

FINGER LAKES VINEYARD NOTES

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Cornell Cooperative Extension

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2001 A GRAPE ODYSSEY (IN DISEASE CONTROL)

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Time once again for the annual review of new developments and various options on the disease-control front. As always, my sincere appreciation goes out to an outstanding team of technicians (Duane Riegel, take a bow), graduate students, postdoctoral associate, and faculty colleagues (D. Gadoury, R. Seem), whose research efforts are the bases for most of the following.

FUNGICIDE CHANGES & NEWS

In contrast to the last few years, there are no major new fungicides or label changes. Thus, a couple of reminders about some of the "newer" materials and a few new details.

Vanguard. This is shaping up to be the "go to" Botrytis fungicide, but don't over-do it. Remember that Vanguard is highly prone to resistance development, and therefore is labeled for a maximum of two applications per season (one per season is better from a resistance-management standpoint). However, even if you apply "only" one or two Botrytis sprays per season, don't use Vanguard as the only Botrytis fungicide year after year. This is a good way to burn it out, and you will.

Fortunately, we now have several unrelated products for Botrytis control, so it's not hard to rotate compounds in a control program.

Vanguard is a systemic fungicide that penetrates berries and flowers (so it's rainfast) but doesn't move from berry to berry. It's not related to any other product on the market, and doesn't control any disease except Botrytis. It's been classified as a "reduced risk" compound by the EPA (good environmental and toxicology characteristics).

Elevate. Last year was the first season for the commercial use of Elevate in NY, and it seemed to do a good job against Botrytis. I've generally gotten good results in my own control trials, although Vanguard has been a little more consistent. The resistance risk for Elevate is still a bit unclear, but it appears to be "moderate". Elevate is not related to any other fungicide on the market, so can (and should) be used in rotational programs for resistance management purposes. Like Vanguard, it's been classified by the EPA as a "reduced risk" fungicide. It does not control any other grape diseases.

Elite. Elite was finally registered in NY last year. Recall that it's a sterol inhibitor fungicide in the same chemical family as Nova, and has given virtually identical control of powdery mildew and black rot in repeated trials over the years (using both at 4 oz/A). I'd choose one over the other on the basis of price. The label claims some activity against Botrytis, but we saw no activity in the one trial where we examined the material for this use; in contrast, the three strobilurin fungicides all provided significant Botrytis activity in the same trial.

Strobilurin fungicides. The strobilurin fungicides (Abound, Flint, Sovran) were discussed at length in last year's version of this treatise. They're an important and unique group of fungicides, and it's worth reviewing a few basics about them.

How they work. The "strobies" are not classical surface protectants (e.g., mancozeb, captan, ferbam, and ziram), the old war horses that don't face

resistance problems. Neither are they true systemics (sterol inhibitors, Ridomil, Benlate), thus they lack the scope of physical properties that this characteristic gives to such fungicides (rapid movement within tissues, good post-infection activity). Rather, their characteristics lie somewhere between these two groups, and they should be thought of this way.

All are excellent inhibitors of spore germination; thus, they are excellent protectant fungicides, providing their best activity when they are present on the foliage or fruit before a spore lands and tries to germinate and infect. They are retained primarily within the outer waxy cuticle of leaves and fruit, which means that they are more rainfast than traditional protectants like mancozeb and captan.

However, some of the strobie fungicide does "leak" from the cuticle into the sprayed organs. For pathogens like black rot, which establishes itself just beneath the cuticle, or powdery mildew (lives on the surface and one cell deep), there is enough leakage to provide significant postinfection control for several days, although not as much as Nova and Elite provide. In contrast, for pathogens like downy mildew which establish themselves further within the tissues (where, presumably, less of the leakage reaches them), the postinfection control is weak. In contrast, Ridomil's is pronounced.

In addition, a small portion of the "leakage" can slowly move from treated leaf surfaces to the untreated surface on the opposite side of the leaf, where it accumulates to the point that it can protect against new infections (so-called "translaminar" activity). For instance, when we treated only the top surface of 'Riesling' leaves with Abound and then inoculated the underside with downy mildew spores 1 day later, we got approximately 50% control (versus 100% control for Ridomil). In contrast, we got nearly complete control when we inoculated after allowing 7 days of "leakage".

Finally, the strobies show significant "antisporeulant" activity. That is, when applied after infection has occurred but before symptoms develop, they often allow lesions to form but inhibit the production of a new round of secondary spores from those lesions. (This probably happens when fungus within the tissues tries to grow back through the surface and contacts the fungicide). Regardless of mechanism, this is a particularly significant property, since economic losses from all major grape diseases except Phomopsis result from repeated infection

cycles caused by rounds of secondary spores produced on newly-infected tissues.

Bottom line: The strobies will work best when you use them as "super protectants" that don't wash off. But the premium price you pay in excess of the standard protectants also provides you with some (incomplete) postinfection activity (depending on the disease), time-dependent translaminar activity, and significant antisporeulant activity. It's a package deal.

Resistance risk. New cases of resistance to the strobilurins continue to be reported internationally, already compromising the utility of these materials for control of certain diseases on other crops. Various pathogens appear to behave differently, and the absolute risk for individual grape diseases is still being determined. Nevertheless, I've heard rumors of confirmed cases of resistance to both powdery and downy mildew on grapes overseas, so this risk must be taken very seriously.

