Marquette Training Trial

Coyote Moon Vineyards
Clayton, NY

Timothy E. Martinson and Chrislyn A. Particka
Department of Horticulture, Cornell University

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 Marquette 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. 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 or in 2014 due to extremely low winter temperatures. 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.

Results:

Yield and Yield Components.

2012. As vines were converted from top-wire training to the three training systems in 2012, year 1 data (Table 1) reflects transition to the new training systems. Post-budburst frost events caused freeze injury to many of the primary buds, resulting in low yields (3-5 lb/vine) and cluster number (23-36 clusters per vine). The Ravaz index indicated that the vines were undercropped, as is expected due to the frost damage.

2013. With a full number of shoots and no spring freeze injury, yields were higher in 2013 (Table 2). The TWC and UK systems both yielded significantly more (essentially double) than the VSP system. TWC and UK had significantly higher numbers than the VSP for nearly all the yield components. Compared with TWC, VSP had significantly fewer clusters per vine (17% fewer) and berries per cluster (34% fewer), and lower berry weight (7% lower). UK yields was 1.9 lb/vine higher than TWC (thought the difference was not significant), but the extra yield was associated with more shoots that were inadvertently left at thinning. VSP also had significantly fewer clusters per shoot than TWC or UK.

2014. During the winter of 2013-2014, extreme low temperatures caused significant trunk damage, resulting in vine collapse in late summer, and some bud damage, resulting in reduced yields (Table 3). Wild turkeys ate most of the fruit on VSP vines, so we were unable to collect yield data, but were able to count the number of clusters, as the turkeys left the rachises on the vines. There was no difference in yield between TWC and UK vines, but there were significantly fewer clusters /vine in VSP compared to TWC or UK; while we cannot rule out that the turkeys didn't remove some rachises, cluster counts conducted early in the season also indicated there were many fewer clusters/vine on VSP vines. VSP vines also had fewer shoots/vine than UK and TWC.

Table 1. Yield and yield components in Marquette training trial at Clayton, NY in 2012 - 2014.

Treatment	Yield t/acre	Yield lb/vine	Clusters /vine	Avg. berry wt. (g)	Cluster wt. (g)	Berries /cluster	Adj. # shoots /vine*	Yield (g)/adj. shoot #	Clusters /adj. shoot #	Pruning wt. (lb)	Ravaz index
2012											
TWC	1.4 ab	3.4 ab	23.6 b	1.3	63.5 a	50.9 ab	35	44.3 ab	0.7 b	2.0	2.4
VSP	1.3 b	3.1 b	26.3 ab	1.3	48.5 b	38.5 b	35	40.5 b	0.8 ab	1.8	1.8
UK	2.1 a	5.2 a	36.3 a	1.2	64.9 a	52.6 a	35	68.1 a	1.0 a	1.8	3.3
2013											
TWC	4.4 a	14.0 a	83.5 ab	1.21 ab	76.6 a	63.2 a	35.9 b	178.1 a	2.3 ab	1.8 b	10.3 a
VSP	2.3 b	7.5 b	69.1 b	1.13 b	48.9 b	43.2 b	36.0 b	94.1 b	1.9 b	2.7 a	3.0 b
UK	5.0 a	15.9 a	100.9 a	1.23 a	72.0 a	58.6 a	40.6 a	177.6 a	2.5 a	1.5 b	12.8 a
2014											
TWC	2.9	9.7	46.6 a	1.6 a	74.7	46.1	56.3 a	76.0	1.0		
VSP	-	-	11.7 b	1.3 b	-	-	32.7 b	-	-		
UK	2.4	7.7	42.5 a	1.6 a	76.7	47.4	45.6 ab	72.0	0.9		

[z] *In 2012 and 2013, shoots were thinned to approximately 35 shoots/vine; shoot counts were done after thinning in 2013, but not in 2012. In 2014, no thinning was done due to the severity of winter damage.*

[y] *Treatment means followed by the same letter within a year and column are not significantly different at the α=0.10 level. Columns where no letters are present indicate a lack of significant differences among treatments.*

Fruit Composition. In 2012, fruit chemistry (Table 2) reflected ample heat unit accumulations during the early season (across treatments, soluble solids around 27.2 °brix; titratable acidity about 10 g/L). In 2013, titratable acidity was higher than in 2012 across all training systems at harvest, and UK had slightly higher levels than VSP and TWC. In 2014, Brix were much lower than in previous years, and TA was again higher than in 2012. There were significant differences in brix and TA at harvest in 2013, with brix higher in VSP than TWC or UK (potentially due to the much lower crop) and TA higher on UK.

