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VITICULTURE NOTES

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I. Current situation

Our research plot harvest wrapped up with Cabernet Sauvignon on 15 October this year, not too different from "average" harvests of the past 10 years, discounting the very early harvests of 2007 and 2010. Aside from the record warm March and corresponding early bud break, it was a rather ordinary year, if "ordinary" ever describes grape growing in Virginia. There were some unusual events for us: both the derecho of June and Hurricane Sandy in late-October caused some trellis damage to our hilltop vineyard, although crops had been harvested in the latter case. We also sustained some hail damage from a July storm, but this turned out to be a minor issue. Rainfall was adequate and, excepting our "root bag" restricted rooting plots, we didn't need to irrigate. After the experiences of last year, bird netting went up at veraison (Figure 1) and we had essentially no bird damage. The two varieties in our principal viticulture research block shown in figure 1 are Cabernet Sauvignon and Petit Manseng. Both do reasonably well with occasional rains in the veraison to harvest period, although last year we had major issues with botrytis developing on the Cabernet. We took a somewhat more aggressive approach this year with our veraison to harvest fungicide program and, arguably, this might have been a factor in bringing in relatively clean fruit at harvest (Figure 2). Our spray program for the 2012 season is shown in Table 1. As with past presentations of our spray schedule, this is not intended to

Figure 1. Overview of vine size management experimental vineyard at the Winchester AREC, late August 2012.

recommend one product over another, or to say that the same program should be used in your vineyard. We do not have a specific, pre-planned "schedule" that we follow for spraying. We consider the growth stage of vines, the environmental conditions since the last spray, weather forecasts, the products previously used, the products that can currently be used in light of Pre-Harvest Intervals (PHIs), resistance management, and our need to access the vineyard and work with the vines in light of product Restricted Entry Intervals (REIs).

Table 1. Fungicides and insecticides, and stage of growth at each application, used in the AHS AREC research vineyard, March-October 2012.

Date-2012	Pesticides used	Growth stage
22 March	Brigade WSB	bud swell
19 April	Penncozeb 75DF	2-3 leaves unfolded
3 May	Penncozeb 75DF; Rally 40WSP; sulfur	5 leaves unfolded
16 May	Penncozeb 75DF; Rally 40WSP; sulfur	10 leaves unfolded
25 May	Penncozeb 75DF; Quintec; Switch 62.5WG; sulfur	pre-bloom
5 June	Penncozeb 75DF; Intrepid 2F; Rally 40WSP; sulfur	bloom
20 June	Penncozeb 75DF; Mettle 125ME; Phostrol; Intrepid 2F	berries pea-size
4 July	Revus; Mettle 125ME; Assail 30SG	berries hard & green
18 July	Phostrol; Quintec; sulfur	berries still hard & green
27 July	Switch 62.5WG; Captan 80WDG; sulfur	berries beginning to soften
13 August	Revus; Quintec; sulfur	veraison
28 August	Phostrol	post-veraison
6 Sept	Captan 80WDG; Switch 62.5 WG	post-veraison
21 Sept	Captan 80WDG (low rate); Pristine	
29 Sept	Belay	berries harvest ripe
3 Oct	Captan 80WDG (low rate); Elevate 50WDG	berries harvest ripe

Petit Manseng harvest dates were 19-20 Sept (about 27.0 Brix). Cabernet Sauvignon harvest dates ranged from 8-15 Oct (Brix ranged from 22 – 23.5).

Figure 2. Cabernet Sauvignon, mid-October, Winchester.

This was a fairly typical program for us although we ended up with three or four more fungicide applications than we normally apply. We relied heavily on mancozeb early in the season for Phomopsis, downy and black rot, and a mix of fungicides including Revus, Phostrol and captan late in the season for downy. The backbone of our powdery program was Rally, alternated with Quintec and Mettle, with sulfur incorporated in most sprays prior to 30 days (+/-) before harvest. Given our experience with botrytis in 2011, we were more aggressive with our botrytis program this year (Switch and

Elevate). Also, the warm, wet weather of August and early September compelled us to take a more aggressive stance towards downy mildew and late-season fruit rots. This explains the late-season captan and Pristine sprays. We did not suffer downy mildew problems and botrytis was a very minor problem on a few Cabernet clusters. Again, canopies were essentially clean (figure 2) at harvest and, with the exception of <2% rotted, individual berries on Petit Manseng mentioned in my last newsletter, the fruit was very clean at harvest.

