)

The 2020 Season so Far...

The apple growing season in 2020 may come early, necessitating that plans are made now to manage the major apple pathogens that benefit from trees' exit from winter dormancy. Apple powdery mildew, a disease intricately linked to host phenological stage, may be of concern this year due to a mild winter and the (so far) warm early spring weather promoting tree development. *Podosphaera leucotricha*, the causal agent of apple powdery mildew, overwinters within bud tissue and can die off when trees are exposed to sustained temperatures below -11.2°F (-24°C). According to the Northeast Regional Climate Center (nrcc.cornell.edu), the northeast US has experienced a warm winter, with average temperatures regionwide far above this kill threshold (Nov 2019: 35°F; Dec 2019: 30.2°F, Jan 2020: 29.9°F, Feb 2020: 30°F), indicating that the powdery mildew fungus will have overwintered successfully.

With the onset of spring, trees will begin pushing buds and generating new tissues that *P. leucotricha* will colonize to establish primary infections (Fig. 1). In the Hudson Valley and along Long Island, early varieties are already at green tip, indicating an imminent start to the growing season in early April. A prolonged period of cooler days would help to slow tree growth, and subsequently, the start of powdery mildew disease symptoms. However, if April proves to be warm enough to significantly promote host growth, expect that powdery mildew primary infections will appear with greater frequency.

continued...
Fig. 1. Primary infection of apple powdery mildew. [Photo: K. Cox]

Warmer temperatures are not the only factor influencing whether powdery mildew will be present in the early season. Precipitation has an impact on powdery mildew disease incidence. The spores of *P. leucotricha* (called conidia) cannot colonize host tissues covered in free water, a marked difference from the wetness requirements for other foliar apple fungal pathogens such as *Gymnosporangium juniperi-virginianae* (cedar apple rust) and *Venturia inaequalis* (apple scab). In the early season, conidia are produced from primary infections and spread by wind to colonize new tissues and form secondary infections (*Fig. 2*). These secondary infections will perpetuate the disease cycle, pro-

Fig. 2. Secondary infection of apple powdery mildew. [Photo: D. Strickland]

ducing multiple rounds of conidia for the remainder of the season, and are the focus of chemical management programs for powdery mildew into the summer months. Should the next month or so be particularly wet due to frequent rainfall, powdery mildew may not be of concern in this year’s early season. In 2019, many areas of New York State had considerable rainfall in May, which suppressed powdery mildew disease incidence. However, we note here the importance of keeping a vigilant eye out for powdery mildew development in your orchards. Extended warm periods without rainfall, typically a boon to growers as their primary foliar disease concern apple scab is not developing quickly in these conditions, would be very conducive to powdery mildew disease development and spread.

continued...
Management Options for Powdery Mildew

Powdery mildew disease control relies primarily on a chemical management program, as pruning the visibly infected shoots of overwintered fungal mycelium (primary infections) is usually too labor-intensive for all but the smallest grower operations. In New York State, powdery mildew is typically managed with the same chemical program as apple scab, since most NY springs are wet and cool, necessitating a focus on the latter disease. Should this spring prove to follow that trend, expect that powdery mildew will be well managed with your current apple scab chemical management program. Should the weather this spring become unseasonably warm and produce little precipitation, do not ease up on your fungicide application programs if you have a historical prevalence of powdery mildew in your orchards (e.g., along Lake Ontario).

A chemical management program focused primarily on powdery mildew would start at tight cluster with applications of protectant fungicides such as sulfur or phosphorous acid. Note that for phosphorous acid-containing products listed for use in apple, such as Rampart, avoid application to plants treated with copper-based compounds at less than 20-day intervals to prevent phytotoxic effects. As bloom arrives, applications of single-site fungicides (e.g., Luna Sensation, Merivon) may be used to manage primary infections to reduce the amount of disease inoculum (conidia) that would otherwise spread elsewhere in the orchard. Alternating single-site fungicides with sulfur into the late spring/early summer months should provide adequate disease control. Although, take care with sulfur applications during hot days (>85°F), as it may cause fruit russetting in warm wet conditions. Given concerns for fungicide resistance development, be sure to alternate fungicide modes of action when you select applications of single-site fungicides. In 2019, we received no reports of powdery mildew control failures in conventionally managed orchards.

An effective early disease management program for powdery mildew will limit primary inoculum in the early season, but stay vigilant for the signs of secondary disease spread. Extended warm periods without precipitation are of greatest concern, as relaxed fungicide programs during this time may allow powdery mildew to develop unchallenged. Apple scab is of course a primary concern to New York growers, yet don’t discount the trouble caused by an entrenched powdery mildew incursion in your orchard.

More on Tree Decline Problems

On December 4, 2019, I attended a workshop on apple decline problems that had been organized by Dr. Kari Peter of Penn State University’s Fruit Research and Extension Center in Biglerville, PA. The workshop, which convened in Winchester, VA, included more than 60 participants, some via electronic connections, from all around the U.S. and from Ontario as well. Participants included fruit growers, private consultants, extension specialists, and scientists from the USDA and various universities. Presentations covered apple tree decline as seen in various regions, current research on the problem, and lots of discussion on possible causes and contributing factors.

