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THE EFFECT OF SELECTED CULTURAL PRACTICES ON LOWLAND BALSAM FIR CHRISTMAS TREES IN NORTHEASTERN MINNESOTA

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Balsam fir (*Abies balsamea* (L.) Mill.) is an important species in the Minnesota Christmas tree industry. Christmas tree production in Minnesota has an estimated value exceeding \$6.5 million from an annual harvest of over four million trees. This accounts for about one-eighth of the total crop harvested in the United States. The industry provides considerable seasonal and some year-round employment which generates a substantial amount of income for both full- and part-time growers.

Balsam fir was the leading seller in the Christmas tree market in the Minneapolis-St. Paul area until about 1965. The decline in balsam fir sales has been relatively steady in this market since then. This decline can be traced directly to the influx of cultured, plantation-grown trees--especially Scotch pine. The wilding, uncultured balsam which previously played such an important marketing role has been unable to keep pace with the increasing consumer preference for cultured Christmas trees.

The objective of this study was to evaluate the effectiveness of selected cultural treatments in producing quality trees on a lowland site densely stocked with wilding balsam. The study site had a water table which was at or near the surface much of the growing season. A sample of 100 trees ranging in height from 3 to 9 feet was selected to receive cultural treatments or to serve as untreated control trees. Basis for selection was that the tree had to be free from injury, of good form, and possess potential as a marketable Christmas tree. The study treatments, their purposes and results after four years appear below.

Treatment 1: The lower branches were removed up to the first good whorl on ten selected trees ranging from 6.4 to 8.6 feet in height (avg. ht. = 7.5'). This treatment was done in September.

Purpose: To determine the effect of this treatment on leader growth.

Results: Three of the ten control trees used in this treatment were lost to wind-throw. Based on a comparison with the remaining seven control trees with a height range of 6.5 to 9.2 feet (avg. ht. = 7.7'), the treatment had no effect on leader growth.

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Leader length measurements before treatment and at the end of each growing season thereafter indicated that the treated trees grew at approximately the same rate as control trees (Table 1). There was no difference in total height growth in the four-year study period between treated trees and control trees.

Table 1. Average leader length after removing lower branches to the first whorl.

<u>Time of Measurement</u>	<u>Average Leader Length (ft.)</u>	
	<u>Treatment</u>	<u>Control</u>
Year prior to treatment	1.0	0.8
At end of first growing season	0.7	0.6
At end of second growing season	0.5	0.6
At end of third growing season	0.5	0.6
At end of fourth growing season	<u>0.9</u>	<u>0.9</u>
Total height growth in four-year period	2.6	2.7

Treatment 2: The lower branches were removed up to the first good whorl on ten selected trees ranging from 5.9 to 9.1 feet in height (avg. ht. = 7.7'). The trunk of each tree was then scarred with a machete on the east and west sides of the tree. Total basal scarring covered approximately 50 percent of the circumference of the tree for a vertical distance of about six inches along the two sides of the trunk. The branch removal and the basal scarring was done in September.

Purpose: To determine the effect of this treatment on leader growth.

Results: Two of the original treatment trees were lost to windthrow. The eight remaining trees were compared to the same control trees used in Treatment 1. Based on this comparison, measurements at the end of each growing season after the treatment indicated that the removal of the lower branches of the first good whorl plus basal scarring resulted in reduced leader growth (Table 2). The total height growth in the four-year period averaged 2.0 feet for the treated trees as compared to 2.7 feet for the control trees, or an average height reduction of 0.7 feet.

Table 2. Average leader length after removing lower branches to the first good whorl plus basal scarring.

<u>Time of Measurement</u>	<u>Average Leader Length (ft.)</u>	
	<u>Treatment</u>	<u>Control</u>
Year prior to treatment	0.8	0.8
At end of first growing season	0.5	0.6
At end of second growing season	0.3	0.6
At end of third growing season	0.5	0.6
At end of fourth growing season	<u>0.7</u>	<u>0.9</u>
Total height growth in four-year period	2.0	2.7

Treatment 3: Ten trees ranging from 3.3 to 4.2 feet in height (avg. ht. = 3.7') were sheared in April. Shearing consisted of clipping leaders and protruding laterals as necessary. Trees were sheared each April throughout the four-year study period.

Purpose: To determine the effect of shearing before growth starts in the spring on tree quality and general appearance.

Results: Ten control trees with a height range 2.7 to 5.0 feet (avg. ht. = 3.8') were selected at the time of first shearing to be used as a comparison with the treated trees. Two of the originally selected control trees were broken in a wind storm so only eight were used in the final comparison. Based on qualitative judgment, the shearing treatment did not improve tree quality or general appearance. At the end of the four-year period, none the treatment or unsheared control trees could be graded as U.S. Premium or U.S. No. 1 according to U.S.D.A. marketing standards.^{2/}

Treatment 4: Ten trees from 3.0 to 4.7 feet in height (avg. ht. = 4.1') were sheared in September in the same manner as in Treatment 3 and this was repeated each September throughout the study period.

