Proceedings of the SYMPOSIUM ON INTENSIVE CULTURE OF NORTHERN FOREST TYPES

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FOREWORD

THE NORTHERN FOREST TYPES constitute a vast natural resource for the United States and Canada. For instance, in the eastern United States there are more than 10 million acres of commercial forest land supporting spruce and fir types alone. The magnitude and variety of this resource is such that treating it in any detail at a 3-day meeting was impossible. Rather, the idea that germinated and developed into this symposium was to present a broad picture of the extent of our knowledge of intensive cultural techniques, the status and trends of our research in the northern forest types, and some actual experiences in managing this resource; and to explore those factors that affect our use of the intensive cultural techniques we have at hand.

There is no doubt that we face a new era in the management of northern forests. The production of wood products is no longer the primary objective of many owners, and increased pressure for the social values of our forests is being felt by all landowners. We must recognize these other forest values, which in turn dictates intensification of all aspects of forest management if we are to meet the future demands of a wood-hungry society.

The enthusiastic efforts of the symposium sponsors—the School of Forest Resources, University of Maine; the Maine Bureau of Forestry; the Maine Forest Products Council; and the U.S.D.A. Forest Service—and the individuals behind those efforts, should be commended. Special thanks are due to Great Northern Nekoosa, Inc., and Brooks B. Mills for their help in providing interesting field trips, and to the Casco Bank and Trust Co. for sponsoring the symposium brochure. Also, without the enthusiastic participation of the experts invited to present papers, and the moderators of each session, the Symposium could not have taken place.

—**BARTON M. BLUM**
Symposium Chairman

PUBLISHER'S NOTE

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held 20-22 July 1976 at Nutting Hall, University of Maine, at Orono.

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STATUS OF HERBICIDE TECHNOLOGY FOR CONTROL OF TREE SPECIES AND TO REDUCE SHRUB AND GRASS COMPETITION

by Maxwell L. McCormack, Jr., Professor of Forestry, Department of Forestry, University of Vermont, Burlington, Vt.

Abstract

The values of herbicides as silvicultural tools are summarized. Treatments are discussed with reference to chemicals and methods of application as they pertain to control of grass and herbaceous weeds, understory vegetation, and overstory vegetation.

An herbicide is a chemical used to reduce or eliminate the detrimental effects of undesirable plants. The potentials for effective use of herbicides in the culture of northern forest types are much greater than current practices indicate. Herbicides are an effective, low cost, easy to apply means for reducing management costs and impact from forest pests while improving growth rates, wildlife habitat, watershed quality, and other objectives of forest management. Though herbicides play an important role in nursery practices, the concern of this report is the production of forest products. Competition from adjacent plants, as undesirable species or stems in an overstocked stand, is a major deterrent to growth and pest resistance of desirable trees. However, uses of herbicides go beyond removal of plant competition and can be grouped into several major categories.

1. Site preparation and preplant treatments
2. Control of species composition
3. Reduction of stocking levels
4. Direct reduction of competition from undesirable plants
5. Establishment of openings for such purposes as wildlife management and scenic vistas

6. Improving access through maintenance of roads and right-of-ways

7. Marking of treatment areas

8. Protection by removing host plant material

9. Protection through firebreak maintenance, and others as management needs require

Alternatives to herbicides such as mulching, cultivation, mowing, and other forms of mechanical treatment are more costly. Often they cause physical injury to desirable tree stems and their root systems. Increased erosion and pollution often result. Abrupt changes in forest environments and consequences of quantities of slash dropped directly to the forest floor from mechanical treatments, as opposed to gradual opening and crop tree conditioning accomplished through herbicide techniques, are factors worth careful consideration.

Herbicides offer many solutions to silvicultural problems. Consideration should be given to the original cause of the undesirable plant material such as harvesting methods, species preferences, residual cull trees, and pest impacts as well as management objectives based on ecological principles rather than a simple policy of eradication of the unwanted. Herbicide techniques appropriate for use today may be inappropriate for tomorrow. Continuous advances in application technology and development of new chemicals make new treatments available. Environmental conservation interests, legal restrictions, applicator licensing requirements, and possible reduced availability because of labeling regulations and costs can make established treatments unavailable. Any treatments used must comply with existing regulations and applicators should consult with their appropriate regional pesticide coordinators. Specific data are available from such references as the Herbicide Handbook of the Weed Science Society of America.

A detailed account of all materials and techniques is beyond the scope of this report. Periodically, practical summaries of basic practices have been prepared (Stamm, 1964; Lindmark, 1965; Shipman and Farrand, (no date); and others). Proceedings of

the Northeastern Weed Control Conference are a source of information on recent developments and additional summary information from other regions is useful (Oregon State University, 1967; Gratkowski, 1975).

