Quarterly report to Virginia Wine Board
1 November 2007

TITLE: Wine grape cultivar evaluations

Principal Investigator: Tony K. Wolf
Wine Board Proposal #: 07-1411-01

Award amount: $4,478 to Wolf; $9,505 to Pattison (SPAREC) = total of $13,983.
Current balance: $3,264.72 of Wolf's portion

Background/Progress:
General observations on harvest, 2007: As with many vineyards in Virginia, the 2007 harvest of our variety planting at Blackstone was relatively trouble-free and the fruit integrity and primary fruit chemistry were well above average. We have not done a detailed assessment of weather/fruit chemistry relationships, but the lack of appreciable rainfall, coupled with the use of our on-site irrigation system, resulted in a harvest of rot-free, high quality fruit. Primary fruit chemistry obtained from 50-berry (per replicate) samples collected at harvest is presented in table 1. With freedom from bird depredation, bees and fruit rot, we allowed fruit to ripen to levels that we have not generally attained in the past at Blackstone. Coupled with the good weather, we had rigorously crop-thinned vines in July to achieve on average about 1.0 to 1.5 pounds of fruit per foot of canopy. With the exception of the very early Muscat blanc, harvest occurred entirely within the month of September, with early varieties (e.g., NY73..['Noiret']) harvested 6 September and the latest-maturing harvested 20 days later.

Soluble solids concentrations were often above 22.0 Brix and, owing to the hot weather, pH was somewhat elevated for a number of varieties (Table 1). Varieties that stood out as superior in fruit chemistry and fruit flavors at harvest were Cabernet Sauvignon, Petit Manseng, Tannat, Norton, Rousanne and Vidal blanc. Wines are being made in the Department of Food Science and Technology at Virginia Tech, and those wines will be shared with industry members through round-table extension meetings.

Despite the damaging Easter Weekend freeze, when the vineyard dropped to 18°F, crop yield per vine was close to target (3.5 to 4.5 tons/acre equivalent) with many of the varieties (Table 2). Data on extent of shoot destruction due to the frost were collected and are presented in Table 3. Varieties that yielded full crops, due to late bud break and or more fruitful secondary shoots include Cab Sauvignon, Mourvedre, Norton, Petit Verdot, Rousanne, and Vidal.

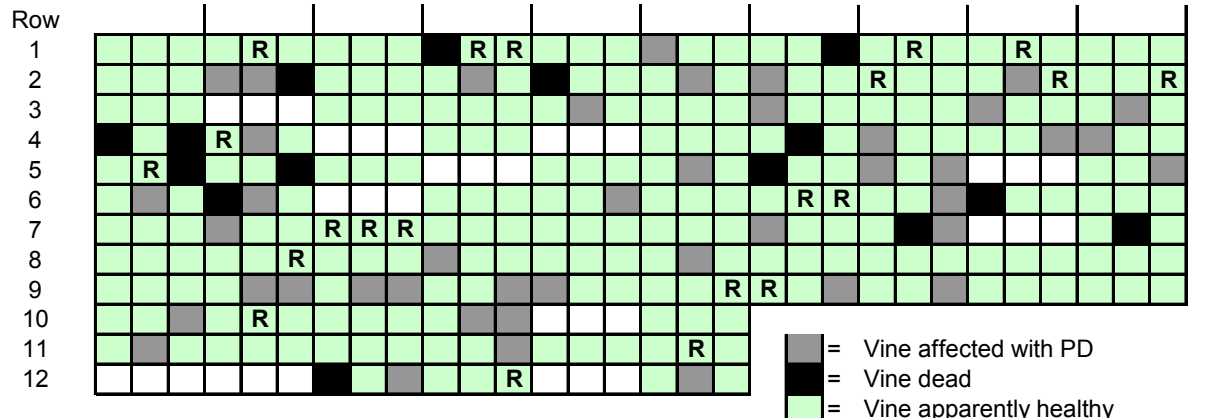
Training was modified in 2007. We converted vines from the Smart-Dyson training (divided canopy) to vertical shoot-positioned. This was done to facilitate application and removal of bird netting and also to restrict yields. While the dry weather was probably the primary factor in determining fruit chemistry at harvest, the lower yields may also have been a factor in the more favorable sugar levels than what we have attained in previous years.

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. The overall incidence of PD was lower in 2007 than in 2006 (Fig. 1); however, the Admire-Pro insecticide did not appear to have a bearing on PD incidence. This treatment will be repeated during the 2008 season with an earlier initial application planned.

