

**Year-end report to Virginia Wine Board
30 June 2007**

Title: Optimized grape potential through root system and soil moisture manipulations
VA Tech FRS # 447728

Principal Investigator: Tony K. Wolf

Award amount: \$18,323

Amount remaining at year-end: \$1,440 (+/-)

Objectives:

- 1) Evaluate the impact of complete ground cover vs. under-trellis weed control, three rootstocks, and three root manipulation techniques as means of regulating the vegetative/reproductive balance of Cabernet Sauvignon clone #337 (VA site)
- 2) Evaluate cover crop species and root pruning to impose water stress on Cabernet Sauvignon vines (NC)

Comments on funding: Funding for this and other Virginia Wine Board projects was made available in early September, 2006. Proposed expenses in July and August were largely avoided or paid from other funds due to uncertainty of funding. The amount shown as remaining at year-end is an approximation. The accounts manager at the AHS AREC (Wolf's work location) was on extended medical leave from early-May through July 2007. This resulted in delayed postings of some charges to the Wine Board accounts. Furthermore, in order to meet Wine Board administrative needs, we were unable to post some wage charges to the accounts after mid-June 2007.

Progress:



Vine on left was planted in a root-restriction bag to constrict vegetative vine development. Vines are in second season in the vineyard.

Objective #1: Cabernet Sauvignon, clone #337 was planted and trellis constructed as described in FY 2007 first quarter report (30 September 2006). Progress since then includes routine vineyard management (pruning, early season vine training, pest management, etc.). Vines have made excellent growth and trellis construction was completed spring 2007. Soil moisture probe access tubes (12) were installed in June 2007. Irrigation components were purchased but we lacked time to install in summer 2007; irrigation will be installed in fall 2007. Border vines (Petit Manseng) were planted in guard rows and buffer plots in May 2007. The growth suppression afforded by root-restriction bags was evident by mid-summer of 2007 (Photo to left). This objective is proceeding on track with project objectives.

Objective #2: The work of graduate student Gill Giese at Shelton Vineyards in Dobson, NC is proceeding as proposed. This project asks two very basic questions:

- Can the vegetative growth period and berry size of mature Cabernet Sauvignon grapevines be regulated with permanent, under-trellis cover crops or root-pruning?
- If so, do those responses translate to improved grape and wine potential quality?

Ideally, we'd like vegetative growth of grapevines, particularly shoot extension, to cease at about the time of veraison. The continued vegetative growth of vines in the final ripening of the crop is often associated with "vegetal" character in wines from methoxypyrazines and other compounds that can be formed in young leaves. The continued vegetative development of vines also contributes to fruit rot problems and increased labor for trimming. We'd also like to produce grapes that have relatively small berries. Small berries have a greater surface-to-volume ratio than do large berries; small berries thus have greater concentrations of flavor and aroma compounds. Achieving smaller berries and restricted vegetative development might be possible by regulating the water available to vines by competition (under-trellis grass) or by root system restriction (root bags, root-pruning, or "size-restricting" rootstocks).

Multiple shoot growth measures among treatments in 2006 and 2007 revealed a reduction in the extent of shoot growth achieved by root pruning, as well as a reduction in shoot length/growth rate with several of the ground covers; orchard grass was the most effective cover crop tested at reducing shoot growth. The effects of root pruning and cover crops on restricting vegetative growth of these vines was most pronounced in the early (prior to July) part of the season, which was relatively dry. Data have also been collected on the performance of 5 different cover crops, on soil moisture, and on plant water potentials as affected both by root pruning and by cover crops. Dormant season pruning weights were collected in winter (06/07) and also showed that both root-pruning and cover crops were effective in reducing vine size. Berry weights and primary fruit chemistry were unaffected by treatment in 2006; however, crops were picked somewhat earlier than optimum (about 19°Brix) due to wet weather and concerns about fruit degradation.

