Simazine enhances balsam fir growth but contributes to deer damage

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Could improve food value of noncommercial trees and shrubs to attract wildlife

Since the beginning of plantation production of balsam fir *(Abies balsamea (L.) Mill.)* for Christmas trees, researchers and growers have sought to improve color, form, and growth rate for this species.

Cultural practices have included fertilization to enhance growth of crop trees and use of herbicides, mowing and mulching to reduce the competition of other plant life. Herbicide use has helped to improve form, growth, and color characteristics but has resulted in increased damage to the plantations by white-tailed deer *(Odocoileus virginianus borealis* Miller). The deer select the culturally improved trees for browse (4).

The Study

The physical characteristics and nutrient constituents of young balsam firs that might influence deer browsing were investigated during 1970 and 1971 in north central Vermont (7) to determine the effect of simazine and fertilizer on these parameters. Three-year-old (2-1) balsam fir planting stock of a local seed source, grown at the investigation site, was used.

The 960 trees were outplanted in May 1970, and the following treatments randomly assigned to blocks of 30 trees: 1) Control-no treatment; 2) fertilizer300 lbs. active ingredient (a.i.) /acre each of N, P, K; 3) herbicide-simazine at 12 lbs. a.i./acrc (4 percent granules); 4) fertilizer plus herbicide at the same rates as 2) and 3).

Evaluations were made on a single year's new growth, the portion of the tree most frequently browsed by deer. Analyses were made at the end of the second growing season. This growth period allowed adequate time for the treatments to affect the young trees. The second year's growth was hand-clipped, evaluated for physical characteristics, and then oven-dried for chemical analysis. Analyses for specific nutrient contents were made using the procedures of the A.O.A.C. (1). Specific tests were selected on the basis of dietary requirements of white-tailed deer (5). Tree survival data were compiled at the time of final sampling.

Data were statistically analyzed using analysis of variance techniques; treatment means were separated using Duncan's New Multiple Range Test (10).

Results and Discussion

The results of major importance to the tree grower are the high survival rates and increased production of plant tissue associated with the simazine application. Survival was highest for the control group, but mean dry weight, a measure of tissue production, was significantly lower for this group (table 1). The group treated solely with herbicide showed the second highest survival rate; average tissue production in this group exceeded all other treatments. The more traditional plantation treatment, fertilizer plus herbicide, ranked third in terms of survival and had a tissue production not statistically different from the herbicide treatment group. In the group to which only fertilizer was applied, survival rate was lowest and average tissue production (3.16 gm.) did not differ significantly from the control group (2.34 gm.). This suggests the possibility of increased economy in production

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TABLE 1.—*Survival means and mean dry weights*

Treatment	X Survival[1]	Survival percent	X Dry wt. grams
Control	28.62	95.4	2.34a
Fertilizer	16.62	55.4	3.16a
Herbicide	26.75	89.2	13.08b
Fert. plus Herbicide	22.88	76.3	11.50b

[1]Average of four treatment blocks of 30 trees each. Those means between treatments having no superscripts the same are statistically different from each other at the .01 level.

by using the herbicide simazine as a preplant or planting treatment instead of using both a herbicide and fertilizer.

We associate the increased tissue production among firs following herbicide treatment to the decreased competition for nutrients, water, and light resulting from the elimination of competing plants and through release of their nutrients in decomposition. Physiological changes, resulting in more efficient photosynthesis, may be associated with the uptake of sublethal quantities of simazine or the action of its metabolites in the tree. Ries (9) found the following metabolic changes in agricultural crops associated with simazine application shortly after treatment: (1) Decreased nitrate in the plants, (2) increased nitrate reductase, (3) higher rates of respiration, and (4) greater nitrate uptake from the soil. Further investigation may reveal similar changes in young balsam firs. This study did not include evaluations beyond the 2-year period. Therefore, further herbicide application and/or fertilization may be required to maintain the maximum rate of growth after this period.

Christmas tree growers, nurserymen, horticulturists, and others who use fertilizers and herbicides should be aware of potential animal damage to culturally improved trees (6). Palatability and nutrient content may be improved, thus making treated trees more desirable as animal food. Knowledge of this potential problem, particularly in areas where animal populations exceed the limits of their natural food supplies, allows suitable preparation, in terms of protection of the trees and control of the animals.

