Cut Christmas Tree Properties of Afghan Pine As Compared to Traditional Species

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Afgan pine (*Pinus eldarica* Medw.) promises to be an excellent species for Christmas tree production in the Southwest (Fisher and Widmoyer 1978, Widmoyer and Fisher 1979). Irrigated plantations grow exceptionally fast and can be harvested as early as two to three years from field planting. Crown form is not sacrificed for rapid growth as three to five flushes of main stem growth are added yearly while maintaining acceptable distance between whorls.

Because Afgan pine performs equally as an ornamental in the Southwest, potted Christmas trees can be successfully transplanted shortly after use. No doubt this attribute will find considerable favor among budget-minded consumers.

Excellent performance in the plantation and landscape does not, of course, gaurantee that Afghan Christmas trees will meet fire safety and consumer standards. A study was therefore conducted to determine the home storage properties of cut Afghan Christmas trees and results are reported here.

Methods and Materials

Eighteen trees each of three traditional Christmas tree species and Afghan pine were harvested or purchased December 11-14, 1979 for the experiment. Selection was based on crown size (1.7-1.8 m, 5.5-6 ft.) and conformity. In Las Cruces, Afghan pines were cut from a plantation receiving an average of 31 cm (13 in.) of supplemental irrigation water applied four times yearly, each application averaging 8 cm. Scots pines (*P. sylvestris*) were purchased from a retail nursery in Las Cruces. Douglas fir (*Pseudotsuega menziesii*) and white fir (*Abies concolor*) were harvested from a forest in northern New Mexico near Mora (elevation 2,286 m, 7,500 ft).

Four days after harvest, branches within 15.5 cm (6 in.(of the base were removed and the trees were shook vigorously to remove loose needles. Trees were subsequently brought inside a laboratory facility maintained at a constant 20.5 degrees C. (65 degrees F.). Ambient relative humidity remained near 35% during the course of the study.

Trees were randomly assigned to receive one of the two experimental treatments. These included no water or the addition of 7.5 liters (2 gal.) to the tree stand. A completely randomized block design included three replications of three-tree plots of watered trees were wrapped tightly with polyethelene bags to avoid pan evaporation. All trees were tied securely to horizontal wires and spaced at five feet intervals within and between rows. Tap water was added as needed to maintain the initial level.

At the end of the 4-week test period, these measurements were recorded: percent moisture, needle fall, water use and flamability.

Moisture content was determined by cutting current year needles. For sampling purposes, trees were divided into three arbitrary parts: top, middle, and bottom. The average weight of the three sub-samples was used in the statistical-analysis. Needles were weighed following harvest, dried at 70 degrees C. for 24 hours, and weighed again. Moisture content is expressed as percent fresh weight and was calculated as follows:

$$\%\ \text{F.W.} = \frac{\text{Moisture loss}}{\text{Fresh weight}} \times 100$$

Needle fall was determined at the end of the test period (4 weeks) by dropping each tree 5 times from 0.6 m (2 ft.) onto a concrete floor. Dropped needles were expressed as needles lost per kilogram of tree weight.

Water use was determined by recording the total volume of liquid added to the containers. To compensate for slight variations in tree size, water use for individual trees was calculated in liters per kilogram tree weight.

Flamability was determined by three separate ignition tests. The hot plate procedure involved placement of twigs of current growth on top of a red-hot electric plate and measuring the time to ignition. Nine foliage samples were harvested from each tree, three from the top, middle and bottom portions. The second ignition procedure simulated an electrical short by using an arc welder. A 1.8 m (6 ft.) steel tamping bar was placed upright and the ground cable attached to it. Test trees were tied to the bar. A welding electrode was scratched over the bar supplying a reproducible spark for determining ignition response.

Trees were subjected to direct flame from an oxygen-acetylene torch in a third ignition test. Recorded were ignition time and tendency of foliage to continue to burn following exposure to flame.

One way analysis of variance and Duncan's multiple range test for separation of treatment means (Duncan 1955) were applied to data analysis.

Results and Discussion

Addition of water was beneficial to all four tree species. At the beginning of the test, Scots pine was the only species with a moisture level below the desirable limit (Table 1). Scots and Afghan pines without water ignited rapidly when testing with the hot-plate, whereas the addition of water to the stand increased time to ignition by 50% and 82%, respectively.

Although unwatered white fir and Douglas-fir resisted ignition for a much longer period, lack of water reduced time of ignition by 37% and 42%, respectively. Scots pine had the highest amount of needle fall, especially when no water was added to the base. The other three species had negligible needle loss. Scots pine used the least amount of water.

