Effect of Water Additives on Fraser Fir Needle Retention

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Summary. Several floral and tree preservatives were evaluated to determine their effect on postharvest needle retention of Fraser fir [*Abies fraseri* (Pursh) Poir.], an important Christmas tree species. Clorox (sodium hypochlorite) and aspirin (salicylic acid) caused massive needle loss, and three of the six commercial additives increased needle loss significantly, No treatment was better than water alone.

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Cut flowers commonly are treated with chemical additives to enhance shelf life (Halevy and Mayak, 1981). Constituents of commercial preparations include ionic salts ($CaCl_2$, $MgCO_3$, and KCI), acidifying agents, carbon sources, and fungicides. Floral preservatives and similar products possibly could improve postharvest needle retention of cut Christmas trees. However, chemicals added to the water of displayed Christmas trees have had little or no benefit, and sometimes have adverse effects (Ahrens and Stephens, 1975; Montano and Proebsting, 1985; Van Wagner, 1963; USDA, 1947). In a recent study with Douglas fir [*Pseudotsuga menziesii* (Mirb.) Franco] Christmas trees, only one out of 10 products, Keeps-it-Green (Hughes Mfg. Co., Paramount, Calif.), resulted in needle retention equal to or better than water alone (Chastagner, 1990).

Fraser fir (*Abies fraseri*) is a valuable Christmas tree species in the United States and Canada. Postharvest needle loss of Fraser fir is increased by low concentrations of certain ions in the irrigation water, as well as high or low pH of the water (Hinesley and Blankenship, 1991). Consumers ask regularly if anything can be added to the water in Christmas tree stands to make trees last longer. Considerable money is spent on chemical additives each year. The objective of this study was to evaluate postharvest needle retention of Fraser fir trees when displayed in water containing various chemicals and commercial products.

Branches from a group of 15-year-old, nonsheared Fraser fir growing at Crossnore, N.C., were collected on 6 Dec. 1990. Space limitations and the large number of treatments prevented the use of whole trees. Fourteen branches were collected from each tree, with one branch assigned to each treatment. This approach eliminated genetic variation in the comparison of treatments within individual trees, and indicated variability among trees. Within each tree, branches were selected for uniformity in size and vigor. Branches consisted of second-order laterals 20 to 30 cm long from the second node of first-order laterals ≈ 2 m above the ground.

After harvest, the cut end of each branch was placed immediately in water. Branches were transported to Raleigh, N.C., and stored overnight at 5C while standing in water. The next morning, the base of each branch was recut under water, and stood upright in plastic containers (round, 8 cm wide, 5 cm deep) with 150 ml of the treatment solutions (Table 1). Containers were painted black to block out light, and sealed to prevent evaporation.

The experiment was conducted in a laboratory at 28 + 1C and 30% + 5% relative humidity, using a completely random designwith 10 replications (trees). The laboratory was lighted between 0800 and 1700 HR daily (except on weekends) with cool-white fluorescent lamps.

Needle loss was evaluated weekly by rubbing foliage lightly with fingers. Abscised foliage was dried to constant weight at 65C and weighed. The experiment was terminated after 4 weeks on 3 Jan. 1991, branches were dried as previously described, and remaining foliage was removed and weighed. Percent needle loss was: (weight of abscised foliage divided by total dry weight of foliage) × 100%. Data were subjected to analysis of variance and means separated with the Waller-Duncan K-ratio test (K = 100, P = 0.05).

Needle loss ranged from 99% with Clorox (sodium hypochlorite) to a minimum of 0.3% for branches displayed without water (Table 1). Although branches displayed without water lost the fewest needles, the foliage dried quickly, faded or turned brown, and became very stiff. Aspirin (salicylic acid) caused 72% needle loss, and three of the commercial products resultedin-30% loss. Tree Care, Crop-Life, and Keeps-it-Green caused 9% to 13% needle loss, which was not significantly different from the distilled water control. Needle loss with sucrose, 7-Up, and distilled water was 5% to 6%.

There was marked variation in needle loss among trees, just as observed in earlier work with Fraser fir (Hinesley and Blankenship, 1991). One specimen averaged 51% needle loss across all treatments, and the remaining nine trees dropped 12% to 31% of their needles (data not shown).

Adding Clorox or aspirin to water is not recommended. These two materials were included because they commonly are suggested as additives, either singly or in combination with

Table 1. ***Chemicals and commercial products evaluated for postharvest needle retention of Fraser fir.***

Chemical or product	Compostion or concentration[z]	Manufacturer	Needle loss (%)[y]
Clorox (sodium hypochlorite)	6.2 ml	The Clorox Co., Oakland, Calif.	99.5 a
Aspirin (salicylic acid)	one tablet (0.38 g)	H.L. Moore Drug Exchange, New Britain, Conn.	72.3 b
Tree Life[x]	9.5 g	The Kirk Co., Puyallup, Wash.	33.4 c
Yule Prolong[x]	16 ml	Plantabbs Corp., Timonium, Md.	29.3 c
Floralife[x]	10 g	Floralife, Inc., Burr Ridge, Ill.	27.6 c
Tree Care[x]	57 ml	Hydrosol, Inc., Bridgeview, Ill.	13.3 d
Crop-Life	75 ml	Polymer Technologies, Inc. Nocatee, Fla.	9.1 de
Keeps-it-Green[x]	7.8 ml	Hughes Mfg. Co., Paramount, Calif.	9.0 de
Distilled water	---	---	6.0 de
Sucrose	1%	Fisher Scientific, Fair Lawn, N.J.	5.8 de
7-Up	950 ml	Pepsico, Inc., Purchase, N.Y.	5.3 de
No water	---	---	0.3 e

[z]*Quantity per liter, mixed with distilled water.*
[y]*Percent, by weight; n = 10 trees; means separated by Waller–Duncan K-ratio test (K = 100, P = 0.05).*
[x]*Mixed according to manufacturer's instructions.*

other materials. No commercial products gave results better than distilled water (Table 1). Sugar and 7-Up-two frequently recommended additives for cut Christmas trees-also had no effect on needle drop. Despite the low percentage of needle loss, branches displayed without water were unacceptable because they dried quickly, faded or turned brown, became stiff, and presented a fire hazard. Thus, water appears to be the only essential ingredient for maintaining needles on cut Fraser fir Christmas trees. Adding chemicals or other substances is not necessary, and in some instances can increase needle abscission.

Literature Cited

Ahrens, J.F. and G.R. Stephens. 1975. The effects of additives on freshness and flammability of Christmas trees. Conn. Agr. Expt. Sta. Bul. 760.

Chastagner, G. 1990. Keeping cut trees fresh. Northwest Christmas Tree Assn. Northwest Lookout 23(3):32-34,37-40, 42-44.

Halevy, A.H. and S. Mayak. 1981. Senescence and postharvest physiology of cut flowers-part 2. Hort. Rev. 3:59-143.

Hinesley, L.E. and S.M. Blankenship. 1991. Attributes of water additives affect postharvest needle retention of Fraser fir. HortScience 26:569-570.

Montano, J. and W.M. Proebsting. 1985. OSU tree keepability report. Northwest Christmas Tree Assn. Northwest Lookout 18(3):58-59,61-63.

USDA. 1947. Treating spruce and balsam fir Christmas trees to reduce fire hazard. USDA Forest Serv. For. Prod. Lab. Tech. Note 250.

Van Wagner, C.E. 1963. Flammability of Christmas trees. Canada Dept. For. Publ. 1034. Ottawa.

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