Future: We have three complete harvests from the Blackstone vineyard at this point (2005-2007). Our experience to date suggests the following, preliminary findings:

- Disease pressure has been greater in this environment than our experience at Winchester. Chardonnay, for example, is very difficult to keep free of powdery mildew. Disease and insect management have greatly improved, however, and the oversight provided by Dr. Jeremy Pattison at Blackstone has been responsible for that improvement.
- Aleatico and Tempranillo have performed poorly, but for different reasons. Aleatico ripens unevenly and is highly susceptible to bee and green June bug injury, perhaps owing to its aroma. Many of the Tempranillo vines were lost within the first several years of planting to crown gall or other causes. While this might have been due to poor nursery stock, the fruit of apparently healthy vines was susceptible to rot. For these reasons, we have removed Aleatico and Tempranillo and those spaces will be planted in 2008 with another Cabernet Sauvignon clone and a Merlot so that data can be collected for a multi-state research project (NE-1020). The recently named variety, Noiret (NY73.0136.17) has also performed poorly from the standpoint of primary fruit chemistry. At full ripeness (about 19°Brix) the fruit lack flavor.
- Varieties that have performed well from a viticultural standpoint include Petit Manseng, Norton, Cabernet Sauvignon, Rousanne and Viognier. Others may perform well if we continue to manage crops, including Petit Verdot, Tannat, Traminette, and Mourvedre.
- With the exception of Norton, all varieties have expressed some incidence of Pierce's Disease (PD) and this will continue to be a threat in the southern Piedmont as winter temperatures remain above average.
- We plan to provide the industry with an update on the Blackstone planting at the VA Vineyards Association's annual technical conference in February 2008.
- Wines have not been formally evaluated from this effort.
- We would anticipate collecting at least 2 more years of harvest data from these vines.

Figure 1. Map of Pierce's Disease (PD) incidence at Blackstone vineyard in 2007. Each cell is a vine. The key to cell status is in lower right corner. "Recovered" vines are those that showed PD symptoms in 2006 but did not in 2007. The incidence of PD was lower (43 affected vines) in 2007 than in 2006 (64 affected vines).



	2006	2007
Total dead vines	10	15
Total vines affected	64	43
recovered vines		21

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 2007.

Variety (clone)	Harvest date	Brix	pH	TA (g/L)
Aleatico	.[z]	.[z]	.[z]	.[z]
Cabernet franc ("#313")	19-Sept	22.6	4.03	3.97
Cabernet franc (#1)	19-Sept	22.6	3.94	3.87
Cabernet Sauvignon (#337)	26-Sept	22.1	3.67	5.19
Chardonnay (#96)	6-Sept	22.7	3.82	4.70
Mourvedre	26-Sept	20.8	3.75	5.23
Muscat blanc	23-Aug	20.3	3.71	4.57
Norton	26-Sept	23.2	3.80	5.20
NY73.0136.17 (Noiret)	6-Sept	19.1	3.59	4.82
Petit Manseng	10-Sept	26.1	3.56	5.94
Petit Verdot	19-Sept	23.5	4.04	4.86
Rousanne	10-Sept	22.7	3.95	4.19
Tannat	13-Sept	23.6	3.62	5.75
Tempranillo	.[z]	.[z]	.[z]	.[z]
Tinta cao	10-Sept	21.9	3.98	4.43
Touriga nacionale	19-Sept	21.4	4.06	4.35
Traminette	6-Sept	20.6	3.79	4.52
Vidal blanc	13-Sept	22.8	3.67	5.33
Viognier	6-Sept	24.0	3.92	3.61

- [z] Vines were removed in early 2007 due to attrition or poor performance.

Table 2. Components of 2006 crop yield for varieties/clones being evaluated at the Southern Piedmont Agricultural Research and Extension Center, Blackstone, Virginia, 2007.