A preliminary report was presented to attendees of the Virginia Vineyards Association's summer technical meeting on 3 August 2006. Research papers were presented on this research at two meetings in July 2007:

- American Society for Enology and Viticulture/Eastern Section, 16-17 July, Fogelsville, PA
- Viticulture Research Forum, University of California, Davis, 17-19 July, Davis, CA



The photo to left illustrates the effect of under-trellis cover crop (vine to right) on suppressing vegetative growth of vines in the North Carolina study. The vine on left is in a border plot which is maintained with an herbicide strip under the trellis. The vine on right has the more optimal canopy architecture.

Summary: Project is on track good. Growth suppression has been possible with cover crops or root-pruning. Effects on fruit chemistry and potential wine quality are still uncertain. The current research is addressing this question.

**Final report to Virginia Wine Board
30 June 2007**

TITLE: Viticulture Extension Operations Support
VA Tech FRS # 547488

Principal Investigator: Tony K. Wolf

Award amount: \$9,400

Amount remaining at year-end: \$77 (+/-)

Objectives:

To support state-wide viticulture extension activities of Mr. Fritz Westover (Viticulture Research-Extension Associate), Ms. Ashley Meyers (Grape Pathology Extension Specialist), and Dr. Tony Wolf through the AHS Agricultural Research and Extension Center.

Comments on funding: Funding for this and other Virginia Wine Board projects was made available in early September, 2006. Proposed expenses in July and August were largely avoided or paid from other funds due to uncertainty of funding. Both Mr. Westover and Ms. Myers resigned their respective positions in January 2007, which was unforeseen at the time the grant proposal was submitted (February 2006). The combination of delayed funding and unexpected staff reductions led to less than expected travel costs and some residual funds at the end of the fiscal year. The amount shown as remaining at year-end is an approximation. The accounts manager at the AHS AREC (Wolf's work location) was on extended medical leave from early-May through July 2007. This resulted in delayed postings of some charges to the Wine Board accounts. Furthermore, in order to meet Wine Board administrative needs, we were unable to post some charges to the accounts after mid-June 2007. That said, this grant was important in providing a means for us to deliver our extension programs in 2006/2007, and we generally completed what had been proposed in the grant proposal.

Progress:

- Wolf, Myers and Westover participated in 6 mid-day vineyard field meetings in the summer of 2006 and spring 2007, with travel supported by this grant. The meetings were arranged by local Cooperative Extension agents in Rappahannock and Nelson Counties, although the meetings were often in other counties as well. Attendance at the vineyard meetings averaged 20 or more growers and subjects ranged from pest management to seasonal vine and vineyard management practices. Grower exit surveys have been very positive, with one result being that regular attendees of these vineyard meetings tend to avoid pitfalls and problems observed by uninformed growers.
- Wolf, Westover and Myers organized and conducted a Cooperative Extension in-service training program in August 2006. Supported in part by a VA Vineyards Association travel grant, the workshop continued training initiated in August 2005. As a result, more Virginia Cooperative Extension agents are competent to work directly with grape producers in their county or multi-county area and, in a follow-up survey, most of the attendees have reported that they have been more apt to work directly with grape growers in their county or area, rather than steering the growers to us.
- With some software and hardware funding provided by this grant, Mr. Fritz Westover developed three MacroMedia Breeze presentations on dormant grapevine pruning. The presentations, which feature animation and audio, are found on Wolf's website (<http://faculty.vaes.vt.edu/vitis>)

- Myers and Westover conducted a 3-day visit of vineyards (3-5, October 2006) in southern and central Piedmont to map occurrence of Pierce's Disease, and to collect powdery and downy mildew samples for Wine Board project (Baudoin, fungicide resistance survey). Results reinforce two growing issues: (1) widespread occurrence of fungicide resistance to strobilurin fungicides and, (2) more northerly spread of Pierce's Disease in Virginia than originally envisioned. Both issues were discussed at the VVA's winter technical meeting (February 2007).
- Myers attended vine trunk disease workshop in Davis, CA in September 2006; a report of this meeting appeared in the September-October Viticulture Notes.
- A computer was purchased for viticulture lab (research and extension uses).
- We (Wolf and Westover) surveyed clients that Viticulture extension associate (Westover) communicated with and gave recommendations to over the past 12 months. Impacts and feedback were very positive and are useful. Most of the recommendations provided to clientele were followed and some respondents indicated that improvements were noticeable by the time of the survey – typically 6 to 12 months later.
- Grant supported travel and participation by Wolf in Virginia Vineyards Association's annual technical meeting (February 2007) and at VVA Board meetings.
- Myers and Wolf attended Eastern Section meeting of the American Society for Enology and Viticulture in Rochester, NY (July 2006), where Myers presented paper on her Pierce's Disease work.
- Westover attended World Congress of Soil Science in Philadelphia, PA and wrote short recap of the meeting for the July-August issue of Viticulture Notes
<http://www.ext.vt.edu/news/periodicals/viticulture/06julyaugust/06julyaugust.html>