Table 2. Fruit composition at harvest in Marquette training trial at Clayton, NY in 2012 - 2014.

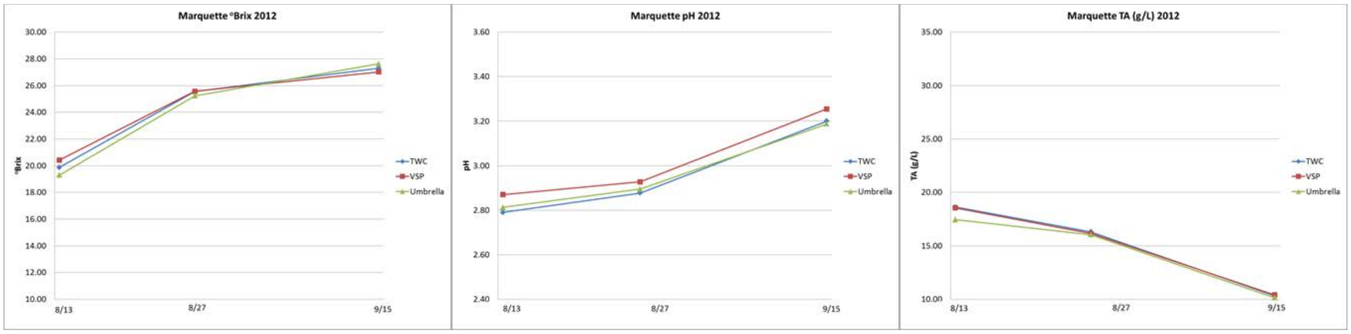
Treatment	°Brix	pH	TA (g/L)
2012			
TWC	27.3	3.20	10.32
VSP	27.0	3.26	10.40
UK	27.6	3.19	10.14
2013			
TWC	25.6	3.01	12.89
VSP	27.4	3.04	12.86
UK	25.3	2.98	13.45
2014			
TWC	24.0	3.22 b[z]	13.16
VSP	23.5	3.35 a	13.32
UK	23.9	3.24 b	12.43

[z] Treatment means followed by the same letter within a year and column are not significantly different at the α=0.10 level. Columns where no letters are present indicate a lack of significant differences among treatments.

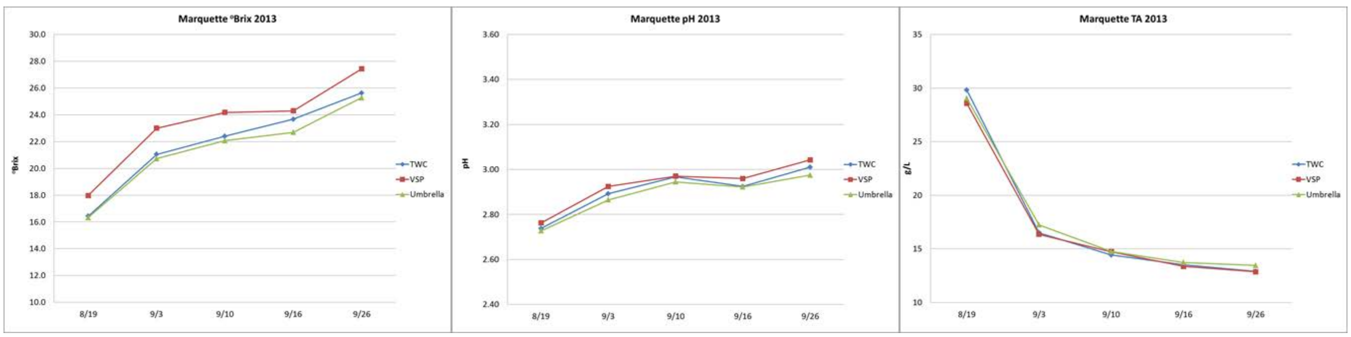
The fruit chemistry trends in all years (Figure 1) show that TA dropped sharply between the first two sampling dates, then levels off. Brix also generally increased more between the first two sampling dates. There were little differences in fruit chemistry during ripening, even just after veraison.

Figure 1. Fruit composition trends in Marquette training trial at Clayton, NY in 2012 - 2014. Samples were collected from shortly after veraison until harvest.