II. Molly Kelly hired as Virginia Tech Extension Enologist:

Molly Kelly has accepted the position of Enology Extension Specialist in the Food Science and Technology Department. Ms. Kelly will be joining the department on December 25, 2012. Molly previously held the position of Enology Instructor at Surry Community College (Dobson NC) for five years. During her tenure there she developed the enology curriculum and managed all aspects of the on-site bonded winery. Under her direction the college produced numerous international, award winning wines. Prior to her position at Surry, Molly was a biodefense team microbiologist with the New York State Department of Health.

Ms. Kelly is currently completing her PhD in Food Science under the direction of Dr. Bruce Zoecklein. Her dissertation research focuses on the characterization of the aroma composition of Petit Manseng.

Ms. Kelly will be expected to develop and implement an Extension program for Virginia grape and wine producers. She will also support the growth and development of the Virginia wine industry through educational programs and applied research that provides an educational bridge between vineyard practices and wine production practices that directly impact wine quality. Molly has previously spoken at the Virginia Vineyards Association's winter technical program, and will participate at the February 2013 meeting in Charlottesville.

III. Pierce's Disease on the move

Figure 3. Red oak leaf with severe scorch presumably caused by Xylella fastidiosis.

We have a large red oak on the edge of our lawn, just in the woods. This year I noticed the normally dark green leaves taking on a "scorched" appearance in early-August (Figure 3). The scorch started low in the tree canopy but had involved most of the canopy by September with substantial defoliation occurring. As I drove around the northern Shenandoah Valley in early fall, I was aware that many red oaks were showing either entire canopies or major limbs similarly affected by the scorch. The "scorch" was not drought-related but was indicative of a disease that affects certain oaks, sycamores, certain *Prunus* species and, actually, a rather large number of woody plants. If I'd seen this in previous years, it hadn't registered with me. The disease is caused by a bacterium, *Xyllela fastidiosa*. What does this have to do with grape growing? The same bacteria (but possibly a slightly different sub-species) cause Pierce's Disease (PD) in grapevines. In addition to the oaks, I started noticing a number of vines with PD-like symptoms in areas where we have not previously seen PD symptoms. Leaf samples were collected from Merlot vines in Albemarle County, Chardonnay and Petit Manseng from Rappahannock

County, and Petit Verdot from Warren County. These and others from a vineyard in the Richmond area were tested for presence of *X. fastidiosa* by Virginia Tech's Plant Disease Clinic. All, except the Petit Manseng, tested positive. Although perhaps more noticeable this year, symptoms of PD have been previously observed as far north as Fauquier County six years ago. In her Masters research at Virginia Tech, entomologist Anna Wallingford reported that PD symptoms were widely distributed throughout 31 separate vineyards in Virginia and that "it is likely that all vineyards throughout the sampled area are at risk of PD" (Wallingford et al., 2007). Her report substantially increased the predicted risk assessment for PD beyond that which we had proposed in the Wine Grape Production Guide (p 33).

Figure 4. Petit Verdot showing Pierce's Disease symptoms. September 2012.

Although unsettling, the number of affected vines observed in this expanded range during 2012 was not that great – the numbers are far greater though in certain Southern Piedmont vineyards and those east of I-95, where growers have been dealing with PD for a longer time. Interestingly – and very anecdotally – the vineyards where I observed PD symptoms in late-summer 2012 were some of the same vineyards that have historically had problems with North American Grapevine Yellows (NAGY). This might relate to commonalties of alternative host plants and other aspects of the vineyard ecology that support leafhopper vectors of the two diseases; however, the current knowledge of vectors suggests *different* vector species for PD bacteria and NAGY phytoplasmas.

