Frontenac Training Trial

Coyote Moon Vineyards
Clayton, NY

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Background and Rationale: Choice of training system influences yield, quality, and labor inputs for growing grapes. A goal of this training trial is to provide data that will allow growers to choose training systems for Frontenac grapes that minimize costs, maximize economic returns to growers and result in high quality, mature grapes for winemaking.

Treatments: We chose two high training systems and one mid-wire training system for comparison. Three training systems and follow up canopy management practices were applied, representing intensive, intermediate, and minimal post-shoot thinning treatments.

- **Vertical Shoot Positioning (VSP)**:
    - Midwire cordon with catch wires
    - Shoot position, shoot tip (hedging), leaf removal
    - *Intensive canopy management*
- **Top Wire Cordon (TWC)**:
    - High cordon
    - Shoot combing
    - *Moderate canopy management*
- **Umbrella Kniffin (**UK):
    - 3-4 long canes arched and tied to middle wire
    - No additional canopy management
    - *Minimal canopy management*

Methods. Training treatments were established in February 2012 during pruning. In both years, vines were pruned to 40-50 count buds per vine, and pruning weights were collected in spring of 2013. In 2013, shoot number was adjusted to approximately five shoots per linear foot of canopy (35 shoots/vine) at 3-5" shoot growth, but thinning was not required in 2012 due to spring frost damage. Bud and shoot count data were also collected at this time in both years. Vine management was done as needed throughout the growing season. In both years, preharvest fruit chemistry samples were collected starting shortly after veraison, then every 7-14 days until harvest. At harvest, cluster number and total yield (kg) data were collected for each vine. Also, during harvest in 2013, samples were collected from the guard vines at the ends of the plots to look at differences in fruit chemistry between exposed and shaded clusters. Five exposed clusters and five shaded clusters were collected from one vine each in two of the four replicates of each training system (so six samples in all, two from each training system).

Results:

Yields. As vines in the research plots had been previously trained to TWC, year 1 data (Table 1) reflects transition to the VSP and UK training systems. Post-budburst frost events caused freeze injury to some primary buds, resulting in lower than normal yields. The Ravaz index was within an acceptable range across treaments, but no significant differences were observed.

Table 1. Yield components in Frontenac training trial at Clayton, NY in 2012.

2012 Treatment	Yield t/acre	Yield lb/vine	Clusters/ vine	Cluster wt. (g)	Berries/ cluster	Avg.berry wt. (g)	Pruning wt. (kg)	Ravaz index
TWC	3.1 a	10.0 a	51.4 a	87.9 a	81.0 a	1.1	0.69	8.1
VSP	1.9 b	3.6 b	37.8 b	72.9 b	70.3 b	1.1	0.69	6.4
UK	2.5 ab	8.1 ab	46.6 ab	79.3 ab	66.0 b	1.1	0.55	6.0

Treatment means followed by the same letter within a column are not significantly different at the α=0.05 level. Columns where no letters are present indicate a lack of significant differences among treatments.

2013. With a full number of shoots and no spring freeze injury, yields were higher in 2013 (Table 2). Vines trained to UK yielded higher than VSP, with TWC in the middle. There were no significant differences in any of the yield components, although the higher yield in UK compared to VSP can be contributed to numerical differences in the number of clusters/vine and berries/cluster (remember that cluster weight is a function of berry weight, which was the same across training treatments, and berries/cluster).

Table 2. Yield components in Frontenac training trial at Clayton, NY in 2013.

2013 Treatment	Yield t/acre	Yield lb/vine	Clusters/ vine	Cluster wt. (g)	Berries/ cluster	Avg.berry wt. (g)	Adj. # shoots/vine	Yield (g)/ adj. shoots
TWC	4.6 ab	14.8 ab	64.8	104.0	92.4	1.1	37.4	179.7 ab
VSP	4.0 b	12.9 b	57.2	102.1	86.6	1.2	35.2	167.5 b
UK	4.9 a	15.9 a	64.4	107.2	94.1	1.1	36.0	206.4 a

Treatment means followed by the same letter within a column are not significantly different at the α=0.05 level. Columns where no letters are present indicate a lack of significant differences among treatments.

Fruit Composition. In 2012, fruit chemistry **(Figure 1)** reflected ample heat unit accumulations during the early season (across treatments, soluble solids around 24.5 °brix; titratable acidity about 13 g/L). In 2013 **(Figures 1 and 2)**, titratable acidity was much higher (about 17 g/L across treatments) than in 2012, reflecting the much cooler year. Despite some numerical differences in fruit chemistry, there were no significant differences in fruit chemistry in either year.

Figure 1. Frontenac brix, pH, and titratable acidity in 2012 and 2013 at harvest.