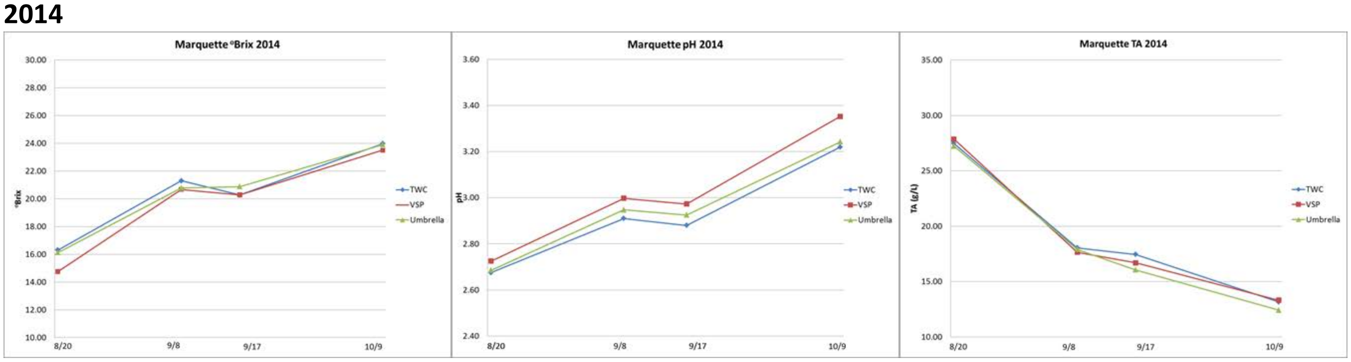
2012



2013

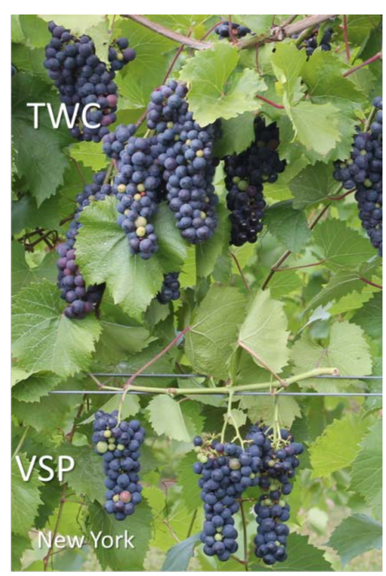


2014



What the results mean:

- The warm 2012 season produced high brix and low titratable acidity. 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 2013, Marquette trained high in either the spur-pruned TWC system or the cane-pruned UK system produced twice as much fruit as the VSP vines.
  - o All yield components were affected. VSP vines had fewer clusters per vine, smaller clusters with fewer berries than the TWC or UK vines, and smaller berries than UK vines.
  - o On a per-acre basis (table below), these yield components resulted in 47% less yield on VSP than on TWC vines, with berry number contributing the



most (about half) to the yield difference.

Yield component	Difference	Lost crop (lb/vine)	Lost crop (t/acre)
Berry weight	7%	0.8	0.3
Berries/cluster	31%	4.4	1.4
Clusters/vine	17%	2.4	0.7
Yield/vine	**47%**	**6.6**	**2.1**

- The low crop on VSP in 2013 resulted in higher soluble solids (2 ° Brix higher), and only moderately affected titratable acidity. pH was slightly higher on VSP than on the other treatments. The impact of this on wine quality may be minor, as TWC and UK fruit reached 25 ° Brix.
- The 2014 season was heavily influenced by severe cold temperatures, which caused bud and trunk damage. Yields were low and trunk damage resulted in vine collapse in late summer. As well, turkeys ate the majority of the crop on VSP vines.
- Over three growing seasons, 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.

Impact of Shading on Marquette Fruit Composition in 2014

Coyote Moon Vineyards
Clayton, NY

Timothy E. Martinson and Chrislyn A. Particka
Department of Horticulture, Cornell University

Fruit composition on shaded and exposed Marquette clusters at harvest in 2014. The same day we harvested our training trial, we collected five shaded andfive exposed clusters from each of six different Marquette vines that were ‘border’ vines in our experiment, and thus not included in the main study data analysis. We weighed each cluster individually, and measured soluble solids (°Brix), pH, and titratable acidity (g/L) on each cluster collected (N=30 shaded and 30 exposed clusters)

Results: Brix were significantly higher and titratable acidity was significantly lower on exposed clusters. Juice pH was modestly lower, but the difference was small (Table 3). Looking at the distribution of the 30 individual measurements (Figure 2) the middle of the distribution fell between 24-25 °Brix for exposed, and 21-22 °Brix for shaded clusters. For titratable acidity, the highest frequency was between 9 and 10 g/L for exposed clusters, and 11-12 g/L for shaded clusters. Grouping Brix and TA by individual vines (Figure 3), brix levels were higher on exposed clusters than shaded clusters, and TA was lower on five of the six vines.

