Effect of Ethephon and Harvest Method on Quality of Stemless Sweet Cherries Harvested for the Fresh Market[1]

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Abstract. **Sweet cherries (*Prunus avium* L.) treated with (2-chloroethyl)phosphonic acid (ethephon) to facilitate harvesting, were low in soluble solids in 1972, but not in 1973. Bruising, pitting and torn stem attachments were attributable to picking method rather than ethephon treatment.**

Ethephon has been used to induce abscission of sweet cherries to facilitate shake removal of fruit intended for processing (1, 2, 3). Although there is little interest in mechanical harvest of fresh market sweet cherries, marketing stemless cherries, even if handpicked, has several potential advantages. Stems often deteriorate faster than the fruit and may become brown, dry, and unsightly. As stems dry, they pull away from the fruit providing a place for rapid moisture loss and a site for fungal invasion. Stems are more susceptible to freezing damage than the fruit and thereby restrict the storage conditions. Stems interfere with sizing and packaging operations and require a special cluster cutting operation which may damage the fruit. After packaging, stems tend to dent and mark the fruit. On the positive side, stems provide a convenient handle for picking and a sensitive indicator of freshness.

Since ethephon is registered for use on cherries and is known to induce abscission of the fruit from the stem (1, 2, 3), we studied the effects of ethephon on ease of harvesting and on the quality of cherries of fresh shipping maturity.

In 1972, 4 'Bing' cherry trees were sprayed with 500 ppm ethephon on June 19, and the fruit harvested on June 26, along with 4 comparable nontreated trees. One-half of each tree was harvested by hand, after which the other half was machine harvested. During the week between treatment and harvest the average daily maximum temp was 25°C. After harvest the cherries were stored in field boxes at -1° and 2° for 2 weeks. Since storage temp had little effect on the response to ethephon, data from -1° and 2° were averaged.

Table 1. Cherry fruit color, soluble solids, and firmness in 1972 and 1973.

Year	Cultivar	Fruit[z] color rating	Soluble[y] solids (%)	Firmness durometer units[x]
1972	Bing	2.8	16.0	–
1973	Bing	4.0	18.4	71.3
1973	Van	3.2	16.1	76.4

[z]Rating scale: 1 = light red, 2 = red, 3 = light mahogany, 4 = dark mahogany, 5 = black.

[y]Determined by hand refractometer.

[x]Shore Instrument Co. Model oo.

In 1973, 2 groups of 3 'Bing' and 2 'Van' cherry trees were sprayed with 300 and 600 ppm ethephon on June 18. The fruit was harvested on June 25, with comparable 'Bing' and 'Van' trees. As in 1972, half trees were first harvested by hand and then the other half by machine. The average daily maximum temp was 30°C between spray and harvest. The cherries were more mature at the time of ethephon application than in 1972 as indicated by color and soluble solids content at harvest (Table 1).

Fruit removal force (FRF) and soluble solids concn (SSC) by refractometer were measured on a sample of 10 fruits from each tree on the day of ethephon application, after 4 days and on the day of harvest. At harvest the cherries were placed in plastic containers holding 75 to 100 cherries and stored at $-1^{\circ}C$ for 2 weeks.

A commercial trunk shaker was used in both years. Maximum shake frequency was 1,000 cycles/min. The 'Bing' and 'Van' trunk diam ranged from 22 to 35 cm and from 20 to 36 cm, respectively. Height above ground level for the shaker attachment ranged from 28 to 64 cm for 'Bing' and 46 to 74 cm for 'Van'. The least efficient combination for shake harvesting was a large trunk and low shaker attachment. Removal efficiency was increased with a high shaker attachment on the smaller trunks. Three-fourths of the test trees should have been headed higher to facilitate attachment of the trunk shaker. The cherries were caught on a canvas tarpaulin spread on the grass cover crop.

The response to ethephon differed greatly between the 2 years, probably because of the difference in temperature (3) and fruit maturity at the time of application.