Notes on needle stiffness at the beginning and end of the test period showed Scots pine as initially having stiff needles (Table 2). Afghan pine without water produced trees with stiff needles by 4 weeks and Scots pine with and without water remained with stiff needles. Douglas fir and white fir needles remained pliable throughout the test period, even

Table 1. Percent needle moisture, needle fall and water use of Afghan pine, Scots pine, Douglas fir and fir after four weeks of home environment. Figures are averages of eighteen trees per treatment.

	% Needle Moisture beginning	ending	Needle Fall** Gms/kg tree wt.	Water use* Liters/Kg tree wt.
Afghan pine — water	56 b		3.44 a	1.67 b
Afghan pine — no water	56 b	19 c	3.8s a	+
Scots pine — water	14 a	15 b	12.96 b	1.42 a
Scots pine — no water	15 a	8 a	21.11 c	+
Douglas fir — water	50 b	55 e	1.50 a	1.50 b
Douglas fir — no water	51 b	49 d	1.40 a	+
White fir — water	54 b	59 f	1.68 a	2.00 b
White fir — no water	53 b	49 d	1.33 a	+

**Means not followed by the same letter within a column are significantly different at the .01 level of probability.
*Means not followed by the same letter within a column are significantly different at the .05 level of probability.

Afghan pine + water	56 b		3.44 a	1.67 b
Afghan pine + no water	56 b	19 c	3.8s a	—
Scots pine + water	14 a	15 b	12.96 b	1.42 a
Scots pine + no water	15 a	8 a	21.11 c	—
Douglas fir + water	50 b	55 e	1.50 a	1.50 b
Douglas fir + no water	51 b	49 d	1.40 a	—
White fir + water	54 b	59 f	1.68 a	2.00 b
White fir + no water	53 b	49 d	1.33 a	—

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with no water at the base.

Afghan and Scots pines with no water ignited and supported combustion when exposed to a simulated electric short (Table 3). No ignition resulted with any tree that had water added to the base. Results with the oxygen-acetylene torch again showed that Afghan and Scots pines without water ignited in the least time and also continued to burn. Addition of water to both Afghan pine and Scots pine increased time to ignition and prevented further combustion. Douglas-fir and white fir ignited slowly and the fire quickly extinguished itself following removal of the flame. White fir with water added resisted ignition for the longest time period recorded.

Conclusions

Afghan pine Christmas trees must receive stand reservoir water to maintain minimal freshness and to meet home safety standards. Watered trees are highly desirable and Afghan Christmas tree production will no doubt continue to expand if consumers are advised to provide water.

Scots pine cut a month or so prior to Christmas often have moderately dry and stiff needles before purchase. Such trees will become fire hazards if left unwatered, but can be restored somewhat and maintained safely if supplied pan water.

Freshly cut Douglas-fir and white fir can be considered safe indoors, although the addition of water will prolong freshness and will afford a wider margin of safety.

Table 2. Needle stiffness at the beginning and at end of treatment period.

	Beginning	End
Afghan pine + water	—	—
Afghan pine + no water	—	+
Scots pine + water	+	+
Scots pine + no water	+	+
Douglas fir + water	—	—
Douglas fir + no water	—	—
White fir + water	—	—
White fir + no water	—	—

Needle Condition:
Pliable (—)
Stiff (+)

Table 3. Susceptibility to ignition by simulated electrical short, hot plate and by direct flame. Figures are averages of eighteen trees.

	Electrical Short (90 amps)		Hot Plate	Oxygen-Acetylene Torch	
	No Ignition (—) Ignition (+)	Support Combustion	Seconds to Ignition**	Seconds to Ignition*	Support Combustion
Afghan pine + water	—	No	14.04 c	9.87 b	No
Afghan pine + no water	+	Yes	2.56 a	5.13 a	Yes
Scots pine + water	—	No	3.52 a	6.67 a	No
Scots pine + no water	+	Yes	1.77 a	4.92 a	Yes
Douglas fir + water	—	No	14.45 cd	15.00 c	No
Douglas fir + no water	—	No	8.38 b	10.00 b	No
White fir + water	—	No	18.04 d	20.00	No
White fir + no water	—	No	11.32 bc	12.00 b	No

**Means not followed by the same letter within a column are significantly different at the .01 level of probability.
*Means not followed by the same letter with a column are significantly different at the .05 level of probability.

The different responses recorded and observed can be attributed to the freshness of white fir and Douglas-fir cut in the dormant condition, absence of November dormancy in Afghan pine, and exposure of Scots pine to shipping and sale lot display.

It is highly probable that the Afghan pine preservation may be enhanced by withholding late summer irrigations to discourage foliage succulence.

Literature Cited

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