**Year-end report to Virginia Wine Board
30 June 2007**

TITLE: Wine grape cultivar evaluations

Principal Investigator: Tony K. Wolf
VA Tech FRS #: 447732

Award amount: \$3,646

Amount remaining at year-end: \$3,138

Objectives: To evaluate novel wine grape cultivars in the Eastern Piedmont of Virginia

Comment on funding: I regret that this project had such a high balance remaining at year-end. With delays in grant approval, I chose to forego hiring part-time wage help for harvest, as originally planned. Our wage help needs in the spring of 2007 were also lower than expected, because more of the work was done by staff at the Southern Piedmont AREC. I take responsibility for the unspent balance remaining with this award and will vow to more accurately assess my financial needs and to fully expend awards in the future.

Progress: Since July 2006, the vineyard at Southern Piedmont AREC (Blackstone, VA) has received regular maintenance and harvest of variety plots occurred between late-August and mid-October.

General observations to-date: Previous problems with raccoons and birds were largely avoided in 2006 by adding additional charged wires to the electric fence and by applying bird netting prior to veraison. Due to its very early ripening, we still lost most of the fruit of Aleatico to a combination of birds and rots. The most notable, negative feature of the vineyard in 2006 was the prevalence of Pierce's Disease (PD) symptoms. This bacterial disease is limited to areas with relatively warm winters, the frequency of which has been associated with a northern extension of the range of PD (<http://www.ext.vt.edu/pubs/viticulture/463-020/463-020.html>). A survey of the Blackstone vineyard revealed that approximately 18% of vines expressed apparent PD symptoms in 2006 (Figure 1). Symptoms were observed on as few as 2 shoots per vine, and in other cases the entire vine was affected. An additional 3% of the planting was dead in 2006, although vine death was not necessarily due to PD. Pierce's Disease was confirmed in a subset of symptomatic vines by using a commercial immunoassay kit. Vine pruning treatments and the use of soil-applied insecticide are proposed for 2007 to help manage PD incidence. It is too early at this point to state relative susceptibility of cultivars at Blackstone to PD.

Primary fruit chemistry at harvest in 2006 is shown in Table 1. Several varieties appear to be promising: Petit Manseng, the white-fruited variety from the Jurançon, retained its distinctive flavors and exhibited a good balance of sugar and acidity at harvest. Cabernet Sauvignon #337, Rousanne, Tinta cao, and Norton also tasted very good at harvest. Generally, the grapes at Blackstone have had higher pH values at harvest, for a corresponding sugar concentration, than what we have seen at the cooler Winchester site. This is likely due to the higher heat summations at Blackstone, compared to Winchester.

Viognier and Traminette, which are also grown at Winchester, have not expressed as intense flavors or aromas at harvest at Blackstone as they do at the Winchester site. Again, that may reflect the greater heat experienced at Blackstone.

We've lost several of the Tempranillo vines to vascular pathogens (e.g., crown gall) and/or winter injury. It's uncertain at this point whether we simply started with poor nursery stock or whether the vines are not adapted to the Blackstone environment. The fruit matures early and has had mediocre quality. NY73.0136.17 (Noiret) colors early, but does not acquire perceptible flavors or aromas or soluble solids levels greater than about 18° Brix. Aleatico and Muscat blanc also mature early. These are both aromatic varieties and (consequently) suffered significant depredation by raccoons and green June bugs in previous years. Both Aleatico and Muscat blanc continue to suffer losses to hornets and wasps. Interestingly, Muscat blanc was nearly devoid of flower clusters in 2006 – no other varieties expressed this problem and the Muscat blanc canopy was not overly shaded in 2005. Tannat and Norton looked reasonably good at harvest, although the Tannat was not as ripe as desired. Our chief problem with Tannat in 2006 was a significant underestimation of cluster weight, which led to excessive crop. We have been able to achieve much lower acid levels at Blackstone than at Winchester with Norton, a reflection of the lower vigor and more open canopies at the Blackstone site.

