Postharvest Quality Comparison of Canaan Fir and Fraser Fir Christmas Trees©

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INTRODUCTION

The United States annually utilizes over 35 million live Christmas trees. Postharvest quality of trees is an important concern of growers, wholesalers, retailers, and consumers. Christmas tree postharvest quality deteriorates over time and is a function of water status (Chastagner, 1986). Common postharvest quality problems include premature needle drop, poor foliage color, trunk splitting, loss of fragrance, reduced branch flexibility, and increased susceptibility to fire (Hinesley, 1984).

Conifers used as cut Christmas trees vary in their rate of drying following harvest, and their capacity to maintain freshness during display. Fraser fir (*Abies fraseri*) loses water slowly, has a high damage threshold, retains its needles well when dry, and is quite durable in the postharvest environment (Mitcham-Butler, et al., 1988). Other species, such as white spruce (*Picea glauca*) dry quickly, have poor needle retention characteristics, and have limited shelf life.

Because of its high postharvest quality characteristics, Fraser fir has become one of the most important conifer species used for Christmas tree production in the Eastern United States. Demand for Christmas tree species with excellent needle and moisture retention continues to build. However, expansion of Fraser fir production is limited on poorly drained sites because of its susceptibility to certain root rotting pathogens (Chastagner et al., 1990).

In recent years, interest has developed in the use of Canaan fir (*Abies balsamea* var. *phanerolepis*) as a Christmas tree in the Eastern United States. Canaan fir is generally considered to have high quality foliage characteristics and is very similar in appearance to Fraser fir. Grower experience also indicates that Canaan fir is less susceptible to the soil-borne pathogens that limit the production range of Fraser fir. Because of this, there is increased interest in growing Canaan fir as an alternative to the more site-demanding Fraser fir. The objective of this study was to compare the postharvest moisture and needle retention characteristics of Canaan fir with those of Fraser fir.

MATERIALS AND METHODS

Whole tree postharvest experiments were conducted between Dec. 2000 and Jan. 2001. Eight Canaan fir and eight Fraser fir were harvested from a commercial grower's field, on Dec. 15, 17, 18, and 19. Trees were maintained unbailed, outside for 0, 1, 2, or 4 days to simulate lot storage and then transported to the postharvest display room at the Russell Larsen Research Center, Penn State Univeristy on 19 Dec. 2000. Prior to transfer to the postharvest display room, a 2- to 3-cm section was removed from the base of the trunk on 4 trees from each storage duration. The postharvest display room was maintained under continuous standard fluorescent lighting, at 48±5 RH, and 68°F. During display, water was added to each tree stand to ensure that the water level in the stand was always maintained above the base of

Table 1. Effect of storage duration and stem trimming on current season needle retention of Fraser fir and Canaan fir. Data points are means where n = 4. Needle loss was measured on a 0 to 10 scale, where 0 = none and 10 = 91 - 100%.

	Days on Display				
Treatment (h)	0	7	14	28	35
		Fraser Fir			
Control	0	0	0	0	0
24 Trimmed	0	0	0	0	0
24 Not Trimmed	0	0	0	0.25	0.75
48 Trimmed	0	0	0	0	0
48 Not Trimmed	0	0	0	0	0
96 Trimmed	0	0	0	0	0
96 Not Trimmed	0	0	0	0.25	0.25
		Canaan Fir			
Control	0	0	0	0.25	0.25
24 Trimmed	0	0.5	0.5	1.25	2
24 Not Trimmed	0	0.5	0.75	1.25	2.25
48 Trimmed	0	0.25	0.25	0.5	0.75
48 Not Trimmed	0	0.5	0.75	1	1.5
96 Trimmed	0	0.75	1	2	3
96 Not Trimmed	0	0.25	0.25	0.5	0.5

Table 2. Effect of storage duration and stem trimming on overall quality of Fraser fir and Canaan fir. Data points are means where n = 4. Quality was rated on a 1 to 5 scale, where 5 = excellent, 4 = good, 3 = fair, 2 = below average, 1 = poor, unacceptable.

	Days on Display				
Treatment	0	10	20	30	40
		Fraser Fir			
Control	5	5	5	5	4.75
24 h trimmed	5	5	5	4.75	4.75
24 h not trimmed	5	5	4.75	4.5	4.5
48 h trimmed	5	5	5	5	5
48 h not trimmed	4.75	4.75	4.75	4.5	4.5
96 h trimmed	5	5	5	4.75	4.25
96 h not trimmed	4.75	4.75	4.75	4.75	4
		Canaan Fir			
Control	5	5	4.5	4.5	4.5
24 h trimmed	4.5	4.5	4.5	4.5	4.25
24 h not trimmed	4.75	4.75	4.5	4.25	4.25
48 h trimmed	4.5	4	4	4	3.75
48 h not trimmed	4.75	4	3.75	3.75	3.25
96 h trimmed	4.25	3.5	3.25	2	2
96 h not trimmed	4.5	3	2.75	2.5	2.25

the tree. Water use was recorded for each tree and changes in moisture status was recorded with a pressure chamber. The extent of current season needle loss was evaluated on a 0 to 10 scale, where 0 = none, 1 = 1% to 10% …, 10 = 91% to 100% loss. Overall tree quality was measured periodically and rated on a 1 to 5 scale where 5 = excellent, 4 = good, 3 = fair, 2 = below average, 1 = poor, unacceptable.

DISCUSSION

Fraser fir generally outperformed Canaan fir in the postharvest environment. Fraser fir needle retention was excellent across all treatments and had only minimal needle loss through 35 days on display (Table 1). Trimmed Canaan fir stored for 96 h had 20% to 30% needle loss after 35 days on display. Both trimmed and untrimmed Canaan fir stored for 24 h exhibited 11% to 20% needle loss by the end of the experiment. Needle loss in Canaan also began relatively soon during display.

Overall quality of Fraser fir was good to excellent throughout the study (Table 2). Quality of Canaan fir stored for 96 h dropped to fair after 10 days on display and was below average after 40 days on display. Only Canaan fir in the 0 and 24 h storage treatments were rated as good after 40 days on display.

Overall, the Canaan fir used in these studies had inferior needle retention characteristics and quality as compared to Fraser fir. However, the data indicates that drying alone does not completely account for loss of needles and quality in Canaan fir, as some dry trees exhibited very good needle retention. Previous work with other species indicates that needle retention is a highly hereditary characteristic (Hinesley and Snelling, 1997). It may be possible to identify Canaan fir seed sources that possess better needle retention traits. If this is possible, the postharvest quality of Canaan fir may be improved through selection and breeding programs.

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