



Viticulture, enology and marketing for cold-hardy grapes



Iowa Training Systems Trial

Snus Hill Winery
Madrid, IA

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Background and Rationale: Over the last several years, five states have been evaluating training systems for cold climate grape cultivars as part of the Northern Grapes Project. With this multi-state collaborative effort, we have increased production of cold hardy grapes (*Vitis vinifera*-based hybrids) and consumer acceptance, and we continue to make strides to understanding cold hardy grape cultivar performance.

Treatments: In 2012, vines originally trained to a single curtain bilateral cordon system were either left alone or converted to a single or split canopy system. The vines also were trained to following systems in 2013 and 2014.

Top wire cordon (TWC):

- High wire cordon

Geneva double curtain (GDC):

- TWC with a divided canopy

Mid-wire cordon with a split canopy and vertical shoot position (SH):

- Scott Henry or Smart-Dyson

Mid-wire cordon/Vertical shoot position (VSP):

- Single canopy

Methods: Vines were shoot-thinned to retain no more than five shoots per foot of cordon. Treatments were applied to three-vine panels and replicated four times in a randomized complete block design. Time to perform each practice per vine was recorded. Fruit were harvested, weighed and a 300-berry sub-sample was collected to analyze fruit quality characteristics (Brix, pH, TA, and malic and tartaric acids) of those cultivars with fruit in 2013. Due to bird and raccoon predation to the 'Marquette' and 'Frontenac' vines, a harvestable crop was not produced in 2014 and 2015, but labor time was recorded for applying treatments. Data of labor and yield variables were analyzed using Tukey's adjustment for multiple comparisons.

Results: 2013: In 'Frontenac' and 'La Crescent' vines training systems that included vertical shoot training (VSP and SH) required more labor than without (TWC and GDC), (Figure 1). The vines of 'Frontenac' and 'La Crescent' were older and more vigorous than the 'Marquette' vines use in this experiment, and their shoots were much larger and more difficult to handle and control in the vertical systems thereby increasing labor time. In 'Frontenac' the GDC and SH training systems, that maximized the cordon length utilized per vine, were more productive than TWC and VSP (Figure 2). The opposite trend was noted in the 'La Crescent' vines, with a higher yield obtained by TWC.

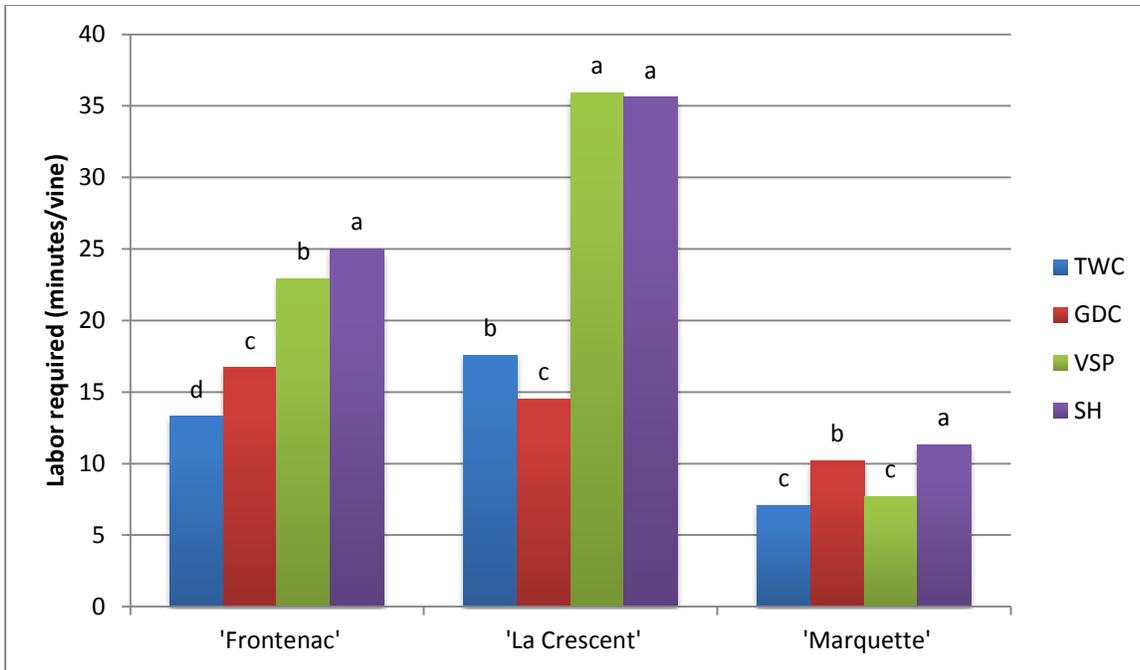
2014. Fruit quality variables of 'Marquette' berry samples taken in September 2014 from Snus Hill Winery's vineyards showed no differences among training system treatments for average berry weight, Brix and pH. TA was higher in fruit from vines trained to a mid-wire cordon with catch wires (VSP) system.

