Testing ethephon-treated table grapes for berry firmness

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In recent years, ethephon (Ethrel) on Emperor table grapes has hastened color development when applied at a rate of 75 to 150 ppm (½ to 1 pint per acre). Ethephon also effectively permits earlier harvest when applied any time from color break to within three weeks of harvest.

Berry firmness is an important textural attribute of Emperor table grapes: most growers express concern if the fruit is too soft. When applied at a rate of ½ to 2 pints per acre, ethephon reduces berry firmness by 10 to 30 percent as determined by a U.C. Pressure Tester using a flat-end 4.8 mm-diameter probe on the flesh at the stylar end of the berry. However, this reduction in firmness would not be important unless the difference were detectable and affected consumer preference or acceptance. The purpose of this study was to establish if berry firmness differences were detectable by a sensory analysis panel. This information is prerequisite to running consumer preference or acceptance tests.

Eleven panelists, selected from sixteen who completed orientation, participated in the study. Panelists were trained to recognize differences between soft, firm, and hard fruit. Berry firmness was determined by the amount of force required to compress a berry—between the molar teeth or between the forefinger and thumb—to a given deformation. Because some panelists were more sensitive to firmness than others, five of the original sixteen had to be dropped.

The fruit from two vineyards was tested. Untreated fruit from vineyard A was much softer than from vineyard B, but percent reduction in firmness from ethephon was similar (see table 1). There were three treatments in both vineyards: 1) untreated, 2) 150 ppm (1 pint ethephon per acre), and 3) 300 ppm (2 pints ethephon per acre). The high rate of 300 ppm was used to assure a wider range of berry firmness differences. Ethephon was applied shortly after color break. When mature, the fruit was harvested and placed in cold storage until time of testing.

Testing took place in a small room in which six individual booths were constructed. The booths minimized interference among panelists and encouraged concentration during testing. Red lights prevented panelists from detecting color differences among samples.

Grapes were washed and allowed to warm to room temperature. A sampling unit consisted of eight berries placed in a black fruit cup and assigned an indentifying number. Panelists compared six pairs placed in random order. Samples were presented to the panelists on a cafeteria tray with a scoring card, glass of water, and cuspidor. Panelists determined the firmest grape of each of the six pairs and circled the corresponding identification number on the score sheet. Choices were studied using chi-square difference analysis.

Untreated fruit from vineyard A was relatively soft with a firmness-pressure reading of 197 grams. Applying 150 and 300 ppm ethephon reduced the firmness 16 and 27 percent, respectively. This firmness difference was easily detected by panelists, who made correct choices 78 and 83 percent of the time when comparing the check with the 150- and 300-ppm treatment, respectively. The 13 percent firmness difference which existed between 150- and 300-ppm-treated fruit was detected by panelists with 67 percent correct choices.

Both treated and untreated fruit from vineyard B were firmer than those from vineyard A. Applying ethephon to vineyard B at rates of 150 and 300 ppm reduced berry firmness by 20 and 28 percent, respectively. The firmness difference between treated and untreated fruit was more difficult to detect with vineyard B (see table 2). A 10 percent difference between the 150- and 300-ppm treatment was not detected by panelists.

Differences in firmness are detectable but more difficult to differentiate with fruit in the range of 250 to 400 grams firmness pressure than with softer fruit in the range of 100 to 250 grams. The data indicate that differences of 10 to 15 percent can be recognized at the low range but not at the high range.

Panelists commented that fruit softer than 150 to 175 grams had poor textural characteristics, describing fruit as "mushy" or "too soft." Fruit above 300 grams was described as "firm" and "crisp." A firmness pressure of 150 to 175 grams appears to be a possible threshold between texturally acceptable and unacceptable fruit. However, a consumer preference/acceptance test should be run to accurately establish this threshold.

Earlier investigations showed that berry firmness slowly decreased in cold storage following an initial increase. Ethephon does not accelerate this process. The length of time Emperor grapes can be held in storage depends, to some degree, on berry firmness. Once the fruit drops below the apparent firmness threshhold it loses much of its textural quality. Ethephon could reduce storage life in cases in which treated fruit drops below the threshold before untreated fruit.

The work in progress described here will be incomplete until use of ethephon for earlier harvesting becomes legal.

TABLE 1. Berry Firmness as Affected by Ethephon Application in Two Vineyards

	Firmness pressure (Gm)*		
Vineyard	Check	Ethephon at 200 ppm (1 pt/acre)	Ethephon at 400 ppm (2 pt/acre)
A	197	166	144
B	370	297	266

*Berry firmness measured with U.C. Pressure Tester using 4.8 mm diameter flat-ended probe.

TABLE 2. Results of Sensory Analysis Comparing Firmness of Ethephon-Treated and Untreated Fruit

Comparison	Percent firmness reduction	Sensory score
Vineyard A		
Check vs 1 pt	16	78*
Check vs 2 pt	27	83*
1 pt vs 2 pt	13	67**
Vineyard B		
Check vs 1 pt	20	64***
Check vs 2 pt	28	68***
1 pt vs 2 pt	10	53 ns

*Significant at 0.1% probability level.
**Significant at 1% probability level.
***Significant at 5% probability level.

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