Variety (clone)	Berry wt. (g)	Cluster wt. (g)	Crop per vine (lbs)	Tons per acre equivalent
Cabernet franc ("#313")	1.66	126.8	9.7	2.6
Cabernet franc (#1)	1.77	195.9	15.2	4.1
Cabernet Sauvignon (#337)	1.37	145.4	11.4	3.1
Chardonnay (#96)	1.59	117.8	5.4	1.5
Mourvedre	1.77	308.2	15.8	4.3
Muscat blanc	2.85	105.3	2.9	0.8
Norton (GDC training)	1.21	100.5	13.3	3.6
NY73.0136.17 (Noiret)	2.00	162.7	7.2	2.0
Petit Manseng	1.18	106.9	9.3	2.5
Petit Verdot	1.22	127.1	15.5	4.2
Rousanne	1.66	193.1	16.6	4.5
Tannat	1.77	298.2	12.6	3.4
Tinta cao	1.72	217.4	8.9	2.4
Touriga nacionale	1.67	89.9	7.1	1.9
Traminette	2.12	165.8	11.0	3.0
Vidal	1.98	264.8	15.9	4.3
Viognier	1.60	145.5	10.9	3.0

Table 3. Extent of bud break on 13 April 2007, percent frost damage, and resulting crop data from vines grown at the Southern Piedmont Agricultural Research and Extension Center, Blackstone, Virginia, 2007. Varieties that are shown in bold text sustained relatively minor frost injury by virtue of their later bud break. Others, such as Cabernet franc clone #1 yielded our target crop level (about 4.0 tons/acre equivalent) despite loss of nearly one-half of primary shoots.

Variety (clone)	Budbreak 13 April (%) wt. (g)	Percent frost damage (of broken shoots) (%)	Crop per vine (lbs)	Tons per acre equivalent
Cabernet franc ("#313")	52	20	9.7	2.6
Cabernet franc (#1)	83	43	15.2	4.1
Cab. Sauvignon (#337)	**58**	**6**	**11.4**	**3.1**
Chardonnay (#96)	85	65	5.4	1.5
Mourvedre	**10**	**0**	**15.8**	**4.3**
Muscat blanc	88	43	2.9	0.8
Norton (GDC training)	**75**	**10**	**13.3**	**3.6**
NY73.0136.17 (Noiret)	70	49	7.2	2.0
Petit Manseng	88	62	9.3	2.5
Petit Verdot	**71**	**5**	**15.5**	**4.2**
Rousanne	**26**	**4**	**16.6**	**4.5**
Tannat	46	19	12.6	3.4
Tinta cao	79	58	8.9	2.4
Touriga nacionale	92	59	7.1	1.9
Traminette	75	13	11.0	3.0
Vidal	**64**	**9**	**15.9**	**4.3**
Viognier	100	47	10.9	3.0

Title: Optimized grape potential through root system and soil moisture manipulations
VA Tech FRS # 447850

Principal Investigator: Tony K. Wolf

Award amount: $20,679
Current balance: $17,376

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)

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. 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). Irrigation components were purchased and main line was installed in September 2007. The individual dripper lines will be installed prior to the 2008 season. Under-trellis cover crops, where appropriate for treatment, were sown in September and are well established at this point. We will begin data collection on vine pruning weights during the 2007-2008 winter. Vine growth during 2007 was generally good and most vines have canes on the cordon wire (Figure 2). This objective is proceeding on track with project objectives.

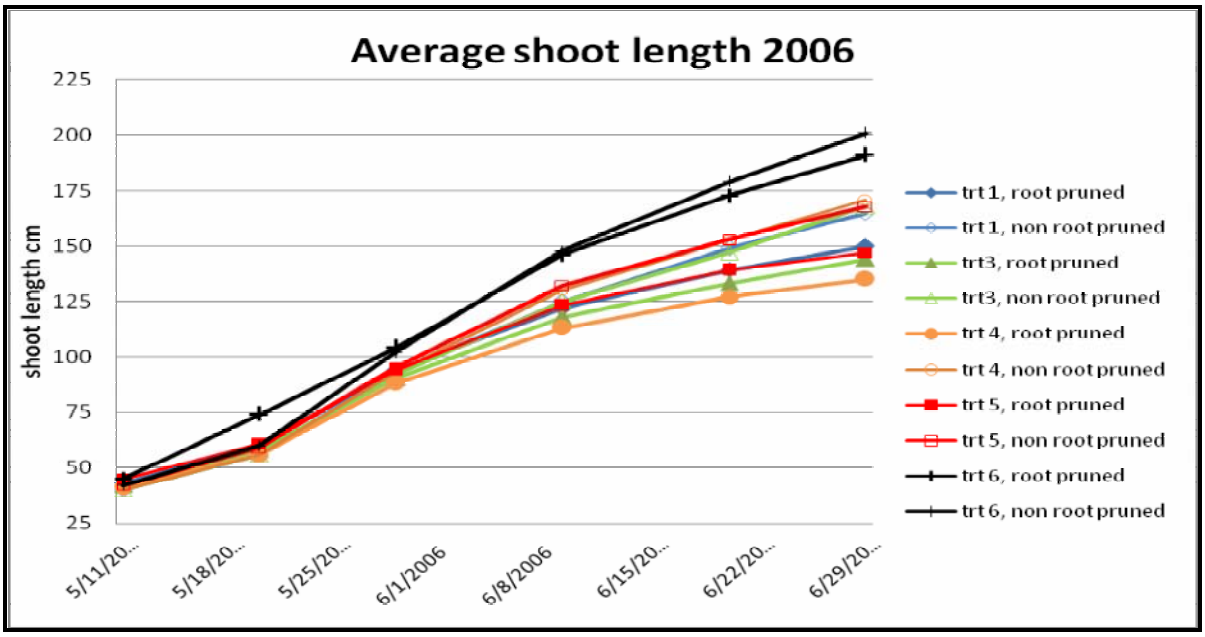
Figure 2. Cabernet Sauvignon at Winchester, November 2007.

