COMPARISON OF METHYL BROMIDE AND IRRADIATION TREATMENT TO MEET QUARANTINE REQUIREMENTS

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Introduction

Export of agriculture commodities to foreign markets is of major interest to the fruit growing areas of the United States. One of the primary factors restricting export of fruits are quarantine barriers established to prevent the spread of insects. Methyl bromide (MeBr) has been used as a fumigant to meet quarantine requirements with varying degrees of success. Regardless of the problems associated with MeBr as a fumigant, it is the only method currently accepted by most countries. Irradiation has been proposed as a possible alternative to MeBr. Research has been conducted on the sweet cherry response to MeBr and to irradiation, but direct comparisons between the two quarantine treatments and sweet cherry response is limited. This study was conducted to determine sweet cherry response to both MeBr and irradiation from identical lots of fruit.

Material and Methods

Five grower lots of 'Bing' and one lot of 'Rainier' sweet cherries were obtained from commercial sources the day of harvest. Each lot was divided immediately into 4 groups of 2.5 kg each and packed in lined fruit boxes. The boxed cherries were held over-night at 1^0 C. The following day the cherries were removed from storage and subjected to various quarantine treatments (MeBr, irradiation at 300 and 600 Gy's and non-treated control). Fruit was treated with MeBr at 64 g/m^3 @ 6^0 C for 2 hrs in a commercial fumigation facility in conjunction with cherries destined for export. Fruit was irradiated at the Batelle-Pacific Northwest Laboratory, Richland, WA using a gamma beam 650 source containing cobalt-60. Distance from the source was adjusted to provide a constant dose rate and exposure time to give total doses of 300 and 600 Gy's.

After quarantine treatments, all cherries were returned to cold storage. At 7, 14 and 21 days, after treatment, one-third (800 g) of the cherries were removed from storage for each cultivar and quarantine treatment and quality evaluated. Quality evaluations consisted of objective color for fruit and stems, firmness, soluble solids, titratable acidity and subjective scores for fruit condition and stem color. Objective color of fruit and stems was determined with The Color Machine, using the Hunter "L", "a", "b" system and calculated hue values. Firmness of the fruit was determined using the Universal TA-XT2 Texture Analyzer equipped with a 3-mm probe. Soluble solids of the fruit was determined by an Abbe-type refractometer with a sucrose scale calibrated at 20^0 C. Acids were titrated to pH 8.2 with 0.1n NaOH and expressed as the percentage of malic acid. Subjective scores for fruit condition and stem color were determined using two laboratory personnel familiar with cherry grades. Fruit and stem were rated subjectively on a scale of 1 to 3 (1= best; 3= poorest) and mean values reported. Analysis of variance was determined by MSTAT and based on significant F-test, means were separated using the Duncan's multiple range test.

Results

'Bing' cherry firmness was reduced with the use of both MeBr and irradiation at either level employed. This reduction in firmness for 'Bing' cherries was not evident in 'Rainier' cherries where firmness did not decrease as a result of MeBr treatment, but did decrease due to irradiation treatment. Titratable acidity was reduced in both cultivars as a result of irradiation treatment, but not MeBr treatment. 'Bing' cherries were darker red in color and 'Rainier' cherries were less yellow, more red in color after exposure to MeBr. Irradiation treatment did not influence the color of 'Rainier' cherries, but did produce a more red-colored 'Bing' cherry, particularly at 300 Gy's. No change in 'Bing' stem color was noted after quarantine treatment, but 'Rainier' cherry stems were greener after exposure to MeBr. This difference in stem color due to MeBr treatment, for 'Rainier' cherries was not evident when subjective scores for color were evaluated. But, subjective scores for 'Rainier' cherry stems was reduced with the use of irradiation treatment. The use of either MeBr or irradiation resulted in subjective fruit damage in 'Rainier' cherries with more damage as a result of irradiation than MeBr. Subjective damage was not evident for 'Bing' cherry fruit or stems, where no differences between treatments were noted.

Sweet cherries can be treated with either MeBr or irradiation at rates sufficient to meet most quarantine requirements and compare favorably in quality with one another. Regardless of the quarantine treatment employed both fruit and stem damage occur as a result of treatment, but not to a degree where consumer acceptability would be in doubt.

Table 1. Quality of 'Bing' sweet cherries as influenced by method of quarantine treatment.

			Hunter Color							
	Firm	Acids	Fruit			Stem			Visual Scores	
Treatment	(N)	(%Malic)	L	a	hue	L	a	hue	Fruit	Stem
Control	8.36a[z]	0.90a	26.6d	10.4a	13.1a	27.9a	-0.4a	90.6a	1.3a	1.3a
MeBr	7.93ab	0.91a	28.7c	9.6b	12.9a	28.2a	-0.4a	91.3a	1.3a	1.4a
300 Gy's	7.23c	0.85b	32.2b	7.4c	9.4d	28.3a	-0.2a	90.3a	1.3a	1.3a
600 Gy's	7.46bc	0.85b	34.0a	7.3c	11.0c	29.0a	-0.2a	90.0a	1.3a	1.3a

[z] Means is a column not followed by a common letter are significantly different (P>0.05).

Table 2. Quality of 'Rainier' sweet cherries as influenced by method of quarantine treatment.

			Hunter Color							
	Firm	Acids		Fruit			Stem		Visual Scores	
Treatment	(N)	(%Malic)	L	a	hue	L	a	hue	Fruit	Stem
Control	6.20a[z]	0.63ab	61.1ab	9.2bc	64.9a	34.3b	-1.7a	97.1b	1.2b	1.3b
MeBr	6.25a	0.67a	58.6bc	12.5a	56.8c	38.1a	-2.9b	103.5a	ab1.3	1.1b
300 Gy's	5.96b	0.61bc	58.1c	9.6bc	62.0b	35.1b	-1.3a	94.7b	1.4a	1.5a
600 Gy's	5.71c	0.59c	62.3a	8.8c	64.6a	35.4b	-1.3a	95.4b	1.4a	1.5a

[z] Means in a column not followed by a common letter are significantly different (P>0.10).