PREEMERGENT HERBICIDE TRIALS WITH DIRECT-SEEDED BLACK LOCUST GROWN IN DIFFERENT SOILS[1,2]

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Abstract. Various soil types were seeded with black locust and treated with different preemergent herbicides to determine their effect on germination, seedling survival, and growth. All treatments except oxadiazon and chloroxuron allowed acceptable survival and growth.

Résumé. Plusiers types de sols furent ensemencés avec du robinier faux-acacia et traités avec différents herbicides de pré-levée afin de déterminer leur effet sur la germination, le taux de survie et la croissance des jeunes plants. Tous les traitements, exception faite de l'oxadiazon et du chloroxuron, ont permis une survie et une croissance acceptables.

Keywords: *herbicide, black locust, direct seeding.*

Millions of acres of new forest lands have been established in the United States using bare-root seedlings; however, only a small percentage was direct-seeded (1). In the southeast, southern pine has been direct-seeded with success in cut-over forest lands (5). On surface-mined lands, direct seeding of black locust (*Robinia pseudoacacia*) has been practiced extensively in the southeast with success (3, 4). However, direct seedling in natural loamy soils presents a greater challenge because of luxuriant weed populations. Weed control in tree nurseries is essential, but costs are high with hand-weeding methods. Herbicides are often cheaper and convenient if used properly (2). New herbicides need to be evaluated for damage to tree seed in addition to tree seedlings.

Previous greenhouse pot studies have evaluated the tolerance of black locust seed to various common herbicides in peat/sand and peat/sand/soil mixtures (8, 9), suggesting that the use of herbicides in direct seeding might be feasible. However, the high germination rates in pot studies were not translated to field trials using seed from the same seed lot (7). Soil moisture problems, rodent pilferage, and/or herbicide activity may all have contributed to low survival. Further testing in soil under controlled greenhouse conditions is necessary in order to evaluate soil effects found in field conditions.

This report compares several trials of seedling survival and growth of black locust seed planted in different soil types, when treated with preemergent herbicides one day after sowing under controlled greenhouse conditions.

Materials and Methods

Seed were scarified with concentrated sulfuric acid for 60 minutes. Twenty-five seeds were planted in individual 3.8 liter plastic nursery containers at 0.6 cm depth in the following soil types:

* *Eudora,* silty-clay loam with a pH of 7.5, 2.0% organic matter, 146 kg available phosphorus (P), and 560 kg exchangeable potassium (K) per hectare.
* *Shellabarger* sandy loam with a pH of 6.1, 1.6% organic matter, 37 kg P, and 575 kg K per hectare.
* *Cass* loam/sandy loam with pH of 7.7, 1.2, organic matter, 22 kg P, and 336 kg K per hectare.

The following day, three replications of each of eight herbicide treatments were applied to the soil surface of randomly selected containers. Eight treatments (Table 1) using the best herbicide rates from our previous trials (6, 7) were prepared. Treatments were: alachlor, chloroxuron, DCPA, EPTC, napropamide, oxadiazon, profluralin, and a control. A 1 ml aliquot stock solution was mixed with 232 ml of water to simulate a 1.3 cm irrigation per pot. Water and fertilizer were provided as needed throughout the experimental

1 Contribution No. 86-388-J from the Kansas Agricultural Experiment Station.
2 Research sponsored in part by the Biomass Energy Technology Division, US Department of Energy under contract with Oak Ridge National Laboratory Martin Marietta Energy Systems, Inc.
3 Department of Horticulture

Table 1. Survival of black locust 60 days after herbicide treatment in various planting mediums.

Herbicide type	Treatment rate	Planting medium: Growth chamber[1/]	Peat+ sand[2/]	Silty clay loam	Sandy loam	Loam/ sandy loam	Field site[1/]
	(kg a.i./ha)	%					
Alchlor (Lasso)	2.2	90a	64b[3]	58ab	36a	49ab	3bc
Chloroxuron (Tenoran 50w)	2.2	100a	70ab	59ab	33a	12c	8abc
DCPA (Dacthal)	11.2	95a	71ab	72a	37a	67a	15a
EPTC (Eptam)	4.5	85a	83ab	47b	29a	63a	4bc
Napropamide (Devrinol)	1.1	85a	66b	55ab	31a	40b	8abc
Oxadiazon (Ronstar)	4.5	95a	65b	5c	12b	5c	0c
Profluralin (Tolban 4E)	0.6	100a	87a	55ab	31a	63a	12ab
Control	—	85a	79ab	61ab	27a	43b	4b

[1] Reference (7).

[2] Reference (6).

[3] Means in columns with same letter do not differ significantly using Duncan's multiple range test, 5% level.

Table 2. Plant height and individual plant dry weight of black locust 60 days after herbicide treatment in different planting mediums.

Herbicide type	Treatment rate	Planting medium: Peat+ sand[1]	Silty-clay loam	Sandy loam	Loam/ sandy loam	Planting medium: Peat+ sand[1/]	Silty-clay loam	Sandy loam	Loam/ sandy loam
	(kg a.i./ha)	height (cm)				dry weight (mg)			
Alachlor	2.2	8.0ab[2]	12.6ab	4.2a	10.7b	170a[2]	250a	130a	250b
Chloroxuron	2.2	10.0ab	12.1ab	4.9a	18.2a	150a	220a	140a	880a[3/]
DCPA	11.2	9.9ab	10.6b	4.6a	10.5b	240a	190a	120a	230b
EPTC	4.5	7.9b	11.5ab	3.8a	10.1b	90a	270a	160a	190b
Napropamide	1.1	10.2ab	14.1a	4.8a	11.2ab	130a	300a	150a	300b
Oxadiazon	4.5	9.9ab	1.2c	2.1b	2.5c	130a	50b	40b	50c
Profluralin	0.6	10.0ab	11.5ab	3.6ab	12.6ab	100a	300a	150a	200b
Control	-	10.9a	12.0ab	5.1a	11.4ab	150a	260a	170a	320b

[1/] Reference (6).

[2/] Means in columns with same letter do not differ significantly using Duncan's multiple range test, 5% level.

[3/] Low survival, more growing space resulted in taller and heavier trees.

period. Seedling counts were made at 6-day intervals. Sixty days after seeding, plant height and final survival counts were recorded. Plants were cut at the soil surface and oven-dried at 65° C for 48 hours for dry weight measurements. Separate tests were conducted for each soil type, thus only ranking between herbicides should be compared.

Results and Discussion

Some herbicide treatments resulted in a significant survival reduction of black locust in some soil types (Table 1). Although grown at a different time, survival was less in soil than in peat/sand mixture as previously reported (6, 7), but usually herbicide comparisons within the different growing media were similar. Compared to the control, all plant measurements were significantly lower for oxadiazon in all three soil types (Tables 1, 2), which is contrary to previously reported results in both growth chamber (7) and peat/sand mixture studies (6). Significant survival differences (compared to control were found with chloroxuron, EPTC, profluralin, adn DCPA only in the loam/sandy loam soil.

Black locust seedlings were significantly shorter than the controls only in soil treated with oxadiazon (Table 2), while no difference was found in the earlier study with peat/sand. Generally, treatments did not cause individual dry weights to differ from the control (Table 2), except with oxadiazon, where survival was low. Survival with chloroxuron was low, but the few surviving seedlings, with little competition, grew to a large size.

Summary and Conclusions

Growth effects between herbicides within any given soil type did not generally differ from those found in the peat/sand mixtures. The one exception was oxadiazon, which severely reduced survival in soil, but not in peat/sand, indicating that high organic matter may be necessary to allow safe use of oxadiazon. Because most of the herbbicides used in this study did not decrease seedling survival or growth in soil, they could provide feasible alternatives to hand-weeding in tree nurseries and establishment of direct-seeded tree plantings.

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