Because of the large number of possible treatments, the status of herbicide technology will be generally grouped according to some common field situations.

CONTROL OF GRASS AND HERBACEOUS WEEDS

Intensive cultural practices involved in the production of Christmas trees have provided much information and experience in control of herbaceous weeds (Ahrens, Flanagan, and McCormack, 1969). Paraquat (1, 1'-dimethyl-4, 4'-bipyridinium salts) has been useful for preplant preparation at rates of 1 to 2 pounds active ingredient per acre treated (lbs. ai/a). Rapid killing back of above ground plant material provides for easier planting and subsequent weed control. Health hazards associated with paraquat make special safety equipment essential and can be cause for using substitutes. Glyphosate (N-phosphonomethyl glycine) is a new material that shows great promise for killing weeds prior to planting. It is a postemergence, relatively non-selective, non-residual material which will control a large number of narrow and broadleaf perennial and annual weeds, trees, and brush. It has the additional advantage of exhibiting active translocation from vegetative plant parts to underground roots or rhizomes. It is best applied at early flowering to maturity.

Residual control of herbaceous weeds is best achieved with simazine (2-chloro-4, 6-bis(ethylamino)-s-triazine) applied as a spray of wettable powder in water. Simazine has good residual action and should be applied early in the spring for best results. Response from late season applications can be accelerated through the use of wetting agents which also help to keep spray equipment clean and functioning. Simazine works well with our native conifers with balsam fir (Abies balsamea (L.) Mill.) tolerating highest rates, followed by the pines (Pinus L. spp.) and then spruces (Picea A. Dietr. spp.).

Action of simazine can be accelerated and improved by combining its application with that of

fertilizer. In turn, simazine also provides nutritional benefits by improving the nitrogen regime and the habitat for mycorrhizal fungi. This latter relationship has been observed with balsam fir, Fraser fir (Abies fraseri (Pursh.) Poir.), white spruce (Picea glauca (Moench) Voss) and species in other areas (Uhlig, 1966). Simazine treatments to balsam fir result in increased survival and improved plant tissue production. In some studies this herbicide alone has resulted in better growth than combinations of fertilizer plus simazine. Planted balsam firs with weed control, primarily with simazine, as the only cultural treatment have grown to heights exceeding seven feet in five growing seasons after planting (Unpublished data, University of Vermont). Wildlife management implications and browse problems result from apparent preferences by browsing white-tailed deer (Odocoileus virgincanus borealis Miller) for simazine-treated balsam fir which have been related to resultant increases in crude protein (Morgan and McCormack, 1973).

Atrazine (2-chloro-4-(ethylamino)-6-(isopropylamino-s-triazine) which is similar to simazine, but more soluble, is also effective and can be used in combination with simazine for faster action and reduced rates of application. Care must be taken not to allow atrazine to contact soft, new growth on conifers or some defoliation can result. Generally, rates of 2 to 10 lbs. ai/a are effective depending on site and operating conditions.

Though most experience with these triazine herbicides has been with conifers, increased survival and growth has been achieved in plantings of black walnut (Juglans nigra L.), red oak (Quercus rubra L.), white ash (Fraxinus americana L.), and yellow-poplar (Liriodendron tulipifera L.) (Erdmann, 1967). Recent field observations in Vermont indicate that sugar maple (Acer saccharum Marsh.) will seed in and grow well in maintained simazine bands.

CONTROL OF UNDERSTORY VEGETATION

Undesirable understory vegetation must be approached with special care to avoid injury to desirable overstory trees. This can be accomplished by careful application of herbicides with hydraulic sprayers or mist blowers in hardwood and softwood stands. Best approaches are with translocatable

foliage applications. It is recommended that basal spraying be avoided since it requires larger volumes of chemical and oil carriers which are undesirable from the viewpoint of environmental and aesthetic concerns.

Best results are obtained with 2,4,5-T (2,4,5-trichlorophenoxyacetic acid). Other phenoxys are also used successfully as separate applications or in combinations. Silvex (2-(2,4,5-trichlorophenoxy) propionic acid) is effective as well as treatments including 2,4-D (2,4-dichlorophenoxyacetic acid). Glyphosate shows promise, but requires more study. Krenite (ammonium ethyl carbamoylphosphonate) may also have some application in the future, but must be applied late in the season. Initial responses to foliar sprays of Krenite simulate normal autumn loss of foliage which has some advantages where recently treated areas might be viewed by the public. Attempts at using amitrole (3-amino-1,2,4 triazole) can result in some root uptake which is potentially injurious to small overstory trees.