Table 3. Cluster weight and fruit composition of five shaded vs. five exposed clusters collected from each of six Marquette vines in 2014 at harvest (n=30 per category)

Shaded/exposed	Cluster weight (g)	Brix	pH	TA (g/l)
Exposed	85.0	23.7 a[z]	3.27	9.7 a
Shaded	77.8	21.6 b	3.31	10.8 b
Statistical P values				
Vine effect	*p*=0.0018	*p* <0.0001	*p* =0.0002	*P=0.0003*
Shading Effect	*p=0.3450*	*p* <0.0001	0.0963	*p*=0.0051

[z] *Means followed by the same letter within a year and 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.*

Figure 2. Range of soluble solids (°Brix), pH and titratable acidity (g/L) on of five shaded vs five exposed clusters collected from each of six Marquette vines in 2014 at harvest (n=30 per category).

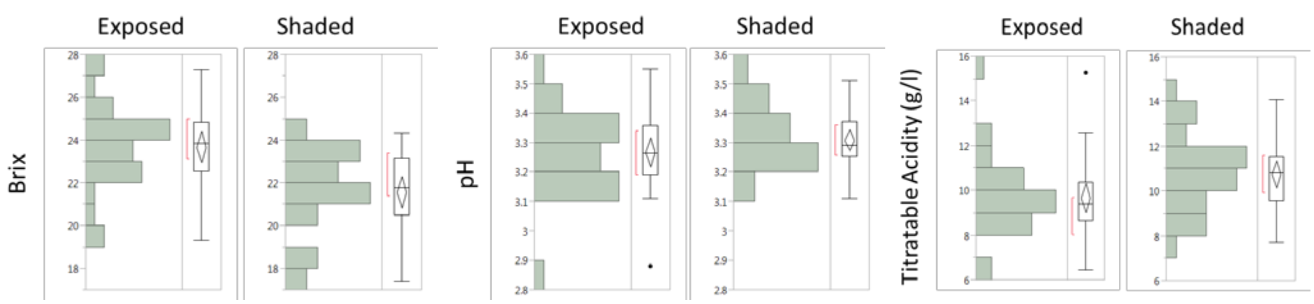
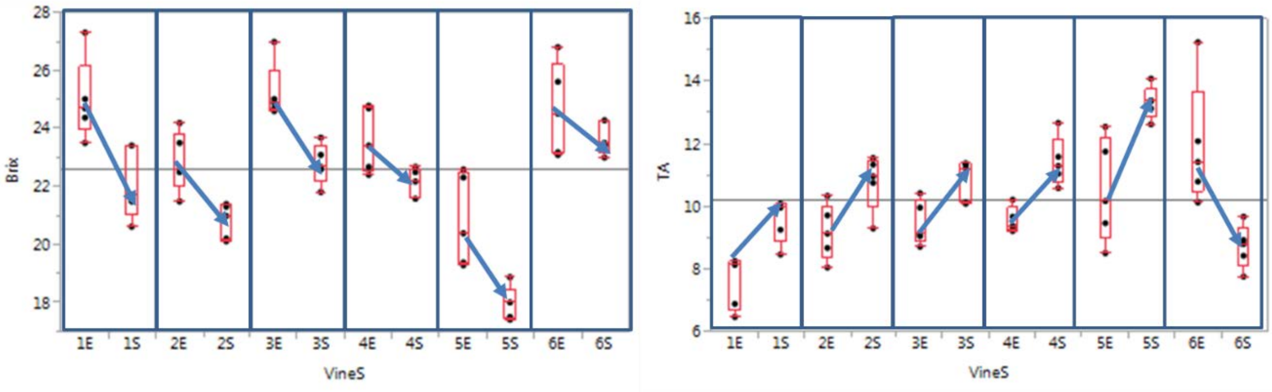


Figure 3. Brix and TA on five exposed and shaded clusters of each of six individual Marquette vines. Each box represents an individual vine, with the range of values for exposed (E) and shaded (S) clusters indicated by the red box plots. Blue arrows indicate difference between median exposed and shaded numbers. Brix was higher on exposed clusters on all six vines; titratable acidity was higher on the six shaded clusters of five of the six vines sampled.



What the results mean:

- Harvest data showed no significant difference in soluble solids or titratable acidity among the three training systems in 2014.
- But *within each vine,* exposed clusters had significantly higher soluble solids (+2.1 °Brix) and significantly lower titratable acidity (-1.1 g/l) than shaded clusters.
- This result points to the benefit of increasing cluster exposure for maximizing soluble solid accumulation and reducing acidity. In short, fruit exposure hastens ripening, and shading in the cluster zone delays ripening.