To date, strobilurin resistance appears to most closely follow the "Benlate model". That is, although there are some important exceptions and unknowns, most resistant isolates are virtually immune to the fungicides and multiply with impunity if they are not controlled by some other material. Furthermore, a fungal strain that is resistant to one of the strobies will be resistant to all of the others. Therefore, all strobies have identical resistance-management label restrictions: Do not make more than four sprays per season of any strobilurin on wine or table grapes, with a maximum of three applications in a row; on juice grapes (or those for other purposes), do not make more than three applications per season. Remember, these are legal maxima. As with so many other things in life, somewhat less than the absolute maximum is often prudent.

These restrictions are designed to (i) minimize the selection of resistant strains, by limiting the number of selection events (sprays); and (ii) limit the opportunity for resistant strains to multiply, by using unrelated fungicides in rotation. So, even though a Concord grower could legally apply three strobie sprays each year and nothing else, s/he would be asking for trouble due to the lack of rotation with unrelated chemistries.

THE STROBIES ARE IMPORTANT TOOLS FOR GRAPE DISEASE MANAGEMENT, AND THERE'S NOTHING SIMILAR IN THE IMMEDIATE PIPELINE TO TAKE THEIR

PLACE. USE THEM WISELY AND DON'T BURN THEM OUT!

Phytotoxicity. The phytotoxicity picture with the strobies is a bit complex. As most grape growers know, Abound is extremely phytotoxic to some apple varieties, but not others. Flint is registered for use on grapes in general, but it's phytotoxic on (and not labeled for) Concords. Sovran is phytotoxic to certain sweet cherry varieties, not others. (As a follow-up to last year's article, the Sovran representative has informed me that spray drift indeed can cause injury on nearby sensitive cherry varieties, so appropriate care must be taken when spraying in such a situation).

However, in addition to these "black and white" situations, all of which are stated on product labels, there are several "gray" areas with at least some potential risks. Remember that the strobies are held primarily in the outer waxy cuticle of the plant, and that only a fraction of the total dose "leaks" through to the inside of the leaves and berries. Most plants (with the exceptions noted above) can tolerate these levels of the compounds inside their tissues. However, when higher doses are "forced" across the waxy cuticle, damage can occur under certain circumstances. What might force these compounds into the leaves and fruit? Oils, organosilicate surfactants, and liquid insecticide formulations, i.e., the same types of materials that move captan from the surface (where it's harmless) to the inside of the plant, where it causes phytotoxicity.

Any potential danger from these "gray" areas will probably depend on specific fungicide/plant species and variety/solvent combinations. For instance, the Flint label advises not to use it on apples (a labeled crop) with organosilicate surfactants. I've received a report from Virginia regarding injury on Chardonnay vines treated with a tank mix of JMS Stylet Oil and Abound (other potentially mitigating factors are not known, and the JMS rep tells me they've had no problems mixing it with Abound on a variety of crops internationally). Most tank-mix combinations with the strobies will pose no problem, and any potential risk should not be overstated. Nevertheless, the prudent approach would be to use caution in mixing the strobies with any material that you wouldn't combine with captan, until you know that it's safe on your particular varieties.

Variable spectra of activities. In my experience, the three labeled strobies are equivalent against black rot (very good) and Phomopsis (only fair, although others have had significantly better results with them

than I have). All three have significant activity against Botrytis, it's still not clear to me how they compare. In head-to-head trials, Flint has shown the strongest activity against powdery mildew, with Sovran second and Abound third; for context, however, note that most growers have been very satisfied with the control that Abound has provided. Abound is clearly superior to Sovran for control of downy mildew, and Flint is weak against this disease.

Nutrol (monopotassium phosphate). Last year, we continued greenhouse tests to find out the basics of how this "dual purpose" material (foliar nutrient plus powdery mildew fungicide) works. The results confirmed our earlier tests, showing that it provides little protective activity (no significant control when applied before inoculation with powdery mildew spores), but that it has significant activity when applied within 3-5 days after exposure to the spores.

This scenario suggests that Nutrol should be more effective when applied relatively frequently (repeated knock-downs), rather than relying on long periods of protective activity between sprays. So for the second year, we compared 8 lb/A on a 14-day schedule versus 4 lb/A on a 7-day schedule (same amount of product per season, but more "hits"). Sure enough, the 7-day schedule was significantly more effective. Control was even better with 8 lb/A every 7 days, but there are economic limits.

Powdery mildew is an unusual disease, since the fungus that causes it lives almost entirely on the surface of leaves and berries (the powdery stuff you see). Thus, it is "naked" and subject to (temporary) eradication following topical treatment with a range of products that don't affect other diseases. Thus, I strongly suspect that the same general principle we've shown for Nutrol will apply to any of the "alternative" PM control products, e.g., salts such as monopotassium phosphate or potassium bicarbonate (Kaligreen, Armicarb), oils such as Stylet Oil or Trilogy, dilute solutions of hydrogen peroxide (Oxidate).

Finally, remember that eradicator activity is very dependent on thorough coverage, since you're relying on direct contact of the spray with the fungus. Don't waste your time and money if you can't provide it.

POWDERY MILDEW (PM) NEWS AND REMINDERS

1. Most berry infection occurs during the first few weeks after the start of bloom. Disease that you see

on the berries later in the season usually is caused by a combination of favorable weather and problems with the spray program during that time.

We've discussed this *ad nauseum* over the years, so I won't do it again. Remember: To control PM on the fruit, use best materials, full rates, and thorough spray coverage (every row!) from immediate prebloom through 2 weeks (Concords) to 4 weeks later. If you try to cheat and get caught, don't say you weren't warned.