Purpose: To determine the effect of shearing after growth ceases in the fall on tree quality and general appearance.

Results: Treatment trees were compared to the same group of unsheared control trees used in Treatment 3. Neither tree quality nor general appearance was improved by this practice. None of the treatment or control trees could be graded as U.S. Premium or U.S. No. 1.

Treatment 5: Stump culture:

- a. Leaving all branches below a cut stem with later shearing of the best branch turn-up (20 trees treated in September),
- b. Leaving only the most dominant branch below the cut stem and later shearing of that branch (20 trees treated in September).

Purpose: To determine the feasibility of growing balsam fir Christmas trees by stump culture.

Results: The practice of leaving all branches below the cut stem resulted in 30 percent mortality of the study trees. There was no dominant or "best" branch on any of the surviving trees that could be sheared. The "turn-ups" were very crooked and of poor quality. The practice of removing all but the most dominant branch below the cut stem resulted in 100 percent mortality of the study trees.

Summary and Conclusions:

Results from this study are based on four years of data which should be a sufficient time for a grower to decide whether or not his cultural practices are effective. A relatively small sample was tested for the treatments. The original samples were made even smaller because of windthrow loss. Nevertheless, the results may be important to a balsam fir Christmas tree grower striving to produce marketable trees from wilding stands.

Basal scarring is commonly employed by balsam fir producers. This technique is designed to reduce leader growth which is often accompanied by fuller crown development and a more acceptable taper. Removal of all branches below the first good stem whorl was tried in this study but was found ineffective in reducing leader growth. However, when basal scarring of the stem was done in addition to removal of the branches, leader growth was reduced by an average of 0.7 feet for the four-year study period. But, even though

^{2/} U.S.D.A. 1962. United States Standards for Grades of Christmas trees. Agr. Mkt. serv., Wash. D. C. 12 p.

height growth of these trees was reduced, there was no apparent response in crown improvement. Tree appearance in terms of crown density was about the same for both the treated trees and the control trees used as a comparison.

Shearing of terminal leaders and lateral branches is an accepted practice of Christmas tree producers and is designed to improve tree quality by stimulating bud development and controlling growth. It is generally accepted that balsam fir can be sheared almost any time of year; but the dormant season, either early spring or fall, is considered the most desirable both in terms of getting results and in a grower's work schedule. Tree quality is difficult to determine since it is based on judgment, which results only from considerable experience. However, it was apparent that neither of the shearing treatments in this study were effective in improving tree appearance and quality. Bud development generally was poor on both the sheared and unsheared trees. Quality of the sheared trees was no better than that of the unsheared control trees. None of the trees would be considered as marketable at a higher grade than U.S. No. 2 according to U.S.D.A. marketing standards. This low grade would hardly justify cultural practices.

Balsam fir growers in northern Minnesota often leave branches on the stem below the cut after harvesting a tree. These often continue growing and eventually curve upward to become new trees. Two stump cultural techniques were tested in this study: (1) leaving all branches; and (2) leaving a single dominant branch below the cut stem. The practice of leaving a single branch was completely unsuccessful as it resulted in 100 percent mortality. Leaving all of the branches below the cut resulted in 30 percent tree mortality. The branches on the surviving trees were poor in quality and none appeared to possess potential as marketable Christmas trees.

Considerable care must be used in interpretation of the results from this study. The predominant feature of the study was its location. The study was conducted on a poorly drained, lowland site which was a high risk area for spring frost damage and windthrow loss. The study trees growing on this site had poor bud development, slow growth, and were of a quality and vigor too low to be able to respond to cultural work. The study site itself had more effect on the results than did the treatments.

Results from the study serve to emphasize the importance of site selection for growers working with wilding balsam fir. Poor sites which will yield only poor quality trees over long periods of time should be avoided. Trees growing on a lowland site, as in this study, may not provide satisfactory results. There is evidence, however, that there are growers in northern Minnesota who have been successful in applying one or a combination of the cultural treatments described herein. Therefore, these results should be interpreted only within the limits of this particular study with due consideration given to site selection.

The importance of balsam fir as a Christmas tree species should not be overlooked. The many desirable features of balsam fir for the user include the following: good needle retention, fragrant odor, good color, non-prickly needles, adequate limb strength for decoration, and a small butt which fits into most home watering stands. However, the species does have several unfavorable features for the grower, such as long rotation period, frost susceptibility, and a somewhat erratic growth pattern.

The above characteristics together with consumer demand seem to dictate the need for more research into production of quality balsam fir. Such research studies can be important to the Christmas tree growing economy of northern Minnesota.