My personal conclusion after the meeting (other attendees might disagree) was that the primary contributors to young apple tree decline are novel viruses and/or herbicide injury. The other problems observed in declining orchards, such as winter injury, black stem borer, and canker diseases, are frequently secondary effects that developed after, or as a result of, stresses created by viruses and/or herbicides. Even the bark injury that is sometimes seen continued...
at shoulder height on declining trees may result from fungal attack enabled by water stress that occurs when conductive tissue at the base of the trunk is damaged. Admittedly, winter injury alone and rootstock blight caused by Erwinia amylovora, the fire blight pathogen, have caused decline in some instances. However, decline caused by fire blight is relatively easy to identify because the pathogen can be either isolated on selective media or detected by PCR.

One possible clue for explaining our current tree decline problem came from Bill MacKintosh, a fruit farmer and private consultant working in Virginia, who said he had learned from industry connections that the surfactants used in at least one formulation of paraquat herbicide (Gramoxone) had been changed by the manufacturer sometime around 2012 or 2013. MacKintosh believes that this formulation change made paraquat more damaging to young trees. I have not been able to independently verify his claim of a formulation change, but the possibility that paraquat has been contributing to the problem in recent years fits with several other observations:

1. Workshop participants from various parts of the country agreed that unexplained tree decline problems were most often found in orchards that had very clean herbicide strips, which are indicative of intensive herbicide use. Young tree decline problems were reported as almost non-existent in organic orchards and less common in orchards that have more residual grass and weeds beneath trees at the end of the year. When contact herbicides are re-applied to relatively clean strips, more of the herbicide is likely to contact the trunks due to lack of weeds or weed residues to intercept droplets and also because droplets that hit the bare soil may be deflected upward onto nearby trunks, thereby increasing the total dose on the trunks.

2. At least one Pennsylvania grower noted that his tree decline problem first showed up in 2013 (Prengaman 2019), which would fit with the time frame when the paraquat formulation was reportedly changed.

3. The problem is showing up in orchards where glyphosate has never been used, so this is not (exclusively) a glyphosate problem. However, the bark damage in many orchards still fits the pattern first described for suspected glyphosate damage to trunks where the initial damage occurs in the pattern that would be expected from herbicides hitting the trunk when applied by a boom sprayer (Rosenberger & Fargione 2004).

4. Problems with glyphosate damage were first noted after the glyphosate formulation was changed to include more surfactants in the early 2000s. Thus, there is precedent for relating a change in herbicide surfactants to increased trunk injury from contact herbicides. Formulation changes can explain why a product that was used without incident for many years may cause injury even though application methods, rates, and timings have not changed.

All of the labels for contact herbicides (paraquat, glyphosate, glufosinate) include warnings about avoiding contact with the bark on young trees. These warnings are rather nebulous because the definition of "young trees" or trees with "green bark" varies depending on whom one asks. "Young trees" might be defined as trees less than 3 or 4 years old, but with today's high-density plantings, I have seen 10-yr-old trees that have trunk diameters similar to those on 3-yr-old trees grown on more vigorous rootstocks and/or at wider spacings. Presumably, small-diameter trunks still have thin bark even though the tree may no longer be "young" in terms of years. And for most of us, "green bark" suggests bark that has continued...
a greenish exterior appearance, whereas one herbicide manufacturer told a colleague many years ago that "green bark" means any tree in which green is evident when the bark is pulled back with a fingernail.

The obvious solution to avoiding injury from contact herbicides is to stop hitting tree trunks with the herbicides, but that is more easily said than accomplished. So what are the options for minimizing damage when contact herbicides are applied in orchards? At least four different consultants have told me that painting tree trunks with white latex paint reduces trunk injury from herbicides. One consultant suggested that paint must be applied annually to be fully effective because tree growth will cause expansion of the trunk that will break the paint seal. However, another consultant suggested that painting trunks every second or third year is sufficient. In either case, with new plantings often having 1200 to 1500 trees/A, painting trunks repeatedly over many acres will be expensive. Furthermore, some of the photos in my files and in at least one publication (Petrovic 2019) show collapsing trees in orchards where trunks had been painted.

A more effective intervention might be accomplished by putting a physical barrier around the base of each trunk. In New Jersey, some growers have for many years used waxed milk cartons (purchased flat as they would be shipped to a dairy prior to filling) that were then stapled around the base of young trees to protect trunks from herbicides. In New York, we have been reluctant to suggest this approach because solid barriers prevented spray coverage of the trunks that has been essential for controlling dogwood borers. Dogwood borers were one of the problems that doomed the use of the white spiral tree guards that were popular in the 1980s. However, something like a milk carton or a split piece of solid white 4-in diameter PVC that could be placed loosely around each trunk may be feasible now where dogwood borers can be controlled with pheromones rather than trunk sprays. The concept may be worth exploring although the risks associated with solid barriers (borer control, delayed winter hardiness at the graft union) need further study.

