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Fruit Varieties Journal 49(2):79-81 1995

Influence Over a Ten-Year Period of Training System on Yield and Fruitfulness of Table Grape Cultivars

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Abstract

Twenty Grape cultivars [*Vitis* species, (L.) Batch], planted Spring, 1983, were trained to the four-cane Kniffin (KN) and to the Geneva Double Curtain (GDC) system over a ten-year period. Yield per vine, pruning weight, number of nodes, cluster weight, berry number per cluster, berry weight, and percent fruit soluble solids were recorded annually through 1993. Across cultivars, vines trained to the GDC averaged 2 kg more yield per vine per year than vines trained to the KN. Yield per node and the number of clusters per vine also were greater for vines trained to the GDC system.

The four-cane Kniffin system is one of the most common systems for grape training in Kentucky (1). Growers use this system because cultivars with varying degrees of vigor are adapted to it. However, Shaulis *et al.* (6) reported 'Concord' vines, especially vigorous ones, trained to the GDC to be more productive than those trained to the umbrella Kniffin. An increase in vine yield using the GDC when compared to the bilateral cordon has also been reported for 'Concord' (3), and 'Niagara' (4). Shaulis and Oberle (5) have reported investigations using various training systems with 'Fredonia.' However, there are many commercial table grape cultivars for which training system studies have not been conducted. This paper reports on table grape performance and yield components in Kentucky using the KN and the GDC.

Materials and Methods

The GDC and the KN training systems, were assigned randomly to ten 60 m-long rows spaced 3.7 m apart with one training system per row. Each row was divided into four 15-m long plots with six vines per plot. Twenty table grape cultivars were assigned randomly to the twenty plots for each training system. Vines were planted 2.5 m apart within rows in June 1983. Beginning in 1986, vines were balanced pruned annually (30 buds left for the first pound of prunings plus 10 buds for each additional pound), and the weight of the prunings and the number of nodes left per vine recorded. These buds were distributed as five to six buds per fruiting spurs on vines trained

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Received for publication _____. Published with the approval of the Director of the Kentucky Agricultural Experiment Station as Paper No. 93-10-126. Mention of trade names in this paper is not to be construed as an endorsement by the Kentucky Agricultural Experiment Station of products named, nor criticism of similar ones not mentioned.
The authors express appreciation to June Johnston for her technical assistance.

to the GDC and on four canes for the KN. The planting was trickle irrigated and managed according to Kentucky Cooperative Extension Service recommendations (1). Vines were not cluster thinned, nor were shoots positioned. Fruit was harvested at maturity, and the yield, weight of three randomly selected clusters, and the percent soluble solids (Atago N1 refractometer) of three randomly selected berries were recorded annually for each vine. Beginning in 1989, berry number and berry weight were also recorded annually for each vine, and were based on the three cluster samples.

Vine survival was severely reduced by winter injury (7), and was poor for many cultivars. Data on performance by training system were limited to those cultivars whose survival with quality and quantity of fruit were acceptable commercially, and included 'Captivator,' 'Challenger,' 'Concord,' 'Glenora,' 'Himrod,' 'Moored,' 'Niagara,' and 'Reliance.' The experimental design was an unreplicated split-plot with incomplete blocking of the subplot treatments (cultivars). As a consequence, an appropriate error term for testing the cultivar x training system interaction could not be obtained. For this reason, only the LSDs across cultivars are presented. All vegetative characteristics were determined in the annual dormant season preceding each harvest. The analysis of variance was performed for each of these variables: yield (kg), pruning weight (kg), yield/node (kg/node), cluster weight (g/cluster), clusters/vine, berries/cluster, berry weight (g/berry), and percent soluble solids. Data were collected during six harvest years (1987- 1992) for 'Captivator,' 'Concord,' 'Himrod,' 'Moored,' 'Niagara,' and 'Reliance'; and five (1988-1992) for 'Challenger' and 'Glenora' due to the lack of fruit on most of the GDC vines and some KN vines in 1987. Data were obtained during four harvest years (1989-1992) for berries/cluster, and berry weight (g/berry) for all cultivars, except for the case of 'Himrod' where missing data necessitated that a three-year mean (1989, 1991, and 1992) be used for berry weight.

