HERBICIDES AID ESTABLISHMENT OF UNROOTED POPLAR CUTTINGS.[1]

Donald Dickmann, Randall Heiligmann, and Kurt Gottschalk, Department of Forestry, Michigan State University, East Lansing.

After one growing season on tilled and untilled sandy loam sites, height of poplar cuttings on plots treated with simazine was twice that of those on plots treated with pronamide or linuron. Survival was unaffected by herbicides.

Control of competing weed vegetation is generally regarded as the most critical factor ira establishment of poplar plantations. The three basic approaches to weed control in these plantations include cultivation (*3, 5*), plastic mulching (*1*), and herbicides (*2, 4, 6*). Cultivation, though effective, is expensive, time consuming, and often damaging to young plants. Mulching with polyethylene is also effective but wholly impractical for large-scale plantings. We feel that herbicides offer the greatest potential for effective, economical control of competing weeds in young poplar plantations.

The challenge, of course, is to accurately prescribe on each planting site a herbicide, dose rate, and application time that will effectively control weeds but not kill or injure the trees. We have, therefore, initiated a series of experiments to explore the effects of various herbicides on poplars planted on Michigan sites. The results of our initial efforts are presented in this paper.

METHODS

Experiment 1—Untilled site. This experiment was established on a level, recently abandoned field near Port Huron in the lower peninsula of Michigan. Existing weed cover consisted of a mixture of annual and perennial broadleaf weeds with small patches of grass interspersed throughout the site. The soil was a sandy loam containing about 4 percent organic matter and having a pH of 6.6 to 6.9. The various herbicide treatments were laid out in a randomized block design with four replications. Each treatment consisted of a 30- by 30-foot plot on which herbicides were sprayed in complete coverage. Plots were separated with 6-foot, untreated buffer strips.

Three herbicides were used: pronamide (Kerb 50-W, Rohm and Haas); linuron (Lorox 50-W, DuPont), and simazine (Princep 80-W, CIBA-GEIGY). Each herbicide was applied at two different rates: pronamide and linuron at 2-and 4-pound bag formulation (1 and 2 pounds active ingredients) per acre and simazine at 3- and 4.5-pound-bag formulation (2.4 and 4 pounds active ingredient) per acre (table 1). Since the site was untilled, 1 gallon (2 pounds active ingredient) per acre of Amitrol-T (Amchem) was also applied with each treatment to suppress existing perennial weeds. Herbicides were applied on April 15, 1976, in an aqueous tank mix using a hand-propelled, two-wheeled sprayer. Warm temperatures and partly cloudy skies prevailed during treatment. Heavy rains occurred during the following night.

Three weeks after treatment all plots were hand planted with 10-inch hardwood cuttings of hybrid poplar (*Populus* cv. maximowiczii x *P. trichocarpa*, NE clone 41). Unfortunately, the cuttings had not been kept sufficiently cool during shipment from the nursery, so most had broken bud and formed rootlets before planting. Overall survival was, therefore, considerably reduced, a result that emphasizes the importance of using good quality planting stock. Cuttings were planted at 6- by 6-foot spacing, giving a total of 25 cuttings per plot. The site was very wet during planting, with standing water in some places, a factor that may also have reduced cutting survival. All herbicide treatments were very evident at this time, with most existing weeds dying or chlorotic.

Experiment 2—Tilled site. A second study was installed adjacent to Experiment 1 on a similar soil. This site, in contrast, was plowed and disked prior to treatment. The study was laid out in a split-plot design with three replications. The major plot treatments were the herbicides pronamide, linuron, and simazine, all applied at 3-pound-bag formulation per acre, while the subplot treatments were three poplar clones (P. x *euramericana* cv. Wisconsin #5; *P. deltoides* x *P.* cv. caudina (NE clone 353), and a *P. deltoides* source from central Ohio). Herbicide plots consisted of 3-foot strips sprayed on April 15 using the same technique as Experiment

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Figure 1.—*Completely released NE 41 poplar cutting growing on a simazine plot in mid-July (Experiment 1).*

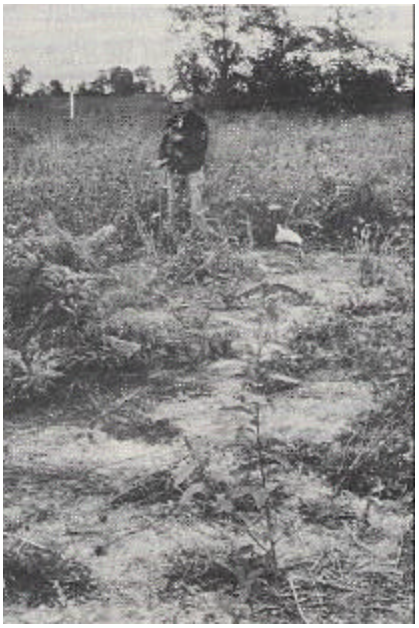

Figure 2.—*Many cuttings on sima zine plots exceeded 3 feet in height at the end of one growing season. Note dense weed cover bordering the plot.*

Figure 3.—*Vigorous Wisconsin #5 cutting on a simazine plat in mid-July (Experiment 2).*

1. Strips were laid out on 6-foot centers, with 10-inch unrooted cuttings planted down each strip at 6-foot intervals. Each subplot contained 12 cuttings of each clone. This site was not as wet as that of Experiment 1 at time of planting, and the cuttings were fully dormant.