What happened in 2012 to make PD symptoms more noticeable? There are two possible contributors, and it's possible that both had a bearing on the increased observation of affected vines this year. We had a record warm March. Budbreak was nearly a month early in some vineyards. This may have led to an earlier emergence (or hatch) of overwintering leafhoppers which gained additional opportunity to infect grapevines with the PD bacterium through their feeding. Earlier infection, coupled with a warm summer, would conceivably lead to earlier symptoms (Feil and Purcell, 2001; Janse and Obradovic, 2010). The other feature of 2012 that very likely affected symptom development is that the 2012 season followed an unusually warm winter. We know that low winter temperatures serve to limit the geographical distribution of PD. In her MSc thesis, Anna Wallingford used a system proposed by Turner Sutton in North Carolina, where climatic zones were rated for PD risk based on the occurrence of either 10°F or 15°F. Regions were **low risk** if the preceding winter experienced 3 or more occurrences of 10°F or 5 or more occurrences of 15°F; **moderate risk** if 2 or 4 occurrences, respectively, and **high risk** if the region experienced 1 or no occurrences of 10°F or 3 or fewer occurrences of 15°F (Anna's thesis is at: http://scholar.lib.vt.edu/theses/available/etd-07232008-094859/unrestricted/Wallingford.pdf) Doug Pfeiffer echoes this benchmark (http://www.virginiafruit.ento.vt.edu/PDWinterRisk.html); "the greatest risk for Pierce's exists when there are fewer than 3 nights with minimum temperature below 9.4°C (15°F). I asked colleagues in California and Texas whether they have sharply defined temperature minima that, if achieved, allow them to sleep easier. It seems this is somewhat of a gray area. However, whether we used 15°F or 10°F as the functionally important temperature to suppress PD symptoms, the occurrence of either temperature minimum was very limited during the 2011-2012 winter. Virginia maps of the frequency of 15°F and 10°F were generated by colleagues at Virginia Tech's Center for Geospatial Information Technology (Figures 5 and 6, respectively). While much of the piedmont and western portions of Virginia saw one day at or below 15°F (Figure 5), most of the southern Piedmont, Tidewater, and Eastern Shore had no occurrence of 15°F or colder, and very few areas saw 3 or more days below 15°F. The occurrence of 10°F was even more limited (figure 6); very few locations had a single occurrence of 10°F or lower.At

