Chemical Cultivation in Cottonwood Seed - Source Plantings

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Introduction

It is certainly unnecessary to review here the literature relating to the need for maintenance of "free space" around newly established cottonwood plantings. Even a bare minimum of experience in cottonwood culture is ordinarily sufficient to impress one with the fact that the young tree absolutely requires at least a one year advantage over its competition if it is to survive. On the other hand, it is not fully known how many years of such intensive care are necessary and what growth advantages might possibly accrue from extended periods of treatment. It certainly is obvious to the economically biased American forester, however, that cottonwood care is expensive and that the young trees should be encouraged to go-it-alone just as quickly as possible.

Even should it be demonstrated, however, that maintenance of competition-free space for periods longer than one year would result in increases in growth and be economically justifiable, the question still remains whether or not the elimination of competition could be accomplished efficiently using conventional mechanical cultivation techniques. It has been our experience, for example, that even though exaggerated stress is placed on the need for care in cultivation, our technicians almost inevitably damage one or more trees each time they work a plot. There is, in addition, the unassessed effect on growth to be considered which results from severance of shallow, lateral roots during the cultivation process.

Obviously, stem damage to individuals and retardation of growth through root injury cannot be tolerated in seed-source study plots. When the exasperating frequency of equipment failure, which always seems to occur at some critical period, is added to the picture, it becomes apparent that a cultivation technique of a non-mechanical nature should be of considerable advantage.

Following the suggestions of Dr. W. C. Bramble, we at Purdue have initiated studies in the use of herbicides for elimination of competition in cottonwood seed-source plantations. The results of our earliest work are reported herein.

Procedure

A plantation containing both native cottonwood *(P. deltoides Bartr.)* and a hybrid obtained from the Soil Conservation Service *(P. "eugenei";* accession number M1-5514) was established in 1961 using one-year-old rooted cuttings. The trees were planted at a spacing of 10' **x 10'** in holes about 30" deep. The soil was classified as a Ross sandy loam. It is a dark colored, high bottom soil developed in alluvium washed from upland areas of calcareous Wisconsin drift. It is slightly acid to neutral.

Following one year of conventional cultivation treatment with disc-harrows, the plantation was divided into plots utilizing a Latin-square design. Treatments were assigned as follows:

4 plots, untreated control;
4 plots, Simazine[1], 1.6 pounds ai per acre;
4 plots, Simazine[1], 3.2 pounds ai per acre;
4 plots, Amizine[2], 4.2 pounds ai per acre.

Using 5-gallon tank sprayers, the chemicals were carefully metered onto square mil-acre areas surrounding each tree. At the end of both the first and second growing seasons following this treatment analyses were made of survival and height growth responses.

Results

In general, results showed that survival was not affected by treatment over the two-year period of this test. Height growth, however, was influenced both by treatment and by time elapsed since treatment.

At the end of the first growing season, height growth was greater on all chemical plots than on untreated controls. These differences were statistically significant at the one per cent level (Table 1.). The Amizine treatment resulted in significantly more growth than either level of Simazine treatment. There was no statistical

Table 1. Mean height growth of cottonwood during the first growing season following treatment.

Treatment	Mean height growth, feet
Control	5.53
Simazine, 1.6 lbs./acre	6.45
Simazine, 3.2 lbs./acre	6.68
Amizine, 7.0 lbs./acre	7.32

[1] Simazine, 80% WP [2-chloro-4, 6-bis(ethylamino)-s-triazine]
[2] Amizine: 45.0% Simazine, 15.0% Amitrole [3-amino-1, 2, 4-triazole]

difference in height growth between plots treated with 3.2 pounds and 1.6 pounds of Simazine per acre.

During the second growing season following treatment, height growth on all chemically treated plots was still greater than on control plots though statistical significance was evident only at the 5 per cent level of probability (Table 2).

A change was also noted in growth differences between chemical treatments. Whereas after the first growing season there was no difference in effect between 3.2 pounds of Simazine and 1.6 pounds, there was a significant difference in growth in favor of the heavier treatment at the end of the second growing season. Further, although after the first season a staistically significant difference existed between growth means on the Amizine treated and 3.2 pound-Simazine treated plots, in favor of the Amizine, this difference disappeared after the second growing season. Height growth was actually slightly greater on the 3.2 pound-Simazine plots, but the difference was not significant at the 5-percent level of probability.

Discussion

The increases in height growth obtained for two years following a single application of herbicides to control weed competition indicate the desirability of maintaining free-space around newly established cottonwood plantings for periods longer than one year—at least under the local conditions encountered in this study. Whether or not the same result could have been accomplished with mechanical cultivation and on other soil types was not tested. Neither can anything be said at this time about the use of herbicides at the time of establishment. These questions are under continuing study.

Table 2. Mean height growth of cottonwood during the second growing season following treatment.

Treatment	Mean height growth, feet
Control	4.10
Simazine, 1.6 lbs./acre	4.79
Simazine, 3.2 lbs./acre	5.62
Amizine, 7.0 lbs./acre	5.54

We are satisfied presently that the application of 3.2 pounds of Simazine or 7 pounds of Amizine per acre at the beginning of the second growing season following establishment is a desirable practice. The mechanical cultivation during the first year reduces the potential weed population to a minimal level and the herbicide then maintains this control for at least two more years.

The lighter application rate of Simazine was as good as the heavier rate the first year, but not the second. Even during the second year, however, it was better than no treatment at all.

The fact that chemical damage was never detected on any of the trees in this test may be attributable to at least two factors. First, planting rooted cuttings in deep holes could have insulated the major portion of the root system from contact with toxic quantities of the herbicide. And secondly, the Simazine[3] was likely tied up in the surface layer of the soil and thus prevented from leaching into the rooting zone.

There is also a possibility that differences exist in susceptibility to given herbicides among the many taxa of the *Populus* genus. Before unqualified recommendations can be given regarding the use of herbicides for the control of weeds in cottonwood plantings, this should be investigated. Used with caution, however, a treatment similar to that described in this paper appears to be a desirable technique for maximizing height growth of cottonwood.

[3] Including the Simazine in the Amizine compound. Aminotriazole decomposes quickly in warm, moist, soils.