Physical and nutritive changes sufficiently significant to be judged as food selection factors were associated with some of the cultural practices used for balsam firs. Since ruminants are known to feed selectively on plants with higher protein content (3), the high crude protein content of the young firs associated with simazine applications may be the most important factor in their being selected as food by deer. Crude protein (N x 6.25) approximately doubled for the treatment groups receiving simazine, raising its quantity in young firs close to the optimum levels for deer rations (5). Another nutritive change associated with the cultural treatments is mineral ash content. Ash content was significantly higher for the herbicide treatment group. The increase, although small, might be enough to influence selective browsing by deer.

Physical changes associated with herbicide application, which might influence deer browse selection, are color and moisture content (succulence). Colors were judged to be darker greens (8), which may be a visual indication of the increased protein content (2). (Darker green colors may also be an asset for commercial Christmas tree production.) Succulence, expressed as percent moisture, was found to be highest for the simazine-treated trees. Increased succulence may affect the feeling of browse in the mouth (palatability) or change its attraction as food in other ways not measured in this study.

The observed capability of simazine to alter physical and nutritive characteristics of balsam fir may have practical application in reducing animal damage to cultured trees. Since deer seem to be attracted to these changes, simazine has the potential to improve the quality of noncommercial shrubs and trees in peripheral areas to buffer the impact on the commercial operation. Buffer foods alone are not the total answer; the need to balance deer populations with carrying capacity should be considered as a final measure in damage cases, unless such populations are selflimiting.

Summary

This study indicates that growth benefits for young balsam firs may perhaps be attained more economically by using the herbicide simazine to control plant competition, as compared to a fertilizer and herbicide combination treatment. Increased survival, greater plant tissue production, and darker green colors are physical characteristics associated with simazine use.

Changes in nutritional quality of trees associated with cultural practices may be a problem to a tree producer. However, adequate tree protection, animal population control, and the production of buffer foods may effectively reduce browse damage. From the standpoint of wildlife habitat management and buffer food production, the cultural practices that make commercial planting susceptible to damage can be used to enhance the food value of non-commercial trees and plants for wildlife. Crude protein content is probably the major factor influencing browsing on young balsam firs.

Literature Cited

1. Association of Official Agricultural Chemists. 1970. *Official methods* of analysis. 11th ed. 1112 pp. Washington, D.C.: J. Assoc. Off. Agric. Chem.
2. Bergerud, A.T. and F. Manuel. 1968. Moose damage to balsam firwhite birch forests in central Newfoundland. *J. Wildl. Manage.* 32: 729-746.
3. Coleman, S.W., K.M. Barth, J.B. McLaren. T. W. High, H. C. Wand and C.S. Hobbs.

1971. Composition of diets selected by grazing beef cattle determined after adjusting for esophageal fistulation effects. Tenn. Agric. Exp. Sta. Bull. 483, 22 pp.

4. Flanagan, T.R. and M.L. McCormack, Jr.'
1970. Balsam fir growth responses fol lowing herbicide treatments. Abstract. *Proc. NEWCC 24:4.*

5. Magruder, N.D., C.E. French, L.C. McEwen and R. W. Swift.
1957. Nutritional requirements of whitetailed deer for growth and antler development. II - Experimental results of the third year. Penn Agric. Exp. Sta. Bull. 628, 21 pp.

6. Morgan, R.H.
1969. The deer browse problem. *American Christmas Tree Journal* 13 (2): 9-12. 7. Morgan, R.H.
1972. Selected cultural practices for young balsam firs and their influence on white-tailed (leer feeding. unpublished M.S. thesis, University of Vernmont.61 pp.

8. Munsel Book of Color.
1963. Color charts for plant tissue. Muosell Color Company, Baltimore, Md.

9. Ries, S.K.
1971. Herbicides as growth boosters. *Weeds Today.* Jan./Feb.: 6-8.

10. Steel, R.C.D. and J.H. Torrie.
1960. *Principles and procedures of Statistics.* McGraw-Hill Book Co., Inc. "›w York, N.Y. 481 pp.

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