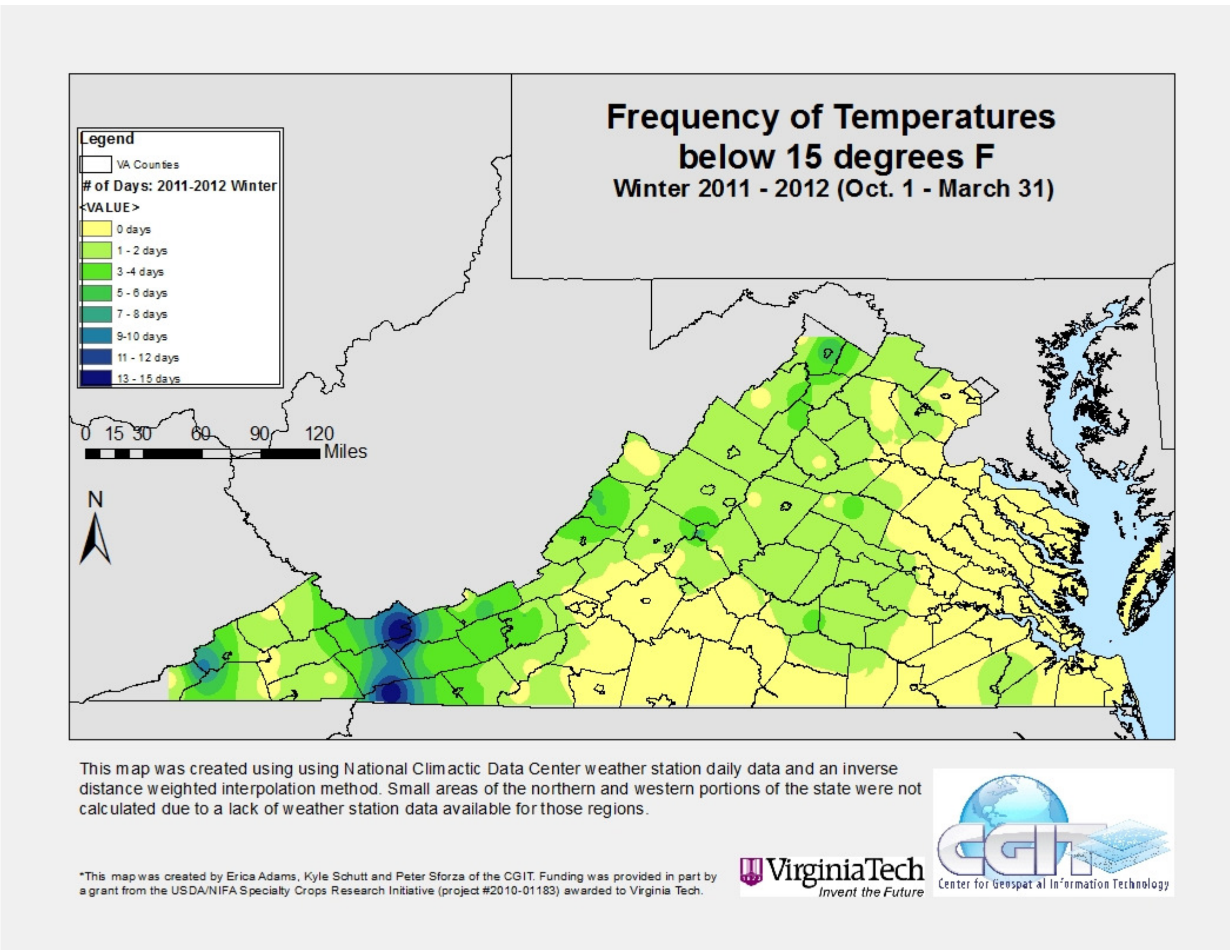

Figure 5. Frequency of temperatures below 15F during the 2011-2012 winter.

our research farm in Frederick County, we had 4 days at or below 15°F (3, 4, 16 and 19 January), and only one day below 10F (9.1°F on 4 January), putting us somewhere between moderate and high risk of PD observation.