In 1972, tearing of hand picked cherries at the stem attachment indicated that the abscission layer had not formed completely in the ethephon treatment (Table 2). In 1973, the FRF decreased rapidly after application of

Table 3. Fruit removal force of 'Bing' and 'Van' cherries as a function of ethephon concn and time. Ethephon applied 6/18/73[z].

Cultivar	Fruit removal force (g)		
Days after treatment	Ethephon concn (ppm) 0	300	600
Bing (3 replications)			
0	492 b	506 bc	554 c
4	488 b	315a	331a
7	462 b	295a	275a
Van (2 replications)			
0	546 c	542 c	550 c
4	449 bc	412 bc	318a
7	520 c	355ab	239a

[z]Mean separation within cultivars by Duncan's multiple range test, 5% level.

Table 2. Soluble solids and mechanical injury of 'Bing' cherries treated with ethephon and harvested by hand or by shaker as a function of ethephon concn and picking method (1972).[z]

			Mechanical injury		
Ethephon concn (ppm)	Picking method	Soluble solids (%)	Pitting[y] (%)	Bruising (%)	Torn stem attachments[x] (%)
0	Hand	16.2 bc	3.5a	22.2a	0.5a
	Shaker	16.8 c	19.4 c	42.8 b	14.8 b
500	Hand	15.1a	9.0 b	30.5ab	6.0a
	Shaker	15.8ab	9.3 b	36.2ab	0.5a

[z]Mean separation within columns by Duncan's multiple range test, 5% level.

[y]Pitting refers to indentations or dark marks in the skin of the cherry fruits not to pit removal from the fruits.

[x]Refers to shearing or tearing at point of attachment between stem and fruit.

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[2]Agricultural Research Service, U.S. Department of Agriculture.

[3]Washington State University Tree Fruit Research Center.

[4]Mention of a trademark name or proprietary product does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture, and does not imply its approval to the exclusion of other products that may also be suitable.

Table 4. Mechanical injury of cherries related to harvest method and ethephon concentration, 1973.[z]

Ethephon (mg/liter)	Harvest method	Mechanical injured fruit (%)							
		Pitting[z]		Slight bruising		Severe bruising		Torn stem attachments[z]	
		Bing	Van	Bing	Van	Bing	Van	Bing	Van
0	Careful handpick	2.8ab	0.6a	9.9ab	5.5a	3.7a	0.6a	0.0a	0.0a
	Commercial handpick	1.5ab	3.0a	21.7 cde	26.9a	4.8a	4.5a	0.0a	0.0a
	Shaker	8.1 b	2.5a	32.1 e	22.5a	16.2 b	68.8 b	2.4a	1.3a
300	Careful handpick	0.4a	2.7a	12.0abc	11.0a	2.3a	1.7a	0.0a	1.7a
	Commercial handpick	4.3ab	3.4a	31.9 c	21.4a	12.9 b	13.4a	0.4a	6.3 b
	Shaker	5.9ab	1.8a	27.8 de	35.9a	10.2ab	39.7 b	0.4a	0.0a
600	Careful handpick	0.4a	0.5a	5.8a	7.7a	0.4a	1.1a	0.0a	0.6a
	Commercial handpick	2.5ab	4.3a	19.2 bcd	18.2 b	11.2 b	8.5a	0.5a	1.1a
	Shaker	5.5ab	0.6a	26.3 de	19.6a	18.2 b	62.9 b	2.4a	0.0a
Avg.	Careful handpick	1.2a	1.3a	9.2a	8.1a	2.1a	1.1a	0.0a	0.7a
	Commercial handpick	2.8ab	3.5 b	24.3 b	23.9a	9.6 b	8.8a	0.3a	2.5 b
	Shaker	6.5 b	1.6a	28.8 c	26.0a	14.9 b	57.1 b	1.7 b	0.4a

[z]Mean separation within harvest method by Duncan's multiple range test, 5% level.