Looking ahead, paraquat may lose favor as a contact herbicide as new requirements for applicator training and use of closed pesticide transfer systems come into effect over the next year. Nevertheless, protecting trees from herbicides will become even more important if glufosinate is substituted for paraquat, because glufosinate is known to cause trunk damage. Thus, a long-term solution for protecting tree trunks from herbicides will be useful, even for those who abandon paraquat in the future.

Finally, I suggest again that tree losses from herbicide injury often result from the cumulative impacts of multiple applications over several years, even though in some cases injury can be pinpointed to a single application event. Trunk injury may be more likely from summer rather than spring applications of herbicides, especially if trees are under water stress at the time applications are made in summer. Reducing the total exposure of trunks to contact herbicides, by whatever means possible, is likely to result in less injury, even if trunks cannot be perfectly protected from all herbicide contact.

Next week: Apple viruses discussed at December's Apple Decline Workshop.


Errata: Can't Get There From Here
Dave Rosenberger, Highland, NY

✧✧ Soon after I started working at the Hudson Valley Lab more than 40 years ago, I asked an experienced colleague how to find an obscure address in the city of Kingston. Without batting an eye, my colleague replied "You can't get there from here," by which he meant that providing directions for the address I was seeking would be too complex to explain.

After Dr. Agnello published Scaffolds online on Monday afternoon, I found that several of the links I had listed were non-functional even when I copied and pasted them into my browser as suggested. After several hours of investigating, I found that links to PDF files stored on my blog became inoperable as soon as they were converted into another PDF file, which is the way Scaffolds is published. No doubt there is some way to "PDF" a linked PDF file while preserving hyperlinks, but I'd rather just say "You can't get there from here." Anyone wishing to pursue the links in the literature citations from last week can access them via my blog at http://blogs.cornell.edu/plantpathhvl/blog/ where I have posted the article with functional links. ✧✧

PRODUCT REGISTRATION UPDATE
(Art Agnello, Entomology, Geneva; ama4@cornell.edu)

New Registration
   • Senstar (Valent, EPA Reg. No. 59639-243) is a combination of spirotetramat (the a.i. in Movento) and pyriproxyfen (the a.i. in Esteem), and is registered for use against a range of foliar pests in pome and stone fruit in NYS. Its label includes aphids (including woolly apple aphid), mealybugs, pear psylla, San Jose scale, lecanium scale, and white peach scale, with suppression effects on several additional species. Not toxic to honeybee adults, but potentially toxic to honeybee larvae through residues in pollen and nectar. Commercial supplies of this product probably will not be in place until mid-season. ✧✧

APPLE IPM INTENSIVE WORKSHOP 2020 PROCEEDINGS NOW ONLINE

✧✧ This IPM school, sponsored by the CCE Fruit Program Work Team, was presented in January 2020 over a 2-day period at the Empire Producer’s Expo, OnCenter Syracuse, NY. Four sessions were conducted, with presentations by Julie Carroll, Art Agnello, Kerik Cox, and Lynn Sosnoskie, and covered Apple IPM for a Healthy Crop; Apple Insect Targets & IPM Tactics; Apple Diseases & IPM Defenses; and Wildlife, Weeds & IPM Wrap-Up. The workshop content (PDFs of the presentations and reference materials) have been posted online at: https://nysipm.cornell.edu/agriculture/fruits/apple-ipm-intensive-workshop-2020/
This site comprises all of the material covered at this workshop, and also serves as a convenient portal to online fruit IPM resources provided by the NYS IPM Program and Cornell Cooperative Extension. Special thanks to Janet van Zoeren, Mike Basedow, Karen English and Grace Marshall for their efforts in organizing and coordinating this effort. ✧✧

PEST FOCUS

Geneva:
   Green Fruitworm 1st catch 3/27

Highland:
   Green Fruitworm 1st catch 3/23
   1st Pear Psylla eggs 3/25
   Spotted Tentiform Leafminer 1st catch today, 3/30
UPCOMING PEST EVENTS

Current DD* accumulations (Geneva 1/1–3/30):
(Geneva 1/1–3/30/2019):
(Geneva "Normal"): 64.2 24.2
(Geneva 1/1-4/6, predicted): 113.5 39.9
(Marlboro 1/1–3/30): 160.7 62.1
*all DDs Baskerville-Emin, B.E.

Upcoming Pest Events (Geneva):
Green apple aphids present 111-265 38-134
Green fruitworm peak flight 91-226 34-106
Pear psylla 1st oviposition 40-126 11-53
Redbanded leafroller 1st catch 111-176 40-81
McIntosh green tip 99-144 38-62

Ranges (Normal ±StDev):
43°F 50°F
91.4 33.6

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.

This material is based upon work supported by Smith Lever funds from the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.