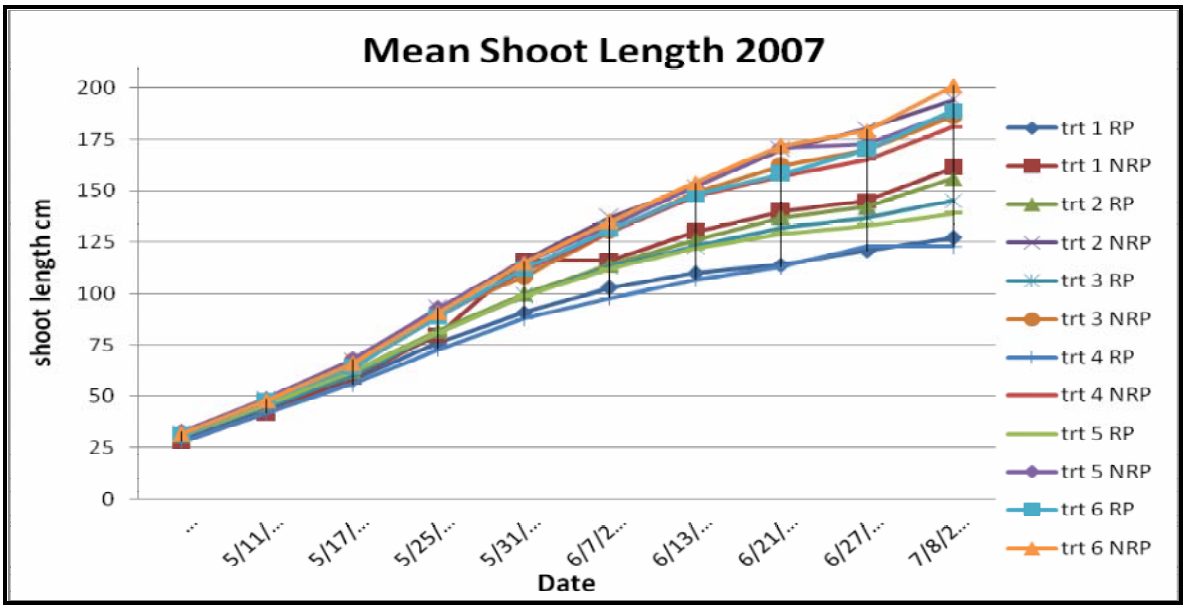
Objective #2: The work of graduate student Gill Giese at Shelton Vineyards in Dobson, NC is proceeding as proposed. This project asks two very basic questions:

- 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 (see following two figures). The effects of root pruning and cover crops on restricting vegetative growth of these vines was pronounced in the early part of the season. 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 generally unaffected by treatments in either 2006 or 2007, although a slight reduction in berry weight was observed with the root pruning treatments (data not shown).





Legend for shoot growth figures (above):

Treatment #1: 'K-31' Fescue
Treatment #2: 'Aurora Gold' Fescue
Treatment #3: Perennial ryegrass
Treatment #4: Orchardgrass
Treatment #5: 'Elite-II' Fescue
Treatment #6: Herbicide strip (control)

Additional vine performance data have been collected on canopy architecture, plant tissue analysis and plant water status. Regular soil moisture measures were also collected again during the 2007 season. Gill Giese has not yet had an opportunity to analyze those data in any detail.

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
Mr. Giese will also present an update on this work at the VA Vineyards Association's annual technical conference in February 2008.

Summary: Project is on track. 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. A more detailed summary report will be prepared at the time that a project re-funding proposal is submitted this winter.