Selected components of crop yield for the 2006 season are presented in Table 2. We had arbitrarily targeted 5.0 tons/acre in 2006; however, we greatly exceeded that goal in many cases due to larger than expected cluster weights (bold font values in Table 2).

The wines being made from the Blackstone fruit will be subjected to chemistry and sensory evaluations and will help identify varieties that are relatively superior performers in the relatively warm part of the state.

Soil-applied insecticide (Admire-Pro) was applied to 3 of the 6 replicates of each variety in June 2007 (two applications). The insecticide is systemic and may offer some reduction in the leafhopper transmission of the Pierce's Disease bacterium. As of June, PD symptoms were not apparent with any vines. Those symptoms did start to appear in August and vines will be rated on 23 August for PD symptoms.

Project is on track.

Recent presentations:

Zoecklein, B.W., T.K. Wolf, L. Pelanne, and S. Birkenmaier. Evaluation of Viognier grapes and wines in response to VSP, Smart-Dyson, or Geneva Double Curtain training in northern Virginia, USA. Poster presentation at 2006 International Cool Climate Viticulture and Enology Symposium, Christchurch, NZ, February 2006.

Wolf, Tony K. Response of Traminette to rootstock and three different training systems. Grower presentation at the NC State University's Viticulture Workshop, 17 November 2006, Raleigh, NC.

Wolf T. K. and B. Zoecklein. 2005. Training system and rootstock effects on Traminette fruitfulness, fruit yields, and vegetative performance. *American Journal of Enology and Viticulture*. 56:4 (abstract). Presented at 2005 ASEV/ES annual meeting, St. Louis, MO.

Pelanne, L., B. Zoecklein and T.K. Wolf. 2005. Effect of training system and rootstock effects on Traminette free volatiles, glycosides, and wine sensory attributes. *American Journal of Enology and Viticulture*. 56:4 (abstract). Presented at 2005 ASEV/ES annual meeting, St. Louis, MO.

Table 1. Harvest date and primary fruit chemistry of varieties/clones being evaluated at the Southern Piedmont Agricultural Research and Extension Center, Blackstone, Virginia, in 2006.

Variety (clone)	Harvest date	Brix	pH	TA (g/L)
Aleatico	- ^z			
Cabernet franc ("#313")	13 Oct-06	19.1	3.76	4.60
Cabernet franc (#1)	13 Oct-06	19.6	3.71	4.49
Cabernet Sauvignon (#337)	27 Sept-06	18.8	3.72	6.29
Chardonnay (#96)	30 Aug-06	20.5	3.74	5.58
Mourvedre	27 Sept-06	17.7	3.70	4.98
Muscat blanc	- ^y			
Norton	12 Oct-06	21.4	3.99	5.94
NY73.0136.17 (Noiret)	19 Sept-06	17.3	3.58	5.49
Petit Manseng	18 Sept-06	23.2	3.47	6.93
Petit Verdot	Not harvested	20.3	3.65	6.43
Rousanne	18 Sept-06	18.5	3.73	5.83
Tannat	21 Sept-06	21.1	3.56	6.56
Tempranillo	- ^z	18.3	3.82	5.62
Tinta cao	18 Sept-06	19.1	3.70	6.25
Touriga nacional	20 Sept-06	18.6	3.73	5.39
Traminette	30 Aug-06	17.8	3.55	6.14
Vidal blanc	30 Aug-06	19.0	3.63	6.29
Viognier	30 Aug-06	21.6	3.89	4.84

- ^z Not harvested due to early bird, insect, and/or fruit rots.

- ^y Muscat blanc was almost entirely devoid of flower clusters in 2006.