2. *Failure to control inconspicuous PM infections on the berries can increase the severity of berry rots (Botrytis and sour rot) at harvest.* In each of the last 3 years, David Gadoury has shown that when unprotected berries of several *V. vinifera* cultivars were inoculated with PM spores about 4 weeks after bloom, very little obvious PM developed. However, such berries developed a fine network of nearly microscopic infections and had much higher levels of rot at harvest than berries that were protected against infection at that time. Furthermore, even when the inoculated berries didn't rot, they supported much higher levels of spoilage microorganisms, and wines made from these berries (by Thomas Henick-Kling's program) had noticeable off-flavors compared to the PM-free control group. Bottom line: Good PM control 4 wk after bloom is important to safeguard wine quality.

3. *Don't overly-rely on SI fungicides, but don't abandon them.* Another topic that's been beaten to death over the years. The "creeping" form or resistance characteristic of the SI fungicides has progressed to the point that these materials don't perform like they used to. However, the high risk of developing resistance to the strobies should be a clear warning that we can't rely only on those fungicides for PM control. That leaves the "alternatives" discussed previously, sulfur, and the SI fungicides. The SIs still provide significant control for many (most?) growers, so let's use them where they fit and keep them alive.

NOTE THAT WHEN CONTROL STARTS BREAKING DOWN BECAUSE OF RESISTANCE TO SI FUNGICIDES, PROBLEMS OCCUR ON BERRIES BEFORE LEAVES. This statement (based on observations and our own research data) has two implications: (i) Be careful about relying on SIs during the bloom and early postbloom period, especially on highly susceptible varieties; and (ii) limited use of SIs may provide adequate control of foliar infections even in vineyards where fruit control is compromised.

Here are the annual reminders with respect to SI resistance management:

(i) Limit SI use, preferably a maximum of three sprays per year, and rotate with unrelated fungicides.

(ii) **Recommended rates and thorough spray coverage are CRITICAL for adequate performance and resistance management.** The surest way to encourage SI resistance is to use low rates of these fungicides. The surest way to provide low rates to certain parts of the vineyard is to provide uneven spray coverage. It's still just that simple.

(iii) The SIs will perform much better, and less resistance will develop, when they're used to combat a small PM population rather than a large one. Position them early in the season (conveniently, not an optimal time for using the strobies) or use them to maintain a clean vineyard mid-season. You're just asking for trouble if you try to use these materials to clean up or slow down a PM problem that's already in full swing (this is true for the strobies, also). If PM blows up for some reason, consider an eradicant treatment (1.5-2% Stylet Oil in plenty of water would be my choice) to get the population down before coming back in with a fungicide at risk of resistance.

4. *Contrary to previous indications, control of PM does appear to increase yield on Concords.* We have just concluded an experiment in which the same treatments have been imposed on the same 'Concord' vines at the Vineyard Lab in Fredonia for 5 consecutive years (1996-2000). Vines have been pruned according to three systems: (1) Balance pruned; (2) 100-nodes; and (3) Minimal. Within each pruning system, vines have received one of four different PM control regimes: (i) No PM fungicide; (ii) two PM sprays (Abound immediately prebloom, Nova 2 wk later); (iii) four PM sprays (Abound/Nova/Abound/Nova @ 2-wk intervals, starting immediately prebloom); and (iv) six PM sprays (Abound/Nova/Abound/Nova/Abound/Nova @ 2-wk intervals, starting immediately prebloom). Yield increases were incremental with increasing fungicide use, leveling off at 10% (relative to the unsprayed) after four sprays in the balance-pruned and 100-node vines, but continued to increase up to 15% in the minimally pruned vines.

Obviously, PM is not the problem on Concords that it is on *vinifera* and certain hybrids, but some control is needed. These data may provide some additional basis for determining how much.

BLACK ROT (BR) NEWS AND REMINDERS

1. *As fruit mature, they become increasingly resistant to infection AND infections take longer to show up.* We've been talking about the period of fruit susceptibility issue for some time. After considerable experimentation, it now appears that fruit are susceptible for 1-2 wk longer than we originally had thought, but still not as long as older recommendations assumed. In experiments conducted last year, inoculated Concord fruit were highly susceptible for the first 4 wk after bloom; disease severity was reduced by approximately 70% when inoculations were made 5 wk after bloom; and no disease occurred from inoculations made 6 wk after bloom. Chardonnay and Riesling berries remained highly susceptible through 5 wk postbloom, and retained significantly-reduced levels of susceptibility through 7 wk postbloom.

For several years, we've noted that fungicide sprays applied immediately prebloom plus 2 and 4 weeks later provide excellent control of black rot in all but the worst-case scenarios. This last spray will protect Concords (and hybrids?) until the berries are no longer susceptible; *vinifera* berries may retain a slight degree of susceptibility by the time the last spray wears off, but fungal inoculum is gone by then unless disease has gotten established somehow. We have not seen a benefit from earlier sprays (to control early leaf infections) except under extreme disease pressure.

One unanticipated but interesting finding to come out of last year's study concerns the length of time required for symptoms to appear after an infection period has occurred. Clusters inoculated within a few weeks after bloom first showed symptoms 13-15 days later, and disease progress was completed by 21 days after inoculation. In contrast, the *V. vinifera* clusters inoculated 6 and 7 wk after bloom showed virtually no symptoms 21 days later, and those symptoms that did develop didn't show until 23 to 33 days after inoculation. Significance: Black rot that begins to show up in early- to mid-August is probably the result of infections that occurred in early- to mid-July. This fact should be considered when trying to determine "what went wrong" should such disease occur.

