

Oregon Wine Advisory Board Research Progress Report

1996 - 1997

Effect of Trellis Type and Canopy Location on Yield Components, Fruit Composition, Fruit Set, and Shoot Morphology in Pinot noir Grapevines

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ABSTRACT

Five different trellis and training systems were compared in their effect on yield components, fruit composition, fruit set, and shoot morphology in Pinot noir grapevines. The treatments were: upright vertical, cane pruned (Guyot); upright vertical, spur pruned (Bi-lateral Cordon); Scott Henry, cane pruned; Lyre, cane pruned; and Geneva Double Curtain (GDC), cane pruned. The GDC and the Scott Henry had the highest yield, but were not significantly different from the Lyre or Bi-lateral Cordon. The double curtain trellis systems had the most clusters per shoot. Vines trained to the GDC had the highest cluster weight. The GDC and Scott Henry had the most berries per cluster. The single curtain trellis systems had more shoots per square meter than the double curtain systems. There were no significant differences in must soluble solids, pK or titratable acidity among the different trellis systems. The double canopy trellis systems were also evaluated by canopy to determine differences within the vine. There were no significant differences in yield components between double canopies within the vine. The north facing curtain in both the GDC and the Lyre had longer mean shoot length. The north facing curtain in the GDC also had higher percentage main shoot leaf area, while the south facing curtain had higher percent lateral shoot leaf area.

INTRODUCTION

The appropriate trellising system is the foundation for effective canopy management. With the correct trellis and training system, the canopy can be balanced with the crop to produce quality grapes, and at the same time maintain the health of the vine. It is the aim of this experiment to determine differences between several trellising systems used in Oregon, providing wine grape growers more knowledge with which to determine the appropriate trellis to integrate into their production system.

MATERIALS AND METHODS

The Lewis-Brown Farm trellis trial was planted in the Spring of 1984. Four cultivars are present: Pinot noir, Chardonnay, White Riesling, and Gewurtztraminer. For this experiment, only the Pinot noir vines were evaluated. The vines are trained to five trellis and training systems: upright vertical, cane pruned (Guyot); upright vertical, spur pruned (Bi-lateral Cordon); Scott Henry, cane pruned; Lyre, cane pruned; and Geneva Double Curtain, cane pruned. The two single canopy systems are spaced 1.5m x 2.0m, and the divided canopy systems are spaced 1.5m x 3.0m. Each treatment consisted of 8 vines. There were

guard rows between each replication, and between single and divided canopy systems within replication. The treatments were replicated 5 times. The Pinot noir vines were balance pruned (28 buds per Kg wood), in February of 1996.

Yield and fruit composition

The Pinot noir crop was harvested October 16, 1996. All fruit from the six center vines was harvested and weighed. The fruit from the double canopy systems was harvested by canopy, and weighed separately. A 24 cluster subsample was used to determine cluster weight, and was then crushed to determine soluble solids, pH, and titratable acidity. A six cluster subsample was used to determine berry weight, berries per cluster, skin weight, and percent skin to berry ratio.

Fruit set

On June 16, 1996, just prior to bloom, one inflorescence per vine was enclosed in a pollination bag to catch all shed flowers. After bloom was completed, the bags were removed, and all shed flowers were counted. At harvest, the same clusters were picked separately, frozen, and then all berries and remaining flowers were counted. Total flower number and percent fruit set was calculated from the total number of flowers and berries.

Shoot morphology

Shoots were hedged one foot above the top wire, and at ground level for the downward hanging canopies. Immediately post harvest, one shoot per vine on the single canopy treatments, and one shoot per canopy on the double canopy treatments were collected. Diameter, shoot length, main shoot leaf area, and lateral shoot leaf area were measured. Leaf Area Index (LAI) was determined using total leaf area and square meter ground surface area. After leaf fall, total shoot number was determined.

RESULTS AND DISCUSSION

Yield and yield components

Table I summarizes the yield and yield components of Pinot noir grapevines trained to the five different trellis systems. The Geneva Double Curtain, and the Scott Henry trellis systems had the highest yields, but were not significantly different from the Lyre and Bi-lateral Cordon. The Guyot had the lowest yield at 1.9 tons per acre. There was no significant difference in clusters per square meter in any of the five systems, and no significant difference in fruit set.