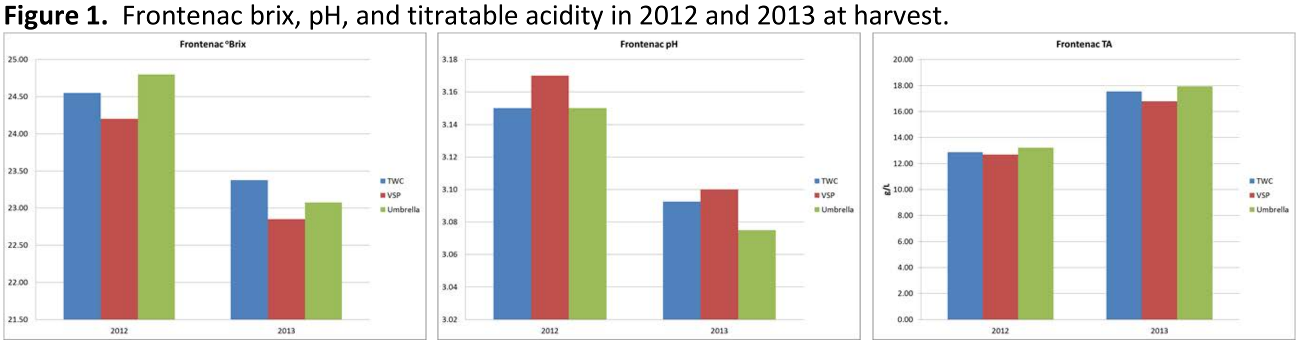
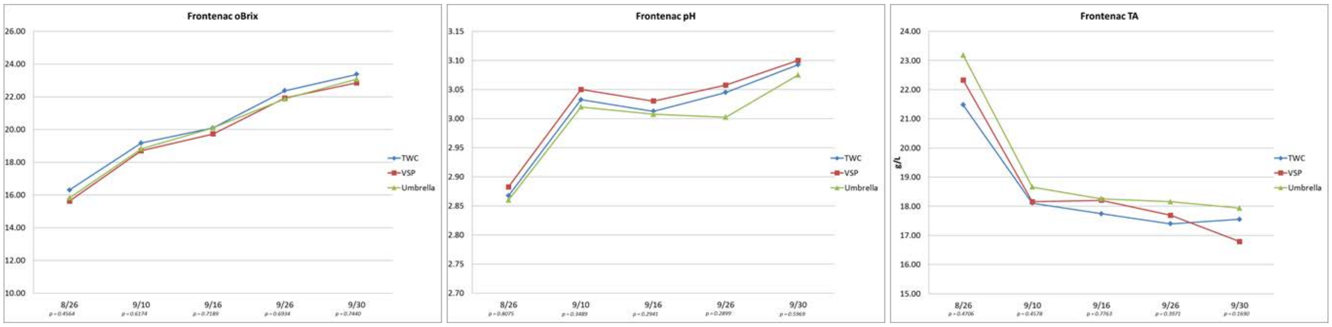


Figure 2. Brix, pH, and Titratable acidity trends in 2013. Samples were collected from shortly after veraison until harvest.

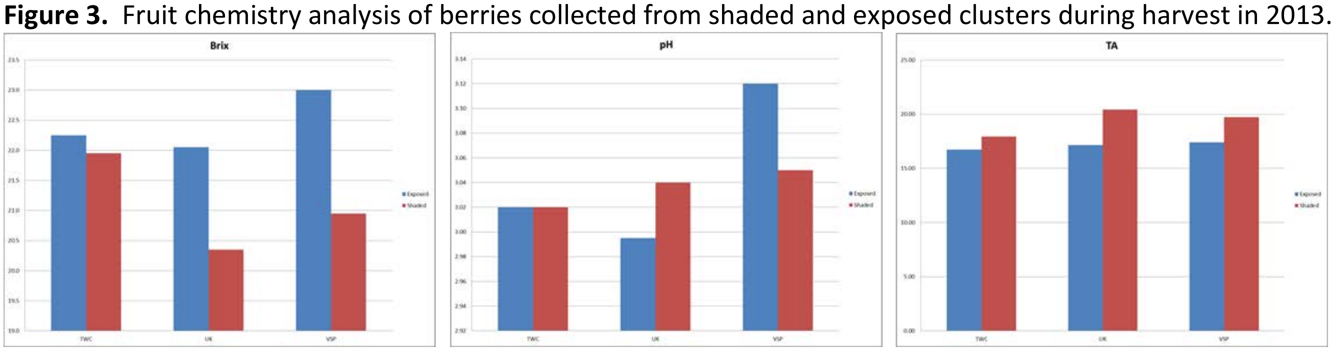


Fruit chemistry of shaded vs. exposed clusters. Across treatments, brix were higher (*p=0.04*) and TA was lower (*p=0.04*) on exposed clusters **(Table 3)**. When looking at the data separated by training treatment (**Figure 3)**, differences in shaded vs. exposed clusters were less obvious in TWC than in UK or VSP. Of notable importance is that across treatments, exposed clusters had approximately 2 g/L lower TA than shaded clusters.

Table 3. Fruit chemistry and analysis of berries collected from shaded and exposed clusters during harvest in 2013, averaged across training treatments.

2013 Exposure	Avg.berry wt. (g)	pH	Brix	TA
Shaded	1.08	3.04	21.08	19.37
Exposed	1.08	3.05	22.43	17.10

Figure 3. Fruit chemistry analysis of berries collected from shaded and exposed clusters during harvest in 2013.



What the results mean:

- The warm 2012 season produced high brix and low titratable acidity, but had a reduced yield due to spring frosts. The more moderate 2013 season provided a more reasonable expectation of maturity levels under northern NY growing conditions, with slightly lower brix and higher acidity at harvest.
- In 2012, yields were influenced both by spring frost and the transition to new training systems.

- In 2013, Frontenac trained to UK yielded almost 1 ton/acre more than VSP-trained vines.
- There were no differences in fruit chemistry in either year.
- Well-exposed clusters have more favorable fruit chemistry (higher Brix, lower TA) than shaded clusters.
- TWC and UK have provided a yield advantage and fewer hand-labor passes through the vineyard than VSP. Some estimates show about a 30% difference in labor inputs.
- UK, without shoot positioning, has the lowest labor costs during the growing season, although as a cane-pruned system, it does require tying after dormant pruning, which is not the case with cordon-spur trained systems (TWC and VSP). Growers using cane pruning may save on post-budburst shoot thinning (canes will not produce 'noncount' shoots; cordons will), but if there is no downward shoot positioning (as in our study), the cluster zone may be more shaded than on the TWC + shoot combing treatment.
- 2013 results suggest that maintaining cluster exposure and avoiding shading is more important that training system, per se, in minimizing acidity and maximizing soluble solids.