2. *Mummies retained in the canopy provide more pressure for BR development than those dropped to the ground.* This should be a no-brainer, but it was striking to see how much influence mummies in the trellis can have. For 2 years, we worked in a machine-pruned vineyard where mummies had been

retained in the canopy after hedging, then hand-pruned them to the ground in certain plots for comparison. Disease levels were considerably higher where in plots where mummies were left hanging, regardless of the spray treatment. This probably was because (i) more spores were produced, and for a longer period, on mummies retained in the canopy compared to those on the ground, and (ii) it was easier for spores to spread to healthy fruit from mummies next to them in the canopy than from those on the ground. Don't ignore this aspect of sanitation if black rot develops in your vineyard.

3. *Fungicides.* Nova and Elite are still the "kings". Unfortunately, the most important time to control black rot (bloom and early postbloom) is when we're trying to substitute strobilurin fungicides to control PM. As with so many other things, there are trade-offs, it just depends which disease is more important to you. Mancozeb, ferbam, and ziram will provide good control under most commercial conditions. Abound, Sovran and Flint have been equal to mancozeb, ziram, and ferbam under moderate pressure and superior under heavy pressure (they're less likely to wash off, and probably retard disease spread due to their antispore activity). Captan, Rubigan, and Procure are fair. Copper is poor.

DOWNY MILDEW (DM) REMINDERS

Last season. High disease pressure last season confirmed previous knowledge about relative fungicide efficacy. Specifically, in our Geneva trial on 'Chancellor' vines (extremely susceptible to fruit infection), over 60% of the berries on unsprayed vines became diseased. When two prebloom plus two postbloom sprays were applied (14-day intervals), disease incidences were: (i) Abound (11 fl oz/A), 2%; (ii) Penncozeb (3 lb/A prebloom, 4 lb/A postbloom), 18%; (iii) Sovran (3.2 oz/A), 33%; (iv) Flint (1.5 oz/A), 48%. Such dramatic differences are unlikely to occur on less susceptible varieties or where inoculum pressure is lower, but these data do indicate the relative limits of the various materials.

Disease biology. Primary infections can occur from about 2-3 weeks before bloom until fruit set, so this is a critical time to prevent disease establishment. Once DM becomes established, it can spread rapidly by wind-blown spores. The disease is highly dependent on dewy nights followed by rainy days, and is favored by temps of about 65-77°F (no activity over 86°F). Under optimum conditions, the generation time is only 4-5 days, so this is a "compound interest" disease with explosive

potential. Conversely, DM will "disappear" during hot, dry weather. It's a disease very much worth scouting for during the summer, to determine its current activity or lack thereof before making a spray decision.

This season. Significant foliar infections last season mean that overwintering inoculum levels are relatively high. When all other things are equal (they never are), sprays need to start earlier in such years than they would if such inoculum levels were low. Use common sense based on weather conditions, but be aware of that fact.

General control strategies are: (i) DM sprays should start on highly susceptible varieties about the 10-inch shoot growth stage (i.e., 2 to 3 weeks before bloom). If in doubt this year, err on the early side.

(ii) All but the most resistant vineyards should receive a DM fungicide in the immediate prebloom and first postbloom sprays unless the weather is bone dry. This is the critical time to protect against fruit infection.

(iii) By the time the first postbloom spray wears off, primary inoculum is pretty well shot and the need for additional treatments should be based on the usual array of factors: presence or absence of established disease in the vineyard, weather, and variety. Typically, DM "goes on vacation" during much of July (many of the spores that spread the disease are killed by the spate of hotter, dry weather that we usually get at that time), then it reactivates as days get shorter and nights get dewier in August. Get out and look.

Ridomil remains the best downy mildew fungicide ever developed for use on grapes, but its cost and lack of activity against other diseases limit its general usage. Which is probably good, since resistance can develop rather quickly if the material is used heavily. The relative efficacy of the three strobies and Penncozeb are provided above (unfortunately, we didn't have the Dithane Rainshield formulation of mancozeb in this particular trial for comparison versus Penncozeb). Copper, mancozeb, and captan are old standards for a good reason: they generally work.

I have seen advertisements and heard rumors of at least two formulations of phosphorous acid coming to market for control of downy mildew diseases (don't confuse with phosphoric acid, the common form of P used in fertilizers). This active ingredient is quite effective, but I doubt if we will see registered products in NY this season. Consider this

a heads-up on the products, more specific news will be provided, as it becomes available.

BOTRYTIS NEWS AND REMINDERS

1. Overview. There is a long-running debate about the most important time to provide fungicidal protection against Botrytis. The fungus primarily attacks very young, injured, dead, or senescing (wilting, ripening) tissues. Thus, one school of thought is that most fruit rot originates early, as (i) direct infections that enter through the blossoms and remain latent (dormant) until the fruit begin to ripen, and/or (ii) infections of old blossom parts (trash), which remain within the clusters and spread to the berries as they ripen preharvest. By this thinking, sprays at bloom and bunch closure would do the job.

A second school of thought is that most berry infections occur from veraison through harvest (from whatever original source), and that good protection during this period makes earlier sprays unnecessary. Until recently, this had been the dominant thinking in New York for many years.

However, based on our own work and a recent, very involved study in New Zealand, I believe in a hybrid of these two concepts. That is, it appears that berries indeed are most susceptible to Botrytis infection from veraison onwards, and that is probably when most damaging levels of infection typically occur. However, it also appears that at least some rot is initiated much earlier, either as latent infections of young berries or in blossom debris. By this scenario, late sprays should provide the lion's share of control, but early sprays can provide significant benefits by reducing the "foothold" that the fungus might otherwise establish within the clusters, and from which it can spread.

