HERBICIDES - THEIR LIMITATIONS AND POTENTIALS FOR SITE PREPARATION

by Henry L. Hansen 1/

HISTORICAL REVIEW

The synthesis of 2, 4-D during World War II and its initial recognition as a great potential weed killer marked the beginning of the modern era of chemical silviculture. In 1914 the North Central Weed Control Conference was organized and held its first annual meeting in Omaha, Nebr., to coordinate research, extension, regulatory, and industry efforts on weed control problems. To be sure, this pioneering was done by people with primarily agronomic interests and with a focus on herbaceous weeds. However, during 1945 and 1946 interest developed in the use of 2,4-D in killing woody plants, particularly poison ivy and such alternate hosts of diseases as Ribes and the barberries. During that year a Subcommittee on Research in Eradicating Woody Plants was organized under the chairmanship of L. W. Melander. In 1947 a symposium on the chemical control of woody plants was sponsored by this committee, and 52 abstracts of research involving woody plants were published.

While the earliest research on the use of 2,4-D on woody plants was oriented to the problems of rights-of-way maintenance, pasture improvement, poisonous plants, and alternate host eradication, foresters were not long in recognizing the possibility that 2,4-D might help to solve some of the silvicultural problems in Minnesota and the rest of the Lake States. By 1947 research was underway using 2,4-D on hazel, alder, willow, and other common forest brush species. Some of this early work was done in the area in which these meetings are being held, on the Chippewa National Forest and at the Lake Itasca Forestry and Biological Station.

Another milestone in the history of chemical silviculture was the initial testing of aerial applications of 2,4-D for silvicultural purposes in 1951. During that year applications were made on an upland site north of Brainerd and on a swamp site near Effie, Minn. Since that time the airplane has been widely used in connection with forest spraying as the means by which phytocides are applied to the forest.

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EVALUATION OF EXPERIENCE

We now have about 12 years of experience with aerial applications and over 15 years of experience in the use of 2,4-D on forestry related woody weed problems. At this time it is very appropriate that we evaluate the implications of this experience on the problems of site preparation.

Most of the application of 2,4-D and other phytocides has been for the purpose of release. This silvicultural procedure is one of the most costly of all forestry activities when the axe, the brush hook, and the machete are the main tools available. Plantations established in the days of the CCC programs often suffered heavy mortality because funds simply were not available for the expensive job of freeing the planted trees .from brush or the competition of sprout hardwoods. Naturally regenerated mixtures of valuable conifers similarly suffered from excessive hardwood competition. It was natural that foresters turned to the new phytocides in some desperation in their search for cheaper release measures. The properties of 2,4-D were explored, and their fortuitous selectivity in favor of the conifers was soon recognized. It became evident that stand mixtures of conifers and hardwoods could be sprayed to give a good measure of control over the hardwoods with relative safety to the conifers. On the drier sites, such as prevail particularly in the western fringes of jack pine distribution in Crow Wing, Hubbard, Wadena, Clearwater, and adjacent counties in Minnesota, it was found that jack pine could be released effectively and at a reasonable cost from intermixed oak by an aerial application of a good phytocide. Similarly pine and spruce understories could be released from aspen overstory competition. These developments made possible more effective and far cheaper release than was possible before the days of 2,4-D.

In connection with the problems of planting site preparation the results of the past in using phytocides are not as widely successful nor as clear-cut in their interpretation. For the purpose of this presentation, site preparation is considered as preliminary to planting or direct seeding or to stimulate natural regeneration.

Little use has been made of phytocides in connection with artificial seeding of areas to secure regeneration. It is probable that the use of selective materials such as 2,4-D would not give as drastic an effect on the seedbed as might be desirable for use preliminary to seeding. Certainly phytocides will not create mineral soil seedbeds, nor will 2,4-D eliminate the herbaceous canopy. It is very possible, however, that chemical treatment may be of considerable help after seeds have germinated to free the young seedlings from competition. However, this is technically a release effect, the value of which has been fully demonstrated and was discussed earlier.

Current interest in planting, even with concomitant expense of site preparation using expensive land clearing methods, raises the question of the

possible role of phytocides. Again, heavy equipment or fire are needed if slash, litter, or standing trees and brush are to be removed. Phytocides may be helpful in several ways. First, they may be useful in killing brush in advance of burning to create favorable fuel relationships. While research is underway to test these possibilities in both shrubby and herbaceous fuel types, the potentials are by no means explored. However, there is evidence that fuel drying by chemicals may expedite summer burning when the dangers are low.