Results and Discussion

Vines trained to the GDC had a greater yield than the KN, averaging a difference of 2.0 kg/vine/year (Table 1). Greater yields of 'Concord' and 'Niagara' vines on the GDC verses the bilateral cordon and the Umbrella Kniffin have been reported (3, 4, 6) and attributed to improved node fruitfulness (yield per node) as a consequence of increasing the light exposure to the leaves of the GDC trained vines (6). In this experiment, node fruitfulness was also improved as the average yield per node per year was greater for vines trained to the GDC system compared to vines trained to the KN system (Table 1). Under the conditions of this experiment, vines on the GDC trellis were more productive than those on the KN system.

More clusters per vine were produced on vines trained to the GDC system compared to the KN system (Table 1). Cluster weights were commercially acceptable and did not differ between the two training systems. A low cluster weight can indicate that a vine is being overcropped. Since there were no differences in cluster weight, training vines to the GDC system resulted in greater total yields by increasing the number of clusters per vine. No differences were observed between the two training systems for either the number of berries per cluster or berry weight, supporting that yield differences were due to the number of clusters per vine. Increases in both the number of clusters per shoot and in cluster weight were reported by Shaulis *et al.*, (6) for 'Concord' vines trained

Table 1. Mean[1] fruit and vegetative characteristics of grapevines trained to Geneva double curtain (GDC) and four-cane Kniffin (KN) training systems, Princeton, KY.

Training system	Yield (kg)	Pruning wt. (kg)	Yield/ node (g)	Grams/ cluster	Clusters per vine	Berries/ cluster	Grams/ berry	% Soluble solids
GDC	7.8	2.0	205	179	45.4	71	3.1	19.6
Kn	5.8	2.1	144	181	32.9	66	3.0	20.0
$LSD_{.05}$	1.8	0.6	27	22	11.9	12	0.3	0.5

[1]Average per year across eight cultivars. Six-year means (1987-1992) were used for yield (kg), pruning weight (kg), yield/node (kg/node), cluster weight (g/cluster), clusters/vine, and percent soluble solids of the two training systems for 'Captivator,' 'Concord,' 'Himrod,' 'Moored,' 'Niagara,' and 'Reliance.' Five-year means (1988-1992) were used for 'Challenger' and 'Glenora.' Four-year means (1989-1992) were used for berries/cluster, and berry weight (g/berry) for all cultivars, except for the case of 'Himrod' where missing data necessitated the use of three-year means (1989, 1991, and 1992) for berry weight.

to the GDC compared to the Umbrella Kniffin, and by Couvillon and Nakayama (2) for 'Concord' vines trained to the Modified Munson compared to the four-cane Kniffin. However, Morris *et al.*, (3) reported no differences in either berry weight or the number of berries per cluster for four of the six years of their comparison of vines trained to the bilateral cordon with those trained to the GDC. This is consistent with the lack of differences in cluster weight, and number of berries and berry weight observed in this experiment.

Pruning weight (kg/vine), a measure of vegetative growth and plant vigor, did not differ between the two training systems indicating that cropping level did not affect overall plant vigor (Table 1). Morris *et al.* also observed that pruning weight did not differ between vines trained to the bilateral cordon and those trained to the more productive GDC (3, 4).

Both trellis treatments were harvested on the same date for each cultivar, and, while training differences affected yield, they did not influence maturity date as measured by percent soluble solids. This is not surprising since both reductions (2, 4, 6) and increases in the percent soluble solids (3) have been reported where vines trained to the GDC increased yield.

Lack of differences in pruning and cluster weights suggest that all vines in this experiment had ample vigor. Vines trained to GDC resulted in greater yields because more fruit clusters were produced per node than on vines trained to the KN trellis. The yield increase on vines trained to the GDC was due to increase in the number of clusters per vine since cluster weight did not change. Based on results of this study, the GDC is recommended for new grape cultivars in Kentucky.

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