Despite these theoretical issues, the real question is, What works? To examine this, we've conducted spray-timing trials for the last 5 years in a Finger Lakes 'Aurore' vineyard, comparing (i) two late fungicide applications at veraison and harvest; (ii) two early applications at bloom and bunch closure (1998-2000 only); and (iii) applications at all four of those timings. The take-home messages are (i) in two of the years (1996 and 2000), the traditional program of sprays at veraison plus 2 weeks later was improved by adding the sprays at bloom and bunch closure; (ii) in two other years (1998 and 1999), equivalent control was provided by applying either the two early sprays, the two late sprays, or all four; and (iii) in 2000, the two early sprays provided little

control by themselves, although they did improve the activity of the two late sprays.

Thus, it appears that the late sprays always provided benefit (about 50-90% control relative to the unsprayed vines), that this control was sometimes improved when the early sprays were applied first, and that the early sprays alone worked well sometimes but not others.

2. *Fungicides.* Cultural procedure (especially promoting good air circulation and avoiding excessive nitrogen) are perhaps more important for controlling Botrytis than for any other fungal disease of grapes. Recognizing this, the availability of new Botrytis fungicides provides significant new tools to complement (not replace) the cultural control tools. In fact, many people feel that Botrytis would have been much worse in the Finger Lakes last year without these new tools.

Vanguard and Elevate are discussed above. Note also that the strobies have continued to perform well, to the point that Flint and Sovran have added Botrytis "suppression" to their labels (Abound may follow suit). This means the companies recognize that the materials provide some control but that they have their limitations. So how do all of these materials fit?

Control programs. veraison appears to be the most important (but not only) time for fungicide applications, so near this time is when the best materials (Vanguard or Elevate) should be used. Decisions about a subsequent preharvest application should be guided by weather, variety, and nerves.

Unless it's very dry, additional protection at bloom and/or bunch closure will probably improve the control provided by the later sprays. The negatives of doing so are cost and the desire to limit sprays to reduce the risk of developing resistance to the Botrytis fungicides. Under moderate pressure, it appears that the strobies may provide adequate protection during the period between bloom and bunch closure (when they have their best fit to control other disease anyway), provided that a Botrytis-specific material is used at veraison and perhaps preharvest if weather conditions dictate. This program appears to work, but I haven't seen it under heavy pressure on the worst varieties, so still consider it somewhat experimental. Under very wet conditions (especially near the end of bloom), the "big guns" (Vanguard or Elevate) may be better choices, but we just don't have the experience yet to know for sure. Strobies or Elevate applied to the

caps will probably fall with the caps (Vanguard should penetrate caps to reach the flower parts), so these materials may be more effective during late bloom rather than at pre- or early bloom.

PHOMOPSIS (Ph) REMINDERS

1. *Early sprays control rachis infections.* Although fruit infections by the Phomopsis fungus can cause serious and spectacular losses in wet years (especially on Niagaras), rachis infections are the most consistent cause of economic losses from this disease. In an experiment last year on 'Concord' vines at the Vineyard Lab in Fredonia, we obtained a 75% reduction in the number of rachises infected (relative to the unsprayed treatment) when the only Phomopsis sprays (Dithane) were applied at the 1-inch and 3- to 5-inch shoot stage. Control was increased to 87% by the addition of two additional prebloom sprays and to 97% by the further addition of two postbloom Ziram sprays. In contrast, we obtained only 10% control when we waited until the immediate prebloom stage to start spraying. A more minimal "grower-friendly" program of Dithane at 3- to 5-inch shoot growth, Rubigan + Dithane immediately prebloom, and Abound in the 1st postbloom spray provided 72% control. Bottom line: In a wet year, apply at least one early spray to control rachis infections.

2. *Fungicides.* Mancozeb, captan, and ziram have all provided good control of the basal shoot infections in our fungicide trials. Abound, Sovran, and Flint have all been mediocre. We have had only one good test of the strobies against rachis infections; they provided significant control, but not as good as that provided by the traditional (and cheaper) protectant fungicides. Trial results from Michigan have shown good control of fruit infections by Abound. The jury's still out on the strobies, in my opinion, but there's no reason to use them early. Let's hope they're adequate during the bloom and early postbloom period (fruit rot control) when they're most likely to be used for other diseases.

PUTTING IT ALL TOGETHER

We all know that there are many good programs for controlling these diseases. Here are a few considerations. As always, just because it isn't listed here doesn't mean it's a bad idea. Only products currently labeled in NY State are listed.

1-INCH SHOOT GROWTH. A **Ph** spray may be warranted if wet weather is forecast and the training

system or recent block history suggests high risk. Option A: Nothing. Option B: Captan or mancozeb.

