Marquette 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 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 all 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 1). 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, as yield/adjusted shoot number was not different between TWC and UK. 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	3.8	3.2
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	3.4	3.1

[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 which was a cooler year, titratable acidity was higher than in 2012 across all training systems at harvest. In 2014, Brix were much lower than in previous years, and TA was again higher than in 2012. The only significant difference among training systems was pH in 2014, where VSP was higher than TWC and UK.

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

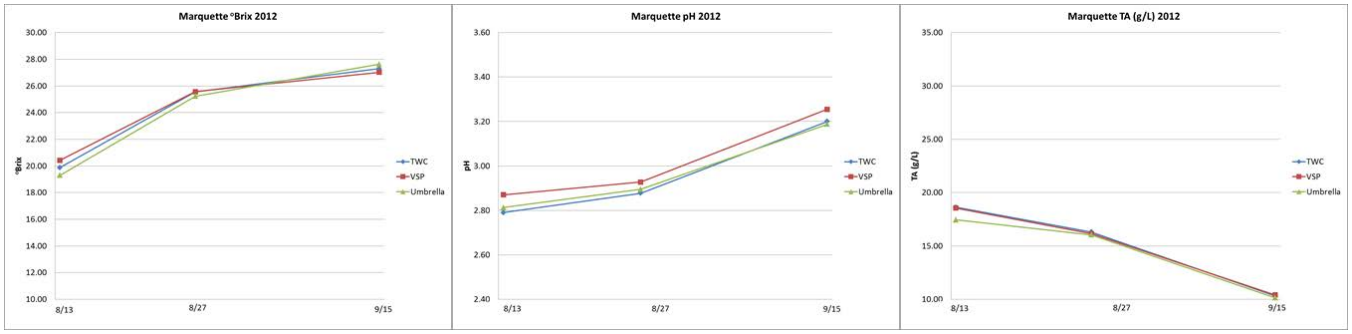
Treatment	°Brix	pH	TA (g/L)
2012			
TWC	27.3	3.20	10.32
VSP	27.0	3.26	10.40
UK	27.6	3.19	10.14
2013			
TWC	25.6	3.01	12.89
VSP	27.4	3.04	12.86
UK	25.3	2.98	13.45
2014			
TWC	24.0	3.22 b[z]	13.16
VSP	23.5	3.35 a	13.32
UK	23.9	3.24 b	12.43

[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.*

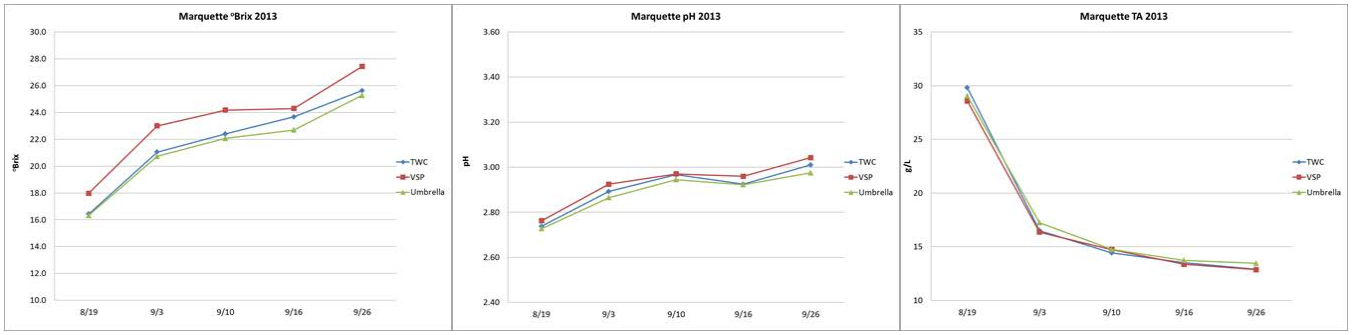
The fruit chemistry trends in all years (Fig. 1) show that TA dropped sharply between the first two sampling dates, then levels off. Brix also generally increased more between the first two sampling dates. There were little differences in fruit chemistry during ripening, even just after veraison.

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

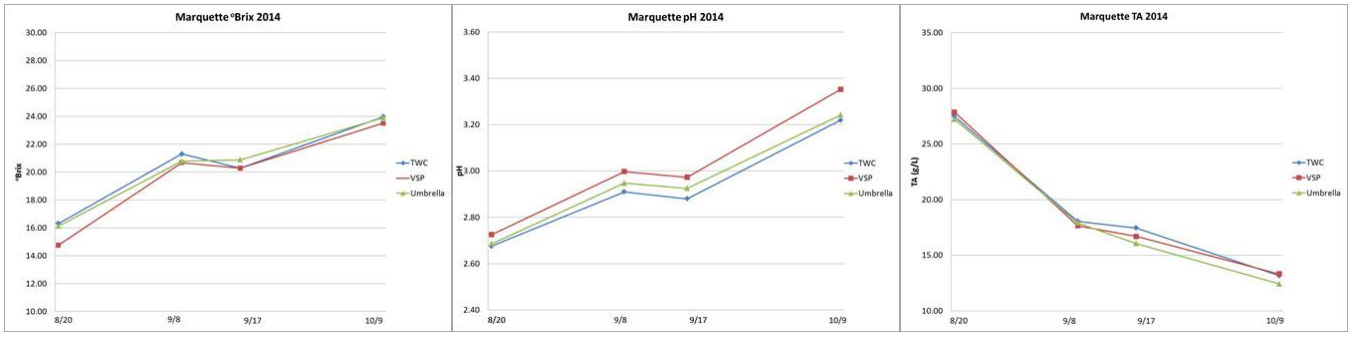
2012



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.
    - All yield components were affected. VSP vines had less heavy clusters and fewer berries than TWC and UK, and fewer clusters and smaller berries than UK.
    - 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 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.