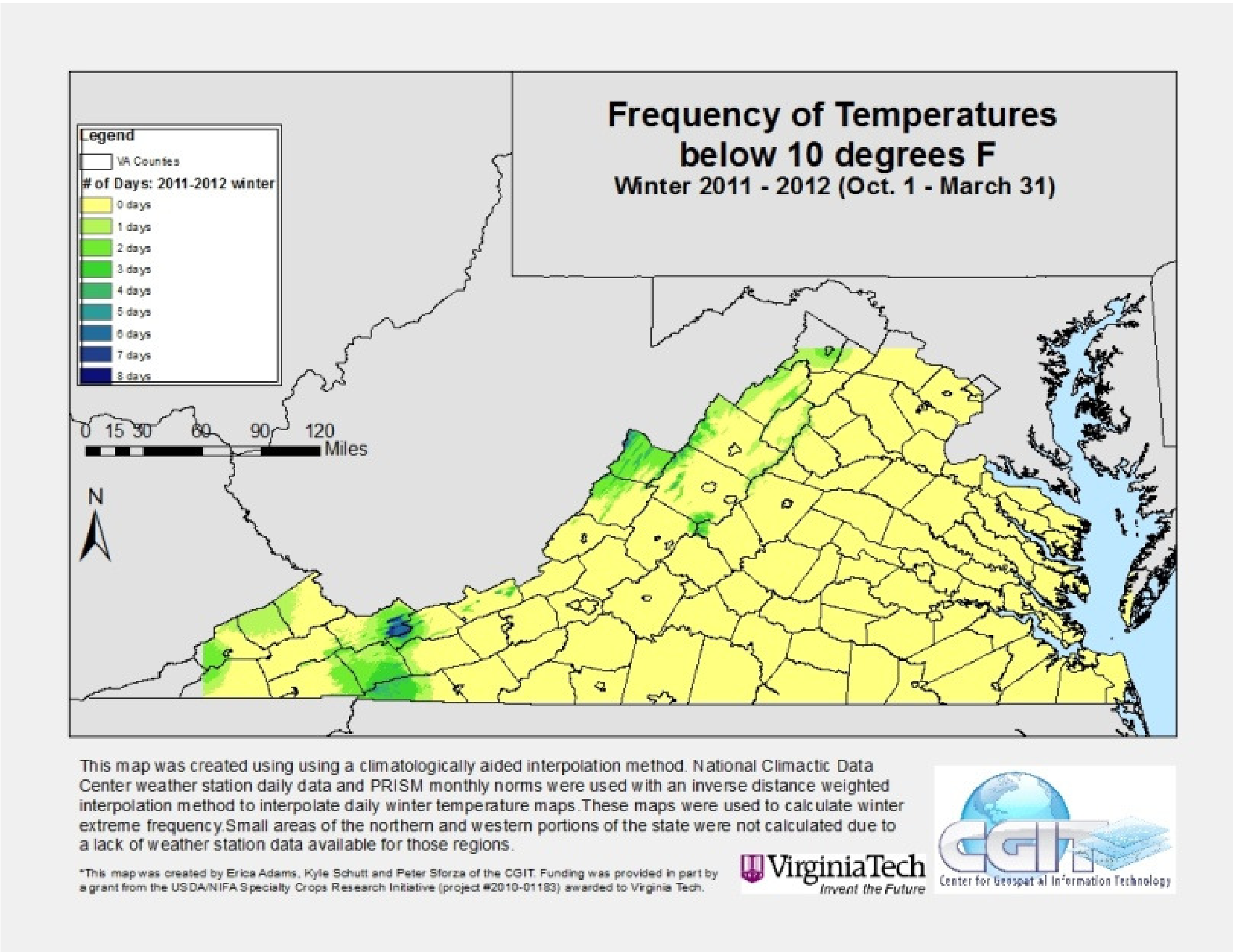

Figure 6. Frequency of temperatures below 10F during the 2011-2012 winter.

So, where does this leave us? Uncertain. We're uncertain what the future winter temperatures will offer but it's very likely that with the trends towards warmer winters, we're apt to see an increased incidence of PD in parts of the state that have historically not been affected. This is not to say that all vines that showed symptoms in late 2012 will necessarily show symptoms (or die) in 2013. If sufficiently cold winter temperatures occur, the vines may recover or show reduced symptoms in 2013; however, they are likely to be reduced in vigor and fruiting capacity.

It's also worth reminding ourselves that we've observed PD in Virginia since the mid-eighties and that vineyards have managed the disease, albeit at increased expense and reduced production when vines are lost. I've asked Jim Kamas of Texas A&M University to visit with us at the Virginia Vineyards Association's winter technical meeting (February 2013) and provide some updates to the talk he gave on PD at Williamsburg Winery back in 2007. Jim's parting shot at that meeting, in describing what he'd seen in Virginia, was "it's manageable". I want growers to be aware of the risks of PD but also understand their options in dealing with it, whether it be active measures to reduce alternative hosts and vector levels or changing varietal options towards less susceptible varieties.

References:

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III. Question from the field: Vineyard design

Q: I'm starting to design my vineyard for planting in 2014 and have gone through the Wine Grape Production Guide and looked at old newsletters (http://www.arec.vaes.vt.edu/alson-h-smith/grapes/viticulture/extension/viticulture-notes-archive.pdf) for guidance on planting density and training systems. I've also read much in the popular press and talked with other growers here in Virginia. The trend appears to be towards high-density plantings with vines trained to simple, vertically shoot-positioned (VSP) canopies. You appeared to recommend divided canopy training systems at one time, but when we visited your research vineyard this summer I noted that it was trained to VSP and planted at a fairly high density of vines. Are you advocating simple VSP training and high density planting?