3-5 INCH SHOOT GROWTH. A traditional time to control **Ph** shoot infections. Perhaps more importantly, our recent evidence indicates that this also is an important time to control rachis infections, which can occur once clusters emerge. Since the late 1980's, we've considered this the time to start control of **PM** on *vinifera* varieties if temperatures consistently remain above 50°F. It's a hard thing to prove, but I'm not so sure this spray is that important in vineyards that were "clean" last year (little overwintering inoculum). If you're spraying anyway for Ph, it won't hurt to add something for PM, but this is probably the least important PM spray of the season. More likely to be important under relatively warm conditions (>65°F), less important if cool. **BR** control is seldom justified unless you're trying to clean up a real problem block AND weather is wet. Option A: Nothing. Option B: Mancozeb (BR, Ph). Option C: Captan (Ph). Easier on predator mites than mancozeb (or ziram), but not as effective against BR (which usually isn't an issue this early). Option D: Nova or Elite (PM, BR). Use 3 oz/A for economy with so little foliage now (but remember that coverage becomes even more important when you're working with lower tank rates). Option E: Rubigan (PM). At 2 fl oz/A (minimal labeled rate), cost is only about \$4. Cheaper than Nova and Elite, especially if BR control isn't an issue. Option F: Sulfur (PM). Not very active at temps below 60°F, but neither is the PM fungus. Doesn't control other diseases. Option G: JMS Stylet Oil (PM). Should eradicate young infections IF thorough coverage is provided. Can use with mancozeb (or ziram), but not with captan (phytotoxicity). Option H: Nutrol (PM). Should eradicate young infections IF thorough coverage is provided. Option I: One of the PM products plus mancozeb or captan for Ph.

10-INCH SHOOT GROWTH. Traditionally, we've recommended not to wait any longer to control **BR**. Continued experience tells us that this recommendation is conservative (the spray generally isn't needed) unless BR was a problem last year (inoculum levels are high) and weather is wet and warm. Don't wait any longer to control **PM** on susceptible varieties (but wait until immediate prebloom on Concord). One of the best times to use an SI, also a possible time to experiment with "alternative" materials. **DM** control will be needed on highly susceptible varieties if disease was prevalent last year and rains of at least 0.1 inches at temps >50°F occur. Rachis infections by **Ph** are a danger in blocks with a history of the disease.

Option A: Abound, Sovran, or Flint (PM, BR, some Ph; also, variable DM [Abound, excellent; Sovran, fair to good; Flint, poor to fair]). Legal, but not the most efficient time to apply these expensive and limited-use materials. Option B: Mancozeb (BR, Ph, DM). A broad spectrum, economical choice if PM isn't a serious concern. Or tank mix with a PM material. Excessive use sometimes leads to mite problems by suppressing their predators. Option C: Nova or Elite (PM, BR). Option D: Rubigan (PM). No BR but cheaper than Nova and Elite. Option E: JMS Stylet Oil (PM). *If (and only if) coverage is thorough*, this spray should eradicate early PM colonies that may be starting because previous PM sprays were omitted. At a retail cost of \$11/gal, a use rate of 1% (1 gal oil /100 gal water), and 50 gal/A spray volume, cost is about \$5.50/A. But don't waste your money if you can't cover thoroughly. Also may help with mites. Option F: sulfur (PM). Reduced activity at low temperatures is still an issue at this time of year. Option G: Nutrol (PM). Short residual activity, but has eradicated activity against recent infections. Same need for thorough coverage as JMS Stylet Oil. Option H: Mancozeb (BR, Ph, DM) + a PM material (SI fungicide, sulfur, JMS Stylet Oil, Nutrol). Choose PM material based on previously-discussed characteristics and cost.

IMMEDIATE PREBLOOM TO EARLY BLOOM. **A critical time for PM, BR, DM, and Ph (fruit infections).** A good time to use a strobilurin on PM susceptible varieties. **This and the first postbloom spray are the most critical sprays of the season--DON'T CHEAT ON MATERIALS, RATE, OR COVERAGE!** Option A: Abound, Sovran, or Flint (PM, BR, some Ph; also, variable DM [Abound, excellent; Sovran, fair to good; Flint, poor to fair]). The best choice in most Finger Lakes vineyards where SIs have been used for a number of years against PM, particularly if multiple disease control is needed. Should provide some Botrytis control if a wet bloom period. Option B: Either Nova, Elite, or Rubigan PLUS mancozeb (PM, BR, Ph, DM). Nova and Elite are the biggest guns against BR, so might be the best choice if pressure is high and BR control is more important than PM. Nova and Elite provide postinfection activity against BR, so would be first choice if significant unprotected infection periods occurred within the previous week. Rubigan is (was?) cheaper than Nova or Elite, but doesn't provide nearly the same BR control; however, mancozeb should be adequate if postinfection control isn't required. Option C: Mancozeb + sulfur (PM, BR, Ph, DM). Cheap and reasonably effective

but not the strongest choice at a time when the strongest choice is most justified. Potential mite problems.

MID- to LATE BLOOM. Vanguard or Elevate for Botrytis control may be beneficial in certain years, particularly in problem blocks if weather is persistently wet. Abound, Sovran, or Flint applied recently may be adequate.

FIRST POSTBLOOM (10-14 days after immediate prebloom spray). **Still in the most critical period for PM, BR, DM, and Ph (fruit).** Same considerations and options as detailed under IMMEDIATE PREBLOOM. Juice grape growers can substitute Ziram (very good BR and Ph, only fair DM) for mancozeb if necessary.