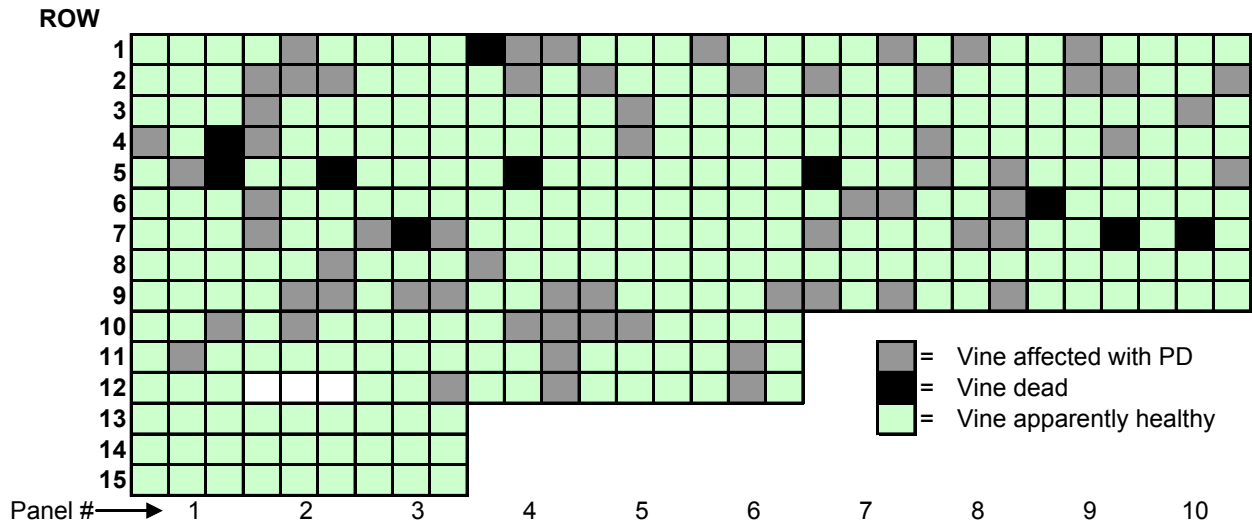
Table 2. Components of 2006 crop yield for varieties/clones being evaluated at the Southern Piedmont Agricultural Research and Extension Center, Blackstone, Virginia, 2006.

Variety (clone)	Berry wt. (g) ^{yz}	Cluster wt. (g) ^x	Crop per vine (lbs)	Tons per acre equivalent ^w
Aleatico	- ^z			
Cabernet franc ("#313")	1.88	152.7	17.8	4.84
Cabernet franc (#1)	2.02	195.5	22.9	6.24
Cabernet Sauvignon (#337)	1.77	195.1	31.4	8.56
Chardonnay (#96)	1.65	174.6	19.9	5.42
Mourvedre	2.25	375.4	31.2	8.49
Muscat blanc	- ^y	.	.	.
Norton (GDC training)	1.68	85.6	29.6	8.08
NY73.0136.17 (Noiret)	2.35	197.0	14.0	3.83
Petit Manseng	1.29	114.9	20.0	5.45
Petit Verdot	1.83	.	.	.
Rousanne	2.21	172.3	18.6	5.07
Tannat	2.15	371.0	33.0	8.99
Tempranillo	2.94	- ^z	.	.
Tinta cao	1.88	122.5	14.7	4.00
Touriga nacional	2.13	56.4	9.4	2.56
Traminette	2.03	192.2	21.8	5.93
Vidal	2.34	318.0	38.3	10.4
Viognier	1.80	205.3	21.6	5.89

-^z Not harvested due to early bird, insect, and/or fruit rots.

-^y Muscat blanc was almost entirely devoid of flower clusters in 2006.

Figure 1. Occurrence of vines that showed any symptoms of Pierce's Disease (PD) in 2006. Affected vines ranged from having as few as 2 affected shoots to being completely affected. Dead or missing vines were not necessarily lost to PD.



351 total vines / 64 with some PD symptoms = 18%. Rows 13, 14, and 15 are Norton, which have not shown PD symptoms, but which may be asymptomatic carriers of the causal bacterium.