[y]Pitting refers to indentations or dark marks in the skin of the cherry fruits not to pit removal.

[x]Refers to shearing or tearing at point of attachment between stem and fruit.

ethephon (Table 3), and at harvest there was no difference between the 2 concn in FRF suggesting the lower rates might be adequate. The hand-harvested cherries harvested cleanly without tearing.

In 1973 we instructed pickers to snap, rather than pull, the individual cherries off the stem, but they were reluctant to adopt this technique because they felt it might be slower. Pickers (not on piece work) who were very careful and used the snapping technique caused less fruit damage than the commercial pickers (Table 4).

In 1972 ethephon reduced SSC, but in 1973 had no effect on SSC (Tables 1 and 2). This may have been caused by the induction of the abscission layer before a time of rapid increase in SSC in 1972 but after this period in 1973. Ethephon treatment might be expected to hasten the color change and softening of the fruit but did not do so in either year (data not shown).

Shaking damaged a higher proportion of cherries than handpicking. The margin of difference was small for 'Bing' cherries, but 'Van' was severely damaged by shaking (Table 4). Differences in the FRF for the 2 cultivars did not seem to be large enough to account for the differences in injury and we speculate that the short stems on 'Van' did not permit the motion necessary for quick removal.

Small trees headed at about 76 cm and pruned to provide a stiff (for maximum shake transmission), open-structured framework would probably facilitate the removal and free fall of fruit. With suitable tree training and an adequate catching and conveying system, it might be possible to mechanically harvest chemically-loosened 'Bing' cherries with no more harvest damage than is now experienced by hand-harvest. This is an important consideration, especially in a large crop year.

After harvest, stemless cherries would be exposed to less damage than cherries with stems because they would not require the cluster cutter, and would not hang up on the sizing and sorting equipment, or be marked by the stems.

Ethephon has caused some leaf drop and gumming of treated cherry trees in these experiments. These effects on the trees may greatly restrict the use of ethephon. We intend to observe the treated trees and make repeat applications until sufficient data have accumulated to warrant sound recommendations. The merits of stemless sweet cherries seem sufficient to warrant trials with other potential chemical loosening agents should tree gumming caused by ethephon be too serious for commercial acceptance.

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†Note added in proof. For ethephon effects under Michigan conditions see:

Aebig, D. E., and D. H. Dewey, 1974. Ethephon improves marketability of 'Schmidt' sweet cherries picked without stems. *HortScience* 9:448-449.

Peach Seedling Weed Control as Part of a *Prunus* Stem Pitting Control System[1]

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Abstract. **In order to reduce the cost of fumigation and weed control in seedling nurseries of peach (*Prunus persica* (L.) Batsch.), a number of herbicides, used with and without Nemagon as a nematicide, were evaluated. While necessary for soil fumigation, the presence or absence of Nemagon did not effect weed control or seedling performance. The best and most economical herbicides were the spring application of simazine at 4.5 kg ai/ha or the fall application of diuron at 3.4 kg ai/ha.**

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An epidemic of peach stem pitting, beginning about 1966, focused attention on the loss of thousands of peach trees in the Mid-Atlantic region of the U.S. (1, 3, 7). Observations by Stouffer and Lewis (7) indicate that early symptoms of stem pitting occurred in the nursery. Numerous workers speculated that this disease might be spread by some soil vector, possibly nematodes.

In 1968 and 1969, fruit tree nurseries in Pennsylvania began fumigating peach seedling nursery soil with Dowfume MC-33[3] (67% methyl bromide, 3% chloropicrin) for the control of nematodes. Since that time, it has been shown that the stem pitting disease can be caused by the tomato ringspot virus which is transmitted by the nematode *Xiphinema americanum* (2, 5, 6). Therefore, it seems highly

[3]Trade name of Dow Chemical Company, Midland, Michigan.