Fruit composition

Table I summarizes the fruit quality of Pinot noir grapevines trained to the five different trellis systems. There were no significant differences in must soluble solids, pH, or titratable acidity among the 5 training systems. The GDC had the highest cluster weight. The GDC and the Scott Henry had the most berries per cluster. The Lyre and the GDC had the highest skin weight, although there were no significant differences in percent skin to berry weight.

Tables 1 and 2: Effect of trellis type on yield components, fruit composition, fruit set, and shoot morphology in Pinot noir grapevines

Trellis	Yield (Kg/m ²)	Tons/Acre	Brix	pH	TA (g/L)	Berry wt. (g)	Cluster wt. (g)	Berries/Cluster	Skin wt. (g)	%Skin/Berry wt.
Cordon	0.76 ab ¹	3.4 ab	19.02 a	3.06 a	8.38 a	0.94 a	100.67 c	112 b	0.102 b	11 a
GDC	1.17 a	5.2 a	19.02 a	3.04 a	8.48 a	0.91 a	130.67 a	152 a	0.106 ab	12 a
Guyot	0.43 b	1.9 b	19.40 a	3.04 a	8.96 a	0.84 a	71.00 d	88 c	0.100 b	12 a
Lyre	0.77 ab	3.4 ab	19.23 a	3.10 a	8.60 a	0.93 a	111.67 bc	123 b	0.116 a	12 a
Scott Henry	1.02 a	4.5 a	18.98 a	3.05 a	8.54 a	0.91 a	115.67 b	131 ab	0.098 b	11 a
	*	*	ns	ns	ns	ns	***	***	***	ns

¹ ns, *, **, *** indicate not significant and statistically significant at the 0.05, 0.01, and 0.001 levels. Values followed by the same letters do not differ significantly.

Shoot morphology

Table 2 summarizes the shoot characteristics of Pinot noir grapevines trained to the five different trellis systems. The Scott Henry, Geneva Double Curtain, and Lyre had the most clusters per shoot. The Cordon and the Guyot had the most shoots per square meter. There were no significant differences in Leaf Area Index (square meter leaf area per square meter ground surface area), in the Bi-lateral Cordon, GDC, Lyre, and Scott Henry, however the LAI for the Guyot was significantly less than for all the other systems. Percent main leaf shoot area, lateral leaf shoot area, shoot length, and shoot diameter had no significant differences between the five systems.

Trellis	Clusters/m ²	Shoots/m ²	Clusters/shoot	Sugar (Kg/Vine)	Fruit Set (%)	LAI	% Main leaf area	% Lateral leaf area	Shoot length(cm)	Sht.diam. (mm)
Cordon	7 a ¹	7 a	1.0 bc	0.14 ab	43.9 a	1.19 a	63.7 a	36.3 a	126 a	7.31 a
GDC	9 a	5 b	1.6 a	0.22 a	38.4 a	1.15 a	70.0 a	30.0 a	123 a	8.04 a
Guyot	6 a	7 a	0.8 c	0.08 b	46.1 a	0.60 b	59.4 a	40.7 a	132 a	7.75 a
Lyre	7 a	5 b	1.5 ab	0.14 ab	41.8 a	1.06 a	62.4 a	37.6 a	130 a	7.72 a
Scott Henry	9 a	6 b	1.6 a	0.19 a	41.9 a	1.11 a	67.4 a	32.6 a	118 a	8.14 a
	ns	**	**	*	ns	***	ns	ns	ns	ns

¹ ns, *, **, *** indicate not significant and statistically significant at the 0.05, 0.01, and 0.001 levels. Values followed by the same letters do not differ significantly.

