

Effects of training system, pruning severity, nodes per bearing unit and shoot positioning on yield and quality of Concord grapes

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IN ARKANSAS, 'Concord' grapevines trained to the Geneva Double Curtain system have consistently produced larger yields than vines trained to the bilateral cordon or Umbrella Kniffen systems [Ark. Farm Res. 28(5):12; 1978]. However, information was needed on the influence of pruning severity, cane length and shoot positioning on yield and juice quality as determined by percentage of soluble solids, acidity, pH and color.

This study was conducted for 6 consecutive years in a 17-year-old, own-rooted, nonirrigated 'Concord' vineyard at the Arkansas Agricultural Experiment Station, Fayetteville. Treatments included: 1) three pruning severities: 30 + 10, 50 + 10, and 70 + 10 [30, 50, or 70 nodes retained for the 1st 454 g (1.0 lb) of dormant prunings and 10 additional nodes retained for each additional pound of prunings removed]; 2) three levels of nodes/ bearing unit: 3, 6, or 9 nodes per spur or cane; 3) two training systems, bilateral cordon (BC) or Geneva Double Curtain (GDC), and 4) two canopy positioning treatments: not positioned (NP: shoots allowed to grow at random) or shoot positioned (P: shoots positioned vertically toward the vineyard floor).

Each plot had five vines and all treatments were replicated three times. Vine yields and pruning weights were determined. Fruit samples, consisting of three whole basal clusters from each plot, were frozen in polyethylene bags for subsequent quality analysis.

Table 1. Main effects of pruning severity, nodes/bearing unit, training system and shoot positioning on the quality of 'Concord' grapes (6-year means).

Treatment	Soluble solids	Yield (Mt/ha)	Acidity(% tartaric)	pH	Color (abs. @520nm)
Training system					
BC	13.1 b*	15.5 a	0.80a	3.65a	0.251a
GDC	15.3 a	15.3 a	0.80a	3.61b	0.253a
Pruning severity					
30+10	12.4 c	15.6 a	0.81a	3.65a	0.266a
50+10	14.2 b	15.6 a	0.80a	3.61b	0.256a
70+10	15.8 a	15.1 b	0.81a	3.62b	0.234b
Nodes/bearing unit					
3	13.4 b	15.5 a	0.81a	3.64a	0.252a
6	14.4 a	15.3 a	0.80ab	3.62a	0.249a
9	14.6 a	15.5 a	0.79b	3.62a	0.255a
Shoot positioning					
Not positioned	13.4 b	15.1a	0.81a	3.64a	0.244b
Positioned	14.9	15.7a	0.80a	3.61b	0.260a

*Means followed by the same letter are not significantly different at the 5 % level by Duncan's multiple range test.

GDC trained vines produced higher yields than the BC trained vines, and each decrease in pruning severity resulted in increased yields (Table 1). By the last year of the study, there were no differences in yield between any of the pruning severities (data not shown). The equalization of yields in the last year is explained partially by a decrease in node fruitfulness (g yield/node), as pruning severity decreased in the last three years of the study.

The main effects of nodes per bearing unit and shoot positioning indicate that the three node spurs produced lower yields than the 6 and 9-node canes and shoot positioning significantly increased yields (Table 1). A significant interaction between nodes per bearing unit and shoot-positioning for the 6-year mean showed the advantage of shoot-positioning 3-node spurs and 6-node canes to increase total yield (data not shown). This yield increase was a result of increased node productivity (g fruit/node) of the shoot positioned vines. Shoot-positioning vines pruned to short spurs resulted in more productive basal buds. This response was attributed to an improved exposure to sunlight.

Table 2. Effects of the combinations of nodes/bearing unit, training system, and shoot positioning on yield and quality of 'Concord' grapes (6-year mean).

Treatment		Yield (MT/ha)		Solids solids (%)		Tartaric acid		Absorbance @520 nm	
		GDC	BC	GDC	BC	GDC	BC	GDC	BC
		50 + 10							
P	3	18.5	14.3	15.1	15.8	0.84	0.80	0.223	0.241
	6	17.4	13.5	15.6	16.3	0.78	0.81	0.257	0.272
	9	14.8	12.3	15.9	16.5	0.80	0.78	0.269	0.302
NP	3	12.8	10.1	15.7	15.1	0.79	0.80	0.294	0.232
	6	13.5	13.8	14.9	15.5	0.81	0.83	0.234	0.255
	9	15.9	14.0	15.3	15.3	0.79	0.80	0.246	0.241

Each value represents the average of the 3 replications.

Training system had little effect on juice quality, except for a slightly higher but commercially unimportant juice pH for fruit on the BC trained vines. The 70 + 10 pruning severity resulted in lower percentage of soluble solids than the 50 + 10 and 30 + 10 pruning severities over all 6 years. Fruit from vines pruned to the 70 + 10 severity did not meet the minimum requirements for percentage of soluble solids (15%) established by the juice industry in the last year and for 2 other years (data not shown). Pruning severity did not affect fruit acidity during the study, but the 30 + 10 severity resulted in slightly higher fruit pH than 50 + 10 and 70 + 10 for the 6-year mean. The 70 + 10 pruning severity produced fruit with poorer color quality than the 30 + 10 and the 50 + 10 for the 6-year mean. The quality was not affected by the number of nodes left on the cane, but the 3-node spurs tended to produce fruit with slightly higher acidity than the 9-node canes (Table 1). Shoot positioning increased the percentage of soluble solids and color quality and slightly lowered the pH, though commercially unimportant. Fruit acidity was not affected.

When both yield and juice quality were considered the 50 + 10 pruning treatments were superior (Table 2). The highest yielding treatments were the shoot positioned with 3 and 6 nodes per bearing unit on the GDC training system. However, the 3 node spurs produced fruit with inferior percentage soluble solids and color. Therefore, the recommendation for Arkansas Concord growers is a system consisting of Geneva Double Curtain training, 50 + 10 pruning on 6-node bearing units and shoot positioning.

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