A: In *many* cases, yes. But "many" leaves open the door for alternatives and "high density" is a qualitative expression. My early "endorsement" of canopy division was a practical approach aimed at translating the growth potential of vigorous vines into increased crop yield. Bear in mind that I'm a product of viticultural training that holds, among other tenets, that the path to profit in the vineyard is to grow relatively large, healthy grapevines that capture a substantial portion of incident radiation (sunlight) with their canopies, and translate that energy into crop <u>that meets the buyer's or winemaker's specifications</u>. I make no apologies for that approach and feel that it is fair to both the independent grower as well as the wine grower who utilizes their own crop and can charge what is necessary in the sales room to cover what may be very high establishment and operating costs. In particular, my recommendations in the late-eighties and early nineties to convert existing Casarsa and VSP vineyards to lyre-training were based on the fact that many of those vineyards had reasonably healthy, large vines in rows that were spaced as much as 12 feet apart. Very little narrow (vineyard) equipment was available at that time and the canopy division was one means of translating a rather inefficient use of vineyard area to increased production, without having to rip out the vines and start over.

While it's worth noting that the 2012 Governor's Cup was awarded for a wine that was made from grapes produced on lyre-trained vines, I ceased recommending open-lyre many years ago – both the installation and the operational expenses (if done well) are just too expensive compared to using narrower row space with either non-divided canopy systems, or vertically-divided training. Furthermore, I'm not convinced that giving vines more space (as by open lyre) will *consistently* produce a more optimal vine size (as measured by cane pruning weight per unit length of canopy, where our goal is about 0.2 to 0.4 pounds of cane prunings per foot of canopy [page 127, Wine Grape Production Guide]). When we installed a small open-lyre vineyard on a colluvial soil here at our station in 1990, the Chardonnay and Cab Sauvignon vines filled the training system and within 5 years we were hedging them on a repeated basis in all but the driest years. Although the Chardonnay were reasonably well behaved, the Cab Sauvignon never really conformed to what I would consider to be "balanced" vines. We dug pits and looked at the root systems on a couple of those vines and found roots as much as ½-inch diameter down below 5 feet in depth; this was a deep soil with ample water holding capacity, but good drainage. It was, in hindsight, not a good site for Cab Sauvignon, regardless of the training system!

I continue to recommend Geneva Double Curtain (GDC) in certain situations – but specifically for those varieties that have a procumbent growth habit and when grown on “high vigor” sites: examples would be ‘Norton’ and ‘Traminette’. Norton benefits from the added exposure of fruit for malic acid respiration and GDC training has the potential to “splendidly” display fruit. Other varieties, such as Traminette, can be tricky – although the shoots are easily trained down with GDC training, and shoot growth is slowed down by that downward orientation, fruit quality can be compromised if it’s excessively exposed. We have seen slightly increased fruit rots, such as ripe rot, with GDC, relative to more protected VSP fruit. The reasons for increased rot potential might relate to the prolonged presence of condensate (dew) on fruit exposed to the sky with GDC under our humid conditions. There is also a certain management skill (and critical timing) required to achieve the best results with GDC training, and this skill is sometimes wanting.

For these reasons, I generally recommend simple, VSP training with most new vineyards going in and as narrow a row width as the grower feels comfortable choosing given his or her equipment; typically this is on the order of 7 to 9 feet. The availability today of many smaller, powerful tractors, is a decided improvement over what was available in the late-eighties and early nineties. If a grower insists on planting to a high-vigor site, I will discuss the potential merits of Smart-Dyson (vertically divided training). But here’s where practicality can run afoul of logic. While the higher yields achieved by more efficient use of vine capacity might argue for Smart-Dyson training, the added management skill required to manage the divided canopies is often lacking. Where the skill exists, the results can be impressive. I still suggest Smart-Dyson under some situations because it can be adapted to varying degrees of vigor over time and over space within the same vineyard block or even within the same row, provided the cordon wire is high enough (about 42 inches). Our own research with Smart-Dyson, GDC and VSP indicated that cropping could be increased with either of the divided canopy systems without compromising (or actually increasing) wine quality potential (AJEV, 60:339-348). One caveat, and a practical factor that ultimately dissuaded me from using Smart-Dyson in our Cabernet Sauvignon growth management experiment: vine side bird netting is far easier to install on simple VSP than on Smart-Dyson-trained vines.

