Ethephon as a Harvesting Aid for `Concord' Grapes

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ETHEPHON has been used successfully as a harvesting aid for many mechanically harvested fruit crops. It accelerates the formation of the abscission layer and facilitates fruit separation and harvesting.

In this study we considered ethephon as a harvesting aid for grapes since the resulting dry stem scar on the grapes may protect the berry from post-harvest quality loss. Also, since `Concord' grapes in Arkansas are harvested at high temperatures, post-harvest quality loss can be very rapid.

Ethephon was applied to 12-year-old own-rooted `Concord' grapevines at 0, 100, 200, 300, 400, and 500 ppm with a 10-liter hand sprayer 8 days before harvest. Vines were selected on the basis of uniform size and fruit load. Experimental design was a randomized block with 3 replications of 1-vine plots.

Fruit were harvested by hand-shaking onto a canvas, and the percentage of berries with leaking stem scars was determined. The ambient air temperature at harvest, during early morning, was 23°C, and berry temperature ranged from 20° to 24° at the time of harvest. Immediately after harvest, 1-kg samples of grapes from each plot were placed in non-vented polyethylene bags and either frozen immediately or held for 12 or 24 hr at 18, 24, or 30°, after which the bags were frozen for later quality analysis.

For quality analyses, samples were thawed, blended for 15 seconds, and warmed to 20°C. Soluble solids concentrations were determined using a Bausch and Lomb Abbe refractometer. After being heated for 1 hr at 85°, pulp was separated from juice with cheesecloth. A 5-ml aliquot of juice was diluted to 125 ml with distilled water, pH was recorded, and the sample was titrated to pH 8.4 with 0.1 N NaOH. Tristimulus color of the juice was determined using a Gardner Color and Color Difference meter standardized to the dark red plaque with values of "L"=23.1, "a"=22.0, and "b"=7.1. A 300ml sample of juice was taken from each sample, and alcohol concentration was determined with a pycnometer.

Ethephon applied 8 days before harvest apparently enhanced abscission, which reduced the percentage of grapes with damaged or wet stem scars when they were hand shaken from the vine (data not shown). The control had 90 percent damaged or wet stem scars; there was a linear decrease in damaged scars to essentially zero at 400 and 600 ppm ethephon. None of the fresh juice quality parameters determined was affected by the ethephon treatments.

During post-harvest holding, fruit soluble solids declined and titratable acidity and pH increased slightly (Table 1). Juice color became lighter (higher "L") and less blue (higher "b") and alcohol content increased with holding time.

The holding temperature had no influence on soluble solids and no consistent effect on titratable acidity or the "a" or "b" color values. However, juice color became darker at the higher holding temperatures and alcohol content increased. A slight reduction in pH occurred at 30°C.

Ethephon had no influence on alcohol production when grapes were held at 18° or 24°C for 12 or 24 hr (Table 2). However, at the 30° holding temperature, which is common during `Concord' harvest in Arkansas, all ethephon concentrations significantly reduced alcohol levels compared to the control after both 12 and 24 hours. Alcohol content can be an indicator of quality loss, and levels above 0.26 percent often are associated with off-flavors in processed juice products. On this basis, ethephon allowed these grapes to be held without quality loss at 18°, 24°, or 30° for 12 hr, but not for 24 hr.

Alcohol production at a holding temperature of 30°C was reduced up to 50 percent when ethephon was used. However, this reduction in alcohol during post-harvest holding, which probably occurred because there were less torn and damaged berries, may occur commercially when a non-slapper mechanical harvester is used. Use of ethephon as a harvesting aid for `Concord' grapes would not be practical in areas where high winds commonly occur at harvest. The addition of SO_2 to the grapes at the time of mechanical harvest may be a more practical method of delaying poet-harvest deterioration (see Arkansas Farm Research Vol. 21, No. 2, p. 5).

Table 1. Main Effects of Postharvest Holding Time and Temperature on Raw Product Quality of 'Concord' Grapes (Ethephon was applied to all plots 8 days before harvest.)

Main effect	Soluble solids, %	Tartaric acid, %	pH	CDM color L	CDM color a	CDM color b	Alcohol, %
Holding time (hr)							
0	15.7	.72	3.62	12.4	11.5	4.6	-[1]
12	15.3	.73	3.63	12.7	11.7	4.9	.18
24	14.7	.75	3.68	13.1	11.5	5.3	.45
LSD @ 5%	0.4	.01	0.04	0.2	NS	0.3	.03
Holding temperature (°C)							
18	15.2	.71	3.67	13.2	11.1	5.1	.13
24	15.3	.76	3.67	12.8	12.0	4.7	.20
30	15.1	.73	3.61	12.7	11.5	5.2	.37
LSD % 5%	NS	.01	0.03	0.2	0.5	0.3	.03

[1]Not determined at harvest.

Table 2. Interactive Effects of Ethephon Concentration, Holding Time, and Holding Temperature on Alcohol Content of 'Concord' Grapes (Ethephon was applied to all plots 8 days before harvest.)

Holding time and ethephon concn (ppm)	Percent alcohol after holding at 18°C	24°C	30°C
12 hours			
0	.11	.14	.40
100	.15	.17	.20
200	.11	.15	.19
300	.13	.18	.23
400	.13	.16	.21
500	.15	.15	.20
24 hours			
0	.22	.39	1.17
100	.26	.41	.71
200	.18	.36	.55
300	.21	.50	.82
400	.20	.35	.47
500	.18	.32	.66

LSD @ 5% = 0.17

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