Measurements of survival, height growth, and weed control were taken on September 21 for both experiments.

RESULTS

The results of Experiment 1 are summarized in table 1. At season's end, both pronamide and linuron showed little capacity to control weeds at the levels applied. Vigorous mixed stands of sweet clover, dandelion, alfalfa,.goatsbeard, goldenrod, wild carrot, thistle, and other broadleaf weeds grew on most plots. Pronamide plots were generally free of grasses, whereas linuron showed little control of grass. Simazine, however, showed good weed control (table 1), with up to 70 percent bare ground on some plots (figure 1).

There was no significant relationship between cutting survival and weed control effectiveness after one growing season (table 1). Height of cuttings, in contrast, was directly related to degree of weed control (table 1). Cuttings from the simazine plots were more than twice the height of cuttings from all other plots, while cuttings from the 4.5-pounds-per-acre simazine treatments averaged several in-

ches taller than those from the 3-pounds-per-acre treatments. Many cuttings on the simazine plots, in fact, exceeded 3 feet in height (figure 2). It is likely that most of these cuttings would survive without further weed control, although under intensive management this probably would not be recommended.

Similar results were obtained in Experiment 2 on the tilled site (table 2). Survival rates among the various treatment combinations were not significantly different, though they were much higher than in Experiment 1. This high survival indicates no apparent toxic effects from the herbicides on the poplar cuttings. Height growth was again significantly affected by herbicide treatment (table 2). For all three clones, cuttings from the simazine plots (figure 3) were twice the height of those from pronamide or linuron plots. Hybrid clone 101 was consistently taller than hybrid clone W5, which was in turn taller than clone 52, a pure cottonwood source. No significant clone x herbicide interaction occurred, indicating the lack of differential genetic response by these clones to the herbicides tested.

Table 1.—*Effects of herbicides on hybrid poplar hardwood cuttings grown for one season on an untilled site (Experiment 1)*

Herbicide	Rate [1] *(pounds/acre)*	Weed Control [2] *(percent)*	Survival [3] *(percent)*	Height *(feet)*
Pronamide	2.0	6 a[4]	53 a	1.1 a
	4.0	11 a	67 a	1.0 a
Linuron	2.0	11 a	50 a	1.0 a
	4.0	12 a	59 a	1.0 a
Simazine	3.0	39 b	66 a	2.2 b
	4.5	46 b	57 a	2.5 c

[1]Rates based on bag formulation. All herbicide treatments also included 2 pounds per acre Amitrol-T.

[2]Percent of sprayed ground devoid of live weeds.

[3]Survival in all treatments diminished because of poor-quality cuttings. Most had rootlets and expanded buds when planted.

[4]Means followed by the same letter are not significantly different at the 5 percent probability level.

Table 2.—*Effects of herbicides on hardwood cuttings of three poplar clones grown for one season on a tilled site (Experiment 2)*

Herbicide[1]	Clone[2]	Survival *(percent)*	Height *(feet)*
Pronamide	W5	94 a[3]	1.3 ab
	101	86 a	1.8 cd
	52	78 a	1.1 a
Linuron	W5	100 a	1.9 cd
	101	80 a	2.1 d
	52	80 a	1.2 a
Simazine	W5	92 a	2.8 e
	101	100 a	3.4 f
	52	86 a	1.7 bc

[1] All herbicides were applied at a rate of 3-pound-bag formulation per acre.

[2] W5 = *Populus* x *euramericana cv.* Wisconsin #5; 101 = *P. deltoides x P.* cv. caudina (NE clone 353); 52 = *P. deltoides* source from central Ohio.

[3] Means followed by the same letter are not significantly different at the 5 percent probability level.

Discussions and Conclusions

The results from both experiments on this sandy loam site indicate that surface applications of pronamide, linuron, or simazine up to 4- or 4.5-pound bag formulation per acre, in a tank mix with Amitrol-T or on tilled or untilled soil, do not adversely affect the survival of unrooted poplar cuttings. Height growth, however, is substantially affected, with only the simazine treatments providing sufficient weed control for acceptable first-year height growth of poplar cuttings. Martin and Carter (*4*) similarly found good growth and survival of cottonwood cuttings with simazine applications up to 12 pounds per acre. Our results contrast with that of Geyer (*2*), who reported substantial simazine-induced mortality of cottonwood seedlings on a sandy loam site in Kansas. Our soil, however, in contrast to the soil in Geyer's study, was high in organic matter, a condition that would minimize-downward mobility of the herbicide and prevent uptake by tree-roots.

Based on these experiments, simazine application up to 4.5-pound bag formulation per acre appears safe for use as a preplant weed control for unrooted poplar cuttings on. tilled sandy loam sites with high organic matter. Where weed cover on such sites consists largely of annual and perennial broadleaf weeds, preplant application of simazine in a tank mix with 2 pounds per acre Amitrol-T can also be used without previous tillage. An additional advantage of simazine is that the label covers its use in weed control for a number of broadleaf and coniferous woody plants. Unfortunately, poplars are not currently included in this list, but it is hoped that the label could be extended to cover them in the near future.

ACKNOWLEDGMENT

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