Results 2015:

- 'Marquette' trained to GDC required more time to prune vines compared with TWC, SH, and VSP (Table 1). However, more growth (pruning weights) was removed during spring pruning of 'Marquette' trained to VSP and SH compared with GDC and TWC. Similar to 'Marquette', 'Frontenac' trained to GDC took longer to prune compared with TWC and VSP systems. Growth removed during spring pruning was greater for 'Frontenac' trained to VSP compared with TWC and GDC.
- Fruit quality variables were similar among training systems for both cultivars with the exception of 'Marquette' trained to SH and compared with GDC. Grapes trained to SH had a higher pH than grapes trained to GDC.

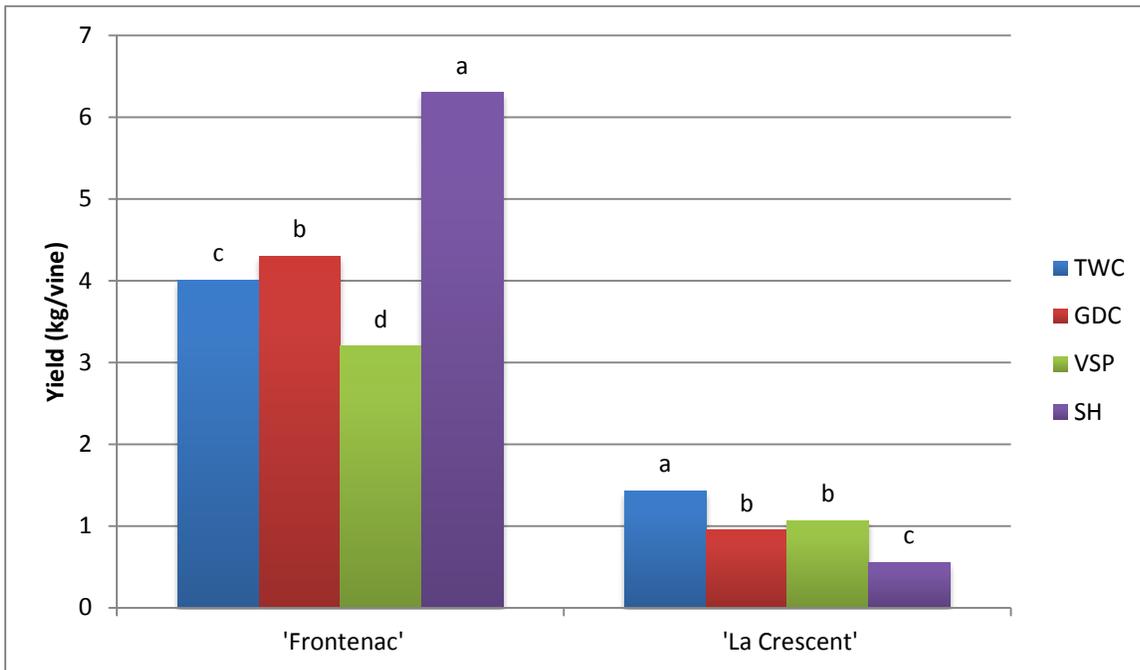
What the results mean:

- No pattern emerged that connected labor and yield across all cultivars in 2013 and 2014.
 - In 'Frontenac', higher labor requirements were needed for the Scott Henry training system, resulting in the highest yield.
 - In 'La Crescent', higher labor requirements of Scott Henry were not offset by increased yields.
 - 'Frontenac' may not be suited for the Vertical Shoot positioning training system because it requires higher labor without a corresponding high yield.
- In 2015, data for both cultivars indicates growth was greater in cold-hardy cultivars trained to VSP as indicated by pruning weights during early spring pruning. The increased time in pruning grapevines trained to GDC was a result of the training system and not a result of the training system promoting more growth. Overall, the training system did not affect fruit quality variables of juice pH, ° Brix and titratable acidity.



Treatment means followed by the same letter within a column are not significantly different at the $\alpha=0.05$ level.

Figure 1. Total labor required per vine for each of the different training systems on 'Frontenac', 'La Crescent', and 'Marquette', Adel and Madrid, IA, 2013.



Treatment means followed by the same letter within a column are not significantly different at the $\alpha=0.05$ level..

Figure 2. Yield at harvest (kg/vine) for each of the different training systems on 'Frontenac', and 'La Crescent', Adel and Madrid, IA, 2013.

Table 1. Fruit quality of 'Marquette' vines trained to a top wire cordon (TWC), Geneva double curtain (GDC), mid-wire cordon with catch wires (VSP), or mid-wire cordon with a split canopy and VSP (Scott Henry -SH) system, September 2014.

Training System	Avg. Berry Wt. (g)	Brix	pH	TA
TWC ^z	150.0 ^y a	19.7 a	3.5 a	8.8 b
GDC	102.5 a	20.5 a	3.6 a	7.8 b
VSP	114.5 a	20.5 a	3.5 a	10.1 a
SH ^x	-	-	-	-
<i>P</i> value ^w	0.103	0.17	0.32	0.009

^z TWC also called single curtain; VSP refers to vertical shoot positioning within catch wires of a mid-wire cordon

^y Means of four replications

^x Fruit not available due to bird and raccoon predation

^w Means within columns followed by the same letter are not significantly different (LSD, alpha = 0.05)

Table 2. Effect of training system on pruning time and vigor of 'Marquette' and 'Frontenac', 2015.

Training system	'Marquette'		'Frontenac'	
	Average time to prune vine (min per person)	Average weight of canes removed (g)	Average time to prune vine (min per person)	Average weight of canes removed (g)
Top wire cordon	2.1	301.6	2.5	271.7
Geneva double curtain	3.3	317.5	3.1	231.5
Scott Henry	2.3	503.2	2.9	558.4
VSP	2.3	528.7	2.3	775.8
HSD ^z	0.5	199.8	0.4	315.2

^z Means within a column are significantly different according to Tukey's Honestly Significant Difference Test, alpha = 0.05.

Table 3. Effect of training system on 'Marquette' and 'Frontenac' fruit quality, 2015.

Training system	'Marquette'			'Frontenac'		
	pH	°Brix	TA ^z	pH	°Brix	TA
Top wire cordon	3.5 ^y	20.4	6.0	3.5	20.3	8.0
Geneva double curtain	3.3	19.9	6.4	3.5	23.8	8.2
Scott Henry	3.7	21.6	5.1	3.5	22.4	8.5
VSP	-	-	-	3.6	21.6	8.3
HSD ^z	0.3	4.8	3.3	0.3	4.5	1.8

^zTA = titratable acidity.

^y Means within a column are significantly different according to Tukey's Honestly Significant Difference Test, alpha = 0.05.

Acknowledgements:

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