The "workhorse" of this category of treatments is 2,4,5-T which is effective in rates of 1 to 3 lbs. ai/a. Mist blowers give most efficient coverage using water as a carrier. Several adjuvants are now available to improve wetting, penetration, translocation, and weatherability. The disadvantages of oil in the carrier can now be avoided. To accomplish thorough kill, it is important to achieve good intake for translocation of the herbicide; quick burning of foliage which is dramatically impressive often precludes this desirable objective.

In addition to beneficial uses of adjuvants, other modifications in technique show promise. For example, difficult to control red maple (Acer rubrum L.) has exhibited increased susceptibility to 2,4,5-T when phosphorus applications are combined with treatment (Brady, 1970). Also, changes in timing of application are possible. Some brush species are susceptible to spring herbicide treatments while conifers are still resistant. Screening tests in the Pacific northwest with genera present in the northeast (Alnus, Rubus, Acer, and Corylus) have been encouraging (Stewart, 1974).

Heavy invasions of Rubus often occupy openings in northeastern forests. Present studies in northern Maine and Vermont indicate that herbicide treatments

show hope of suppressing the undesirable vegetation to the benefit of spruce and fir. To date silvex looks good at rates of 2 to 3 lbs ai/a and shows good control of all strata of Rubus, even when there is a closed upper canopy of leaves. Good results have also been obtained with 2,4,5-T glyphosate. Krenite exhibits potential, but will require more study. In cases where residual trees or larger plants are present it is important to take measures so they do not interfere with reaching target plants with herbicide applications.

CONTROL OF OVERSTORY VEGETATION

Treatment of overstory plants, or stands of brush species where no trees are present, can be accomplished through foliar applications. Aerial applications can be very efficient. Spraying of 2,4,5-T controls hardwood growth sufficiently to allow establishment of conifers. Isolated trees which are larger than the target canopy can result in shielding so that separate preparation or followup treatments might be desirable. In cases where fresh stumps and girdled trees result in quantities of sprouts that are not desired for wildlife management purposes, herbicide treatments can be utilized to reduce impact from sprouting. Treatment of fresh cut stumps very soon after cutting is desirable. These applications are a good example of where colored dyes are a definite aid in efficient execution of treatment.

Aerial sprays using several phenoxys in Vermont have shown that all treatments including 2,4,5-T gave some level of control (Newton and Smith, 1971). Application of low rates of 2,4,5-T from fixed wing aircraft on relatively small areas, 17 to 54 acres, has been effective in reducing hardwood competition in softwood stands (Butler, Hudson, and Flanagan, 1963).

Where broadleaved brush poses a threat to conifers another material which has been effective is picloram (4-amino-3,5,6-trichloropicolinic acid). When combined with 2,4-D or 2,4,5-T in foliar applications, picloram provided better brush control than either of the phenoxys alone (Perala, 1974).

Hard to kill species and individual large stems may need special attention where foliar sprays are used. Where combination treatments or removal of selected large stems are the basis of timber stand improvement operations, injector or frill-plus-chemical

applications can be very effective. In effect, a frill plus herbicide is a continuous series of injections around the circumference of a stem. Injection by long-handled tree injector at the root collar or hypo-hatchet at a convenient working height has the advantages of being neat and efficient, and placing the chemical in an individual selected stem as a metered dose. Present techniques involve use of undiluted herbicide in rates of 0.5 to 1.5 ml per injection with spacing of injections regulating dosage. The phenoxys are used. Their effectiveness is increased, especially on red maple, by adding picloram. Very good results are obtained with the organic arsenicals. Depending on season of treatment, summer months appear to give best results, cacodylic acid works best to control beech (Fagus grandifolia Ehrh.). Monosodium methane arsenate provides control of red maple, sugar maple, striped maple (Acer pensylvanicum L.), white birch (Betula papyrifera Marsh.), aspen (Populus L. spp.), hophornbeam (Ostrya virginiana (Mill.) K. Koch), white ash, and conifers which is equal to, or better than, cacodylic acid (Newton and Smith, 1971). Materials and dosages vary with species and season. Several existing reports provide practical guidelines (Little and Fenton, 1964; Filip, 1965; Peevy, 1972; and others).

SUMMARY

Numerous opportunities exist to use herbicide treatments for intensive culture of northern forest types. Each situation must be evaluated for its specific requirements so an ecologically sound treatment can be directed at realistic, undesirable target vegetation while exposure of non-target organisms is minimized. All must be done within legal restrictions. It should be remembered that complete kill of undesirables is often not necessary and a significant positive response of the desirable trees is the objective and proof of beneficial treatment.

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