SECOND POSTBLOOM. **BR** control still advisable under wet conditions and important if infections are evident on the vine. Fruit are less susceptible to **PM** now, but *vinifera* varieties (and susceptible hybrids?) still need PM protection, particularly to guard against fruit rots and promote wine quality. New foliage remains highly susceptible to PM. Avoid SI fungicides if more than a little PM is easily visible. **Ph** danger is mostly over unless very wet. Primary **DM** should be over, but continued protection may be needed on susceptible varieties if weather is wet, especially if disease already is established (look and see) Option A: Abound, Sovran, or Flint (PM, BR, some Ph; also, variable DM [Abound, excellent; Sovran, fair to good; Flint, poor to fair]. Provides good residual control of the listed diseases if used now. Should provide some Botrytis control. Option B: Nova or Elite (BR, PM) + captan or mancozeb (66-day preharvest restriction) if DM and Ph control are needed. Option C: Rubigan (PM) + either (a) mancozeb (if more than 66 days before harvest) for BR, DM, and Ph; or (b) captan (DM, Ph, some BR); or (c) ziram (BR, Ph, some DM). Option D: Sulfur (PM) + either (a) mancozeb (if still allowed) or (b) captan. In most years, lessening disease pressure makes this economical option increasingly practical as the season progresses. Option D: Copper + lime (some PM, DM). Adequate for Concords, not enough PM control for *vinifera* and susceptible hybrid varieties.

ADDITIONAL SUMMER SPRAYS. Check the vineyard regularly to see what's needed, the main issues will be **PM** and **DM**. On *vinifera* and other cultivars requiring continued **PM** control, use sulfur as an economical choice to maintain control; SIs and strobilurins are options if they haven't been

overused earlier AND little disease is evident. Both provide the advantage of longer residual activity than sulfur, especially in wet weather. For **DM**, copper + lime or captan are economical standards; Abound is a viable option if general disease pressure or other conveniences justify its cost; Ridomil can be used in case of emergency. **BR** should not be an issue after the second postbloom spray, except in unusual circumstances (disease is established in the clusters of *vinifera* varieties, wet weather is forecast, and it's possible to direct sprays onto the clusters). **Ph** should not be an issue. See previous discussion for **Botrytis** at veraison, and preharvest.

CONVENTION QUESTION BOX ANSWERS PART II

[There are still several questions that will be addressed in the next newsletter – TEM]

Why isn't Sauvignon blanc more widely planted in New York?

Because people have not paid the attention to it which it deserves. Sauvignon Blanc is a great grape variety for Long Island and it also can produce beautiful wines in the Finger Lakes. –*Thomas Henick-Kling*

From a viticulture standpoint, it does have a tendency to produce canes that don't harden off as early as other cultivars, and lack of winter hardiness is a concern. There are some plantings on the Niagara peninsula, however. –*Tim Martinson*.

Seven years ago, Bruce Reisch said GM grape vines would be available in seven years, where are they?

After about 7 years of work on the genetic modification of Chardonnay and Merlot, we have field trials underway in New York, and a larger planting even fruiting in California. The first genetically engineered vines from our program were planted in 1998. So far, we have seen some increases in powdery mildew resistance among a few of the Chardonnay vines, but not among the Merlot. Now that vines are beginning to bear fruit, we will have the opportunity to screen for Botrytis bunch rot resistance, a disease which should be targeted by the same gene we were using for powdery mildew resistance.

Our first set of transgenic Chardonnay and Merlot carried a single gene. The vines now in the laboratory should be carrying two or more genes. We are working now to determine which of these new lines are most promising.

I can't recall if I was overly optimistic at the time in 1994 when we first turned our attention away from development of a transformation system and toward the development of useful cultivars by genetic modification - perhaps I said GM vines would be available in 7 years, or perhaps I said GM vines would be in the field in 7 years. Looking back over grant proposals written in 1993, I found that we were predicting that field trials would begin around 1997 or 1998. That was indeed the case. As with most research on grapevines, the field trial phase requires multiple years. In our case, we wish to determine not only which lines carry the trait of interest, but will resistance be stable and long-lasting, and will the variety maintain its characteristic identity and wine quality? Before a product is commercialized, regulatory approval will also be required from USDA, FDA, and EPA. This will be preceded by stringent product testing.

Perhaps, I was referring to other research projects taking place around the world seven years ago? Well we are by far not the only lab with field trials of genetically modified grapevines. Some of my colleagues at Geneva have a project to improve virus resistance in transgenic rootstocks and scion varieties. Other companies like DNA Plant Technology and Dry Creek Labs in California also have field trials. The most advanced work of any type took place from the mid 1980s through about 1998. Moët & Chandon had a long-term well funded effort (collaborative with French universities) to develop varieties resistant to Grapevine Fanleaf Virus. Public opinion forced closure of this project, and the vines are now held at an undisclosed location in France. Yet, despite the public pressure in Europe which seems much more severe than in the U.S., government programs in Germany and elsewhere are also field testing transgenic vines. Australia is doing so, as well.

Your question gave me a nice opportunity to discuss the considerable progress in our lab and elsewhere, but I am not going to go out on any limbs to predict when a commercial product will become available!
- Bruce Reisch

How do you set up alliances or contacts to sell your crop?

The best way to do so is by contacting processors or wineries directly to determine their needs. We also maintain an e-mail listing for grapes 'wanted' or 'available' that may be useful in obtaining contacts. A group here in New York is working to set up a

'grower classified' electronic exchange, where one could list this type of information. -Tim Martinson

What are the current concepts in rootstock protection during prolonged sub-zero temperature period?

In general it's not the rootstock one is trying to protect, but rather the cold-sensitive scion variety. This is done by hilling up soil over the graft union and the buds at the base of the scion variety. Hills are removed at least every other year to prevent 'scion rooting'. Hilling up is a costly, time consuming activity, so some growers have concentrated on using it on young vineyards and doing less hilling up in mature vineyards. Others protect the graft union by placing piles of sawdust (a good insulator) around the base of the vine. These measures do not prevent trunk injury or injury to buds above the soil (or sawdust) line. Rather they protect the parts you will need to rebuild and replace winter-injured trunks. In more extreme climates, growers of cold-sensitive varieties train their vines to produce a few long canes, and then bury the entire cane in the winter. -T. Martinson

How does the use of organic pesticides versus conventional herbicide and fungicides subsequently affect taste or grape quality?