A second benefit possible in connection with planting site preparation involves reduction of competing vegetation. Two considerations arise at this point. First, should treatment be made before or after planting, and second, to what extent is such treatment needed and helpful. Certainly there is inadequate experience on which to make judgments contrasting pre-planting vs. postplanting applications. This should be the object of considerable testing under a wide range of field conditions and considering it in connection with both mechanical and burning site preparation.

The extent to which phytocides can reduce competition to planted trees depends in a large measure on the nature of the site being planted. Some experience is now being acquired on the Chippewa National Forest and elsewhere. It appears that where planting is being done on sites formerly supporting stands with a heavy brush understory the chemical treatment is most necessary. Pine and aspen sites with dense growths of hazel, prairie willow, cherry, and other aggressive upland brush species tend to produce heavy regrowth following site preparation by mechanical clearing or pre-burning. Such areas will usually require a phytocidal treatment to carry through the planted trees. On the other hand, sites on which tolerant hardwoods such as maple and basswood grow seldom have heavy brush understories. This explains why current experience in mechanically clearing such sites seems to indicate less need for chemical treatment. Regrowth from the root systems of the hardwood trees is far less aggressive than that from hazel and other brush species. These ecological relationships must be known much more intimately in connection with the site preparation problem.

The use of phytocides as an aid in site preparation on open field plantings where sod and herbaceous weeds is the main problem is being given much attention now because of the more recent availability of some phytocides other than 2 4-D. Such materials as simazine, amizine, diuron, atrazine, and others are being widely tested to improve survival and early growth of Christmas trees as well as farm shelterbelt and windbreak species. Tests in Minnesota have shown that good to excellent weed control was obtained from simazine and atrazine in about 90 percent or more of the statewide trials underway in 1961 and 1962. These materials, applied to the soil in the fall previous to planting or in the spring before emergence of the weeds, do not injure most woody plants being planted because their effect is primarily on germinating seeds and very young seedlings. Amizine, a combination of amino triazole, to control already established grasses and weeds, and simazine, to kill seedlings germinating after the application, also is proving useful in plantings of this type. In the case of amizine, however, sprays must be directed so as not to contact and injure the planted trees.

There has been very little testing of these phytocides as well as of other nonselective soil sterilants in connection with forest type plantings. It is possible that a soil sterilant which is extremely potent in killing all vegetation and which will have low residual toxicity will be developed and may be useful in preplanting site preparation. A number of chemicals are now available which will do a good job of killing everything on a planting site. However, their high cost and the fact that their residual toxicity kills young trees planted the following year makes their utility limited.

Finally, phytocides have been tested to some extent in stimulating natural regeneration of forest stands. Again, the tests are highly.inadequate as a basis for determining the potentials of this silviculturally. A few trials seem to indicate limited or little success with red pine. The difficulties of securing abundant reproduction of this species are well known and apparently the phytocides do not offer a cure-all. Where advance regeneration is present, however, 2,4-D applications may be of great assistance in carrying through the young seedlings. This, of course, is again an example of release.

Research at the Lake Itasca Forestry and Biological Stations indicates that 2,4-D sprays may be more useful in encouraging white pine regeneration. This species is far more aggressive than is red pine. Where an adequate seed supply is available, sprays to kill brush and improve light and heat on forest seedbeds have been found to greatly improve white pine regeneration. Even with this species the most striking benefits to be obtained from spraying with 2,4-D are a result of releasing young advance seedling growth from brush competition, greatly increasing the rate of juvenile growth, and assuring a higher ultimate survival percent.

SUMMARY

After more than 15 years of experience and research in the use of selective phytocides and 12 years of using aerial spraying, much has been learned about the potentials and limitations of these materials in silvicultural operations, but a surprising amount still remains to be learned.

In general, excellent results have been obtained where release of conifers from competition of brush or hardwoods has been the problem. This has been true of planted conifers as well as natural regeneration in various stages from initial germination to sapling size. Treatments have been relatively cheap and effective.

Presently available phytocides do not clear rough sites sufficiently for machine planting without the use of fire or heavy mechanical equipment. However, on sites where brush is a problem their use may be an important adjunct to mechanical or burning methods of site preparation. The timing of such applications is a matter requiring further study and testing and must be related to the ecological conditions prevailing.

Soil sterilants of greater potency, lower cost, and less residual toxicity than those presently available may open the way to much wider use of chemicals for site preparation in connection with planting, direct seeding, and natural regeneration.