Can the Smart-Dyson lead to over-cropping? Absolutely, but so can VSP. We have a difficult time getting high red wine quality potential from any system that exceeds about 1.5 pounds of crop per foot of canopy (a bit higher with Smart-Dyson) in all but the exceptional years (such as 2007 and 2010).

All of this said, my <u>preferred</u> vineyard design would comprise a site that affords a low to moderate degree of vigor (page 127, Wine Grape Production Guide) and use of practices such as under-trellis cover crops that intentionally compete with vines (primarily) for moisture (Hatch et al., AJEV, 62;298-311). The under-trellis cover crops (volunteer weeds or planted vegetation) are a necessity to reduce soil erosion potential if rows are oriented up and down the slope on steeper sites (e.g., >15% slope).

In terms of vine spacing (planting density), we would have to agree on terms such as “moderate” or “high” density, and associate those terms with some numbers. Moderate to me is on the order of 1000 to 1500 vines per acre (e.g. ~ 9’ X 5’ down to 7’ x 4’); high(er) density is anything greater. My vine spacing recommendations are decidedly “moderate”: I use a range of 4 to 6 feet for in-row spacing, with 5 or more being suitable only for cordon training, and 6 being special situations, such as a desire to use non-divided training with Norton with an eye towards mechanized harvesting. Very lean sites with head-training and cane pruning would be okay with 4. Until someone shows me perceptible wine quality differences between 3 feet in the row (or less) and 4 feet (or more) in the row – *all other factors being equal* – it strikes me that the higher density is only a greater establishment and operational expense. But, to borrow another author's expression, perhaps I have not been struck hard enough. Four feet seems to be a good dimension for promoting uniform shoot growth along bi-laterally arranged canes. So… an 8' x 4' spacing recommendation yields 1361 vines per acre, which could be bumped up to 1556/acre if the available equipment allowed traffic at a 7-foot row width. To put this in perspective, our first research vineyard that I planted in Winchester in 1987 had vines spaced 7 feet apart in 12-foot rows (I had to farm with the equipment available at the time, and the in-row spacing was more or less an industry convention at that time for cordon-trained vines). So yes, my recommendations have changed some over the years.

Some growers are adamant that their adoption of "high" density (up to 2000 vines per acre) is resulting in higher wine quality potential than what they were previously achieving at lower density. I don't dismiss the comments of respected wine growers. But aside from density, what else changed when the new vineyards were planted? Vineyards that have been planted since 2000 are in many cases based on superior clones and less likely to have leafroll virus that still plagues many of our older vineyards. These replanted vineyards are also usually farmed by experienced vineyardists who have gained considerable knowledge since their first vineyards were planted and are less apt to make careless mistakes that can affect wine quality potential. To attribute high wine quality potential to vine spacing (and hence vine size) alone is a stretch.

A final comment: We are in the very preliminary stages of organizing a one-day technical meeting this coming summer to discuss vineyard design features on "challenging" landscapes. As interest shifts towards steeper sites and more rugged terrain in efforts to achieve higher wine quality potential, it introduces design and operational considerations that were far less complex on flat land. Stay tuned.

V. Upcoming meetings:

Here's an advance notice that he Virginia Vineyards Association annual winter technical meeting will be held at the Omni Hotel in Charlottesville, January 31 – February 2, 2013. The meeting will have a heavy emphasis on integrated pest management (particularly disease and insect issues), and will also feature sessions on the 2012 Governor's Cup Gold medal wine tastings and discussion and an afternoon session on Viognier.

I wish each of you a Happy Thanksgiving!