Yield and Quality Response of 'Concord' Grapes to Mechanized Vine Pruning

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WITH the increasing scarcity of manual labor for vineyard pruning operations, mechanized vine pruning is receiving much attention. Completely mechanized pruning of 'Concord' with no follow-up of manual pruning has been shown to produce acceptable yields and quality for one year (Ark. Farm Res. Vol. 24, No. 3). However, continued overcropping of 'Concord' because of insufficient hand pruning following the mechanical pruning operation may produce fruit with unacceptable raw product quality.

Yield, vine size, and juice quality were determined from 'Concord' grapes for 6 consecutive years of hand pruning to a 30+10 pruning schedule (30 nodes retained for the first 454 g or 1 lb of dormant prunings and 10 additional nodes retained for each additional 454 g) or mechanical pruning followed by no node adjustment or node limitation to 60 or 90 per vine. Both the mechanical pruner and hand pruner left canes approximately 5 nodes long. To accomplish the mechanical pruning, a Wagner Pruning Aid ,as used (Paisley Machine Shop, Grandview, WA 98930).

Vines were trained to either the Geneva Double Curtain (GDC) or a single wire cordon (SC) training system. All vines were manually shoot positioned (current season's growth manually positioned vertically toward the vineyard floor) immediately after bloom and twice more on approximately 3-week intervals. The study was a randomized block with 6 replications of 2-vine plots.

All treatments were harvested on the same date, fruit yields were recorded, and in 1979 (the final year of the study) approximately 2.5 kg of fruit from each plot were collected for juice preparation. Fruit was destemmed, crushed, and placed in jacketed steam kettles for heating to 75°C. After they reached this temperature, the juice samples were cooled to 60°C, pectinase was added, and after 2 hours pulp was lightly pressed through cheesecloth. The juice was filled in 130 ml (4 oz) bottles, sterilized at 85°C for 30 minutes, and placed in cold storage (0°C) for 1 month before analysis.

Soluble solids content was determined on a Bausch and Lomb Abbe refractometer. A 2 ml sample of juice was diluted to 100 ml with deionized water, acidified to pH 1.5 with HCl, and centrifuged. Absorbance was determined using a Bausch and Lomb Spectronic 20 spectrophotometer at 520 nm. A 5 ml sample of juice was diluted to 125 ml with deionized water, pH was determined, and the sample was titrated to pH 8.4 with 0.1 N NaOH to determine acidity.

The effects of training and pruning treatments on yield for the first 5 years (1974 through 1978) indicated that the GDC training system was generally more productive (see table). Mechanically pruned vines with nodes not limited (no touch-up) or limited to 90 nodes were higher yielding than the hand pruned 30+10 vines for the first year (1974) on both training systems (data not shown). However, by 1977, these cropping treatments were not out yielding the more severely pruned 30+10 vines.

In the 6th year of the study (1979), vines on the GDC training system with 90 nodes retained following mechanical pruning and vines on both training systems with no node adjustment following mechanical pruning were low in yield. Low yields and high numbers of nodes retained per vine resulted in poor fruit yield per node on vines receiving these treatments in 1979. These low yields were partially due to small berries and poorly developed clusters.

Objective quality evaluation of the 1979 juice indicated poor, unacceptable soluble solids levels with the no touch-up treatment and the treatment with 90 nodes retained following mechanical pruning, regardless of the training system. Neither of these treatments attained the 15% level of soluble solids established as the minimum level of acceptability by the unfermented juice industry. The percent green fruit, which is an indication of uneven ripening, was high on these treatments. This uneven ripening of the grapes within each bunch contributed to the low soluble solids levels as well as significant reductions in juice color (abs. @ 520 nm). The reduction in soluble solids and juice color occurred in the 6th year even though these treatments (90 nodes and no touch-up) had considerably lower yields.

Juice pH was extremely high in the fruit from hand pruned 30+10, GDC treatment. The juice was blue in color, rather than the typical purple color that is expected with 'Concord' juice (data not shown). Acidity in this treatment also tended to be low; if the fruit had been harvested earlier, pH and acidity problems might not have developed.

In summary, hand pruning to limit the number of nodes per vine to 60 following mechanical pruning maintained fruit yield and juice quality comparable to vines balanced pruned to a 30+10 schedule. Retaining 90 or more nodes per vine following mechanical pruning reduced fruit yields per vine and per node after the 6th year and juice quality was unacceptable. These treatments resulted in uneven ripening of the grapes. Continuous mechanical pruning of 'Concord' grapevines would be feasible only in relatively uniform vineyards that have been shoot positioned, and followed by cane selection and node limitation. The number of nodes retained after mechanical pruning should be based on the vigor of the vines.

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Effect of Training System and Pruning Treatment on Yield and Quality of 'Concord' Grapes[1]

Treatment	5-year[2] mean yield (MT/ha)	1979 Yield (MT/ha)	Nodes/ vine	Green fruit (%)	Soluble solids (%)	Color (abs @ 520nm)	pH	Acidity as tartaric (%)
GDC								
30+10	13.1bc	15.7a	41c	3.0ab	15.2a	.343ab	3.79d	.72d
60	12.4bc	15.9a	60bc	2.3a	15.1a	.291bc	3.68cd	.76bcd
90	14.5b	8.1b	90ab	9.1abc	13.8b	.261cd	3.61cd	.82a-d
No touch-up	17.6a	8.6b	104a	12.6c	13.3bc	.199ef	3.46abc	.86abc
SC								
30+10	10.0d	10.1ab	31c	4.0ab	15.0a	.320abc	3.60bcd	.80a-d
60	12.1cd	12.4a	60bc	4.1ab	15.7a	.364a	3.48abc	.76cd
90	12.0cd	9.9ab	88ab	8.8abc	13.6b	.230de	3.41ab	.90a
No touch-up	13.5bc	6.5b	114a	11.4bc	12.0c	.167f	3.35a	.88ab

[1]Means separation within columns by Duncan's multiple range test, 5% level.
[2]1974 through 1978.