Double Canopy Comparisons

There were no significant differences in yield or fruit composition between the north and south facing curtains of the GDC (Table 3). The GDC did however have a higher percentage of main shoot leaf area in the north facing curtain than it did in the south facing curtain (Table 4). Resulting in higher percentage of lateral shoot leaf area in the south facing curtain than in the north facing curtain. Also, the north facing curtain had significantly longer shoot length than did the south facing curtain. The Lyre had no significant differences between curtains in yield or fruit composition. The north facing canopy of the Lyre did have a significantly longer shoot length than did the south facing curtain (Table 4). There were no significant differences between top and bottom canopies in yield, fruit composition, or shoot morphology with the Scott Henry system.

Tables 3 and 4: Effect of canopy location on yield components, fruit composition, and shoot morphology in Pinot noir grapevines

TABLE 3

Trellis System	Canopy	Brix	pH	TA	Sugar (Kg/Vine)	Yield (Kg/m ²)	Skin wt. (g)	Cluster wt.(g)	Berry wt. (g)	Clusters/ m ²
GDC	North	19.1 a ¹	3.04 a	8.60 a	0.08 a	0.41 a	0.10 a	105.3 a	0.92 a	9 a
GDC	South	18.9 a	3.08 a	8.32 a	0.09 a	0.46 a	0.11 a	102.7 a	0.90 a	9 a
		ns	ns	ns	ns	ns	ns	ns	ns	ns
Lyre	North	19.3 a	3.10 a	8.58 a	0.11 a	0.56 a	0.11 a	103.3 a	0.89 a	9 a
Lyre	South	19.2 a	3.10 a	8.64 a	0.10 a	0.49 a	0.12 a	99.3 a	0.96 a	10 a
		ns	ns	ns	ns	ns	ns	ns	ns	ns
Scott Henry	Bottom	18.9 a	3.04 a	8.42 a	0.11 a	0.58 a	0.09 a	108.0 a	0.89 a	9.3 a
Scott Henry	Top	19.1 a	3.08 a	8.68 a	0.10 a	0.50 a	0.11 a	103.3 a	0.88 a	8.5 a
		ns	ns	ns	ns	ns	ns	ns	ns	ns

¹ ns, * indicate not significant and statistically significant at the 0.05 level. Values followed by the same letters do not differ significantly.

TABLE 4

Trellis System	Canopy	Berries/ Cluster	%Skin/ Berry wt.	Shoots/ m ²	Clusters/ Shoot	LAI	% Main leaf area	% Lateral leaf area	Diameter (mm)	Shoot length(cm)
GDC	North	116 a ¹	12 a	2 a	1.5 a	0.46 a	68 a	32 b	8.16 a	129 a
GDC	South	117 a	12 a	2 a	1.8 a	0.45 a	60 b	40 a	7.93 a	117 b
		ns	ns	ns	ns	ns	*	*	ns	*
Lyre	North	115 a	13 a	3 a	1.9 a	0.53 a	63 a	37 a	7.72 a	135.5 a
Lyre	South	104 a	12 a	3 a	1.6 a	0.64 a	65 a	35 a	7.72 a	125.0 b
		ns	ns	ns	ns	ns	ns	ns	ns	*
Scott Henry	Bottom	113 a	10 a	3 a	1.9 a	0.57 a	64 a	36 a	8.25 a	135.4 a
Scott Henry	Top	118 a	12 a	3 a	1.7 a	0.46 a	69 a	31 a	8.04 a	100.9 a
		ns	ns	ns	ns	ns	ns	ns	ns	ns

¹ ns, * indicate not significant and statistically significant at the 0.05 level. Values followed by the same letters do not differ significantly.

CONCLUSIONS

In this study, trellis type had the greatest impact on yield components. There was little effect on shoot morphology characteristics except LAI. The double canopy systems had higher yield, cluster weight, and more berries per cluster, than did the single canopy systems. The trellis trial is located on the Willamette Valley floor. On a high potential site such as this one, double canopy systems appear to be better suited to vineyard management.

ACKNOWLEDGMENTS

We would like to thank the Oregon Wine Advisory Board for the funding of this research. Special thanks to Steve Castagnoli, the OSU Viticulture crew, and the Lewis-Brown Farm crew for help on this project.