Herbicides, in general are not applied 'over the top' of a vineyard, and therefore, no residue should be directly contacting grape clusters. Some materials can be translocated within vines, but the amount ending up in fruit should be minimal. Fungicides are designed to be applied to foliage, of course. Preharvest intervals (in some cases very long ones, such as mancozeb's 66 day pre-harvest interval) are designed to minimize residues remaining at harvest. To my knowledge, neither the SI fungicides (Nova, Rubigan, Bayleton) nor the strobilurins (Abound, Flint, Sovran) have been associated with 'off' flavors in wine or juice. The organic choices, Sulfur and copper compounds, if applied too near harvest, can impart detectable flavors to wine. Whether organic or not, however, fungicides have a strong *positive* effect on flavor and quality: They prevent the grapes from becoming diseased. Even small amounts of powdery or downy mildew, or *botrytis* bunch rot infected fruit have detrimental effects on wine quality. -T. Martinson

ECONOMIC IMPACT OF WINE PRODUCTION

Excerpted from the Wine Press 3/24/01

Jim Trezise

NY Wine and Grape Foundation

WINE FACTS from the American Vintners Association (AVA) confirm the huge economic importance of our industry: Grapes are grown in over 40 states, and wine produced in 49 states. Grapes are the highest value fruit crop in America, and the 6th largest overall, and winegrapes represent 2/3rds of the total. Wine production adds value of \$2 for each \$1 of farm gate value. The U.S. represents 6.3% of the world's wine production (fifth, after Italy, France, Spain, and Argentina). Wine contributes over \$45 billion to the U.S. economy, 556,000 jobs, \$12.8 billion in wages, and \$3.3 billion in state and local tax revenues.

YOU CAN SAVE MONEY ON YOUR TAX BILLS

Mark James

NY Farm Bureau

[I'm printing this in response to a Question Box question: What tax incentives or resources are available to vineyard owners? Mark James previously published this response in a Farm Bureau publication – TEM]

Over the past several years, I occasionally receive a phone call from a farmer or someone who rents agricultural land to a farmer asking if there are any programs that can reduce the property tax burden on their land. I ask if they are receiving an agricultural assessment on their property or if they are aware of the other rebate and credit programs available from the State of New York. I have found that there are a surprising number of individuals who have not heard the news about these programs. This article is to let you in on a few of the programs that you may qualify for.

Ag Assessment Program. The first and most common of these tax programs is the agricultural value assessment. If a farmer has less than ten acres he must gross at least \$50,000 average over the last two years from agriculture. The program is available to non-farmers provided the land being rented for agricultural production is to a qualified farmer. The first step in the application process is to contact your soil and water district to make an appointment. Be sure to bring a copy of your tax map.

Building Exemptions. The next program is the ten-year building exemption on agricultural buildings. If you have built a new agricultural building you should apply for this ten-year property tax exemption. You have up to one year from the completion date to file provided it is by March 1 of the following year.

For greenhouse owners, there is a one time filing to exempt temporary greenhouses. These greenhouses primary function should be producing plants or raising animals and not retail sales.

For silos, grain bins and commodity sheds, you can file for a property tax exemption on these structures, again provided that the primary purpose is for the storage of forage, grains, feed grains, or feed components. The same form is used for bulk milk tanks and coolers, and manure storage and handling facilities,

For orchards and vineyards, you may be eligible for a four-year property tax exemption on new or replanted acreage. It can not exceed 20% of the total acreage unless it is part of a state declared disaster area and those crops were lost to disaster.

The deadline for filing with your assessor on all of the previous items is March 1

School Tax Credit. The Farm Preservation Act of 1996 allows for a refundable state income tax credit for qualified farmers. The credit is 100% on acreage and farm buildings up to 250 acres and 50% on acreage above 250 acres. For more information on who qualifies, contact our office for a booklet and the tax forms.

Sales Tax Exemption. Finally, farmers are eligible for a sales tax exemption on certain items used on the farm. For the latest information on qualifying items contact our office for a brochure and tax exemption forms.

UPCOMING EVENTS

Late May. *Spring Pest Management Update and Barbecue.* This annual event will feature updates by University, Commercial suppliers, and regulatory persons, along with a barbecue.

Look for details (not nailed down as of this writing) in the next Vineyard Notes, or in E-mail updates.

July10-13. **Niagara-On-The-Lake, Ontario.**
Space Age Winegrape Growing and ASEV Eastern

Section Annual Meeting. Contact our office 315-536-5134 for more details.

August 7-10, 2001, Kennett Square, Pennsylvania. *Second Annual Eastern Pinot Noir Conference.* The purpose of this conference is to critically taste Pinot Noir wines from across the region and beyond. Modeled after the incredibly successful Steamboat conference in Oregon, this event asks wine makers and growers to bring their wines to share and to be evaluated by their peers in an informal and casual setting. The goal is to improve our wines through the unrestrained sharing of knowledge and experience, both in the cellar and the vineyard. Entry to this event is limited to commercial producers only in an effort to assure the confidentiality of our conversations. For more information and registration, please contact Mark Chien at 717 394-6851 or mlc12@psu.edu.

Cornell Cooperative Extension

Finger Lakes Grape Program

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