8. McPhee, H.G. and D.A. Cameron. 1980. Shedding can be avoided in early-cut spruce. Amer. Christmas Tree J. 24(3):43-45.

9. Mitcham-Butler, E.J., L.E. Hinesley, and D. M. Pharr. 1987. Soluble carbohydrate concentration of Fraser fir foliage and its relationship to postharvest needle retention. J. Amer. Soc. Hort. Sci. 112:672-676.

10. Montano, J. and W.M. Proebsting. 1985. OSU tree keepability report. Northwest Christmas Tree Assn., Northwest Lookout 18(3): 58-59, 61-63.

11. Montano, J. and W.M. Proebsting. 1985. Effects of drying on cut Douglas-fir. J. Amer. Soc. Hort. Sci. 110: 751-754.

12. Montano, J.M. and W.M. Proebsting. 1986. Storage of cut Douglas-fir: relationship to the damage threshold. HortScience 21:1174-1175.

13. Munsell Color. 1977. Munsell color charts for plant tissues, 2nd ed. Baltimore MD.

14. Van Wagner, C.E. 1963. Flammability of Christmas trees. Canada Dept. of Forestry Pub. 1034.

Tolerance of Direct-Seeded Honey Locust to Preemergent Herbicides in Various Soil Types[1]

W.A. Geyer and C.E. Long[2]
Departments of Forestry and Horticulture
Kansas State Unversity
Manhattan, KS 66506

Abstract

Various soil types were seeded with honey locust (*Gleditsia triacanthos L.)* and treated with preemergent herbicides to determine their effect on germination, seedling survival, and growth. Tested were alachlor at 2.2 (2.0), chloroxuron at 2.2 (2.0), DCPA at 11.2 (10.0), EPTC at 4.5 (4.0), napropamide at 1.1 (1.0), oxadiazon at 4.5 (4.0) and profluralin at 0.6 (0.5) kg ai/ha (lb ai/A). Acceptable survival and growth was found for all but oxadiazon which significantly reduced survival in the sandy loam soils.

Index Words: *Gleditsia triacanthos*, seeding, toxicity, herbicides, alachlor, chloroxuron, DCPA, EPTC, napropamide, oxadiazon, profluralin

Introduction

Wbed control in tree nurseries is essential, but costs are high with hand-weeding methods (1). Herbicides are often less expensive and convenient if used properly (2), however, herbicide tolerance varies with tree species. New herbicidal products need to be evaluated for damage to tree seed and seedlings.

Previous greenhouse pot studies have evaluated the tolerance of black locust (*Robinia pseudoacacia* L.) and honey locust (*Gleditsia triacanthos* L.) seed to various common herbicides in peat/sand mixtures (5) and black locust in peat/sand/soil (7, 8) and in seedbeds (3), suggesting that the use of herbicides in direct seeding might be feasible. However, high germination rates in pot studies were not duplicated in field trials using black locust seed from the same seed lot (6), whereas honey locust survival was nearly the same. Soil moisture problems, rodent pilferage, and/or herbicide activity may all have contributed to poor survival of black locust when planted in the field. Further testing in various soils under controlled greenhouse conditions with black locust showed good survival and growth with many preemergent herbicides (4). Similar activity may be likely with seeded honey locust.

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

Materials and Methods

Seed was scarified with concentrated sulfuric acid for 60 minutes. Twenty-five seeds were planted per individual 3.8 l (#1) plastic nursery containers at 0.6 cm (0.25 in) depth in each of the following soil types:

- Eudora silty-clay loam with a pH of 7.5, 2.0% organic matter, 146 kg/ha (130 lb/a) available phosphorus (P), and 560 kg/ha (500 lb/a) exchangeable potassium (K).
- Shellabarger sandy loam with a pH of 6.1, 1.6% organic matter, 37 (33) P, and 575 (513) K.
- Cass loam/sandy loam with a pH of 7.7, 1.2% organic matter, 22 (20) P, and 336 (300) K.
- Keith silt loam with pH of 6.8, 1.3% organic matter, 70 (62) P, and 1930 (1722) K.
- Waldeck, fine sandy loam with pH of 7.2, 1.2% organic matter, 56 (50) P, and 411 (367) K.

The following day, three replications (containers) 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 (5, 6) were prepared: alachlor (Lasso) 2-chloro-N-(2,6-diethylphenyl)-N-(methoxymethyl) acetamide at 2.2 kg/ha (2.0 lb/a), chloroxuron (Tenoran 50W) N'-[4-(4-chlorophenoxy)

[1]Received for publication January 19, 1987; in revised for September 30, 1987. Contribution No. 87-180-J from the Kansas Agricultural Experiment Station. Research sponsored in part by the Biomass Energy Technology Division, US Department of Energy under contract with Oak Ridge National Laboratory Martin Marietta Energy System, Inc.

[2]Professor and Associate Professor, resp.

phenyl]-N, N-dimethylurea at 2.2 kg/ha (2.0 lb/a), DCPA (Dacthal) dimethyl 2,3,5,6-tetrachloro-1,4-benzenedicarboxylate at 11.2 kg/ha (10.0 kg/ha, lb/a), EPTC (Eptam) S-ethyl dipropyl-carbamothioate at 4.5 kg/ha (4.0 lb/a), napropamide (Devrinol) N,N-diethyl-2-(1-naphthalenyloxy) propanamide at 1.1 kg/ha (1.0 lb/a), oxadiazon (Ronstar) 3-[2,4-dichloro-5-(1-methylethoxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2-(3H)-one at 4.5 kg/ha (4.0 lb/a), and profluralin (Tolban 4 E) N-(cyclopropylmethyl)-2,6-dinitro-N-propyl-4-(trifluoromethyl)benzenamine at 0.6 kg/ha (0.5 lb/a), plus a control. A 1 ml aliquot stock solution was mixed with 232 ml of water to simulate a 1.3 cm (0.5 in) irrigation per pot. Applications were made with plastic bottle topped with a sprinkler can head. Water and fertilizer were provided as needed throughout the experimental period in the greenhouse. 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 (90°F) 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

Survival of honey locust was generally unaffected by many of the seven preemergent herbicide treatments evaluated in this study (Table 1). Although grown at different times, survival was similar in all soils. In two of the tests, survival was significantly lower for oxadiazon (Ronstar) at 4.5 kg/ha (4.0 lb/a). Much greater sensitivity to this herbicide was also noticed for black locust seed in a previous study (4).

Height growth of surviving honey locust seedlings was not significantly reduced by the herbicide treatments and the untreated controls, except for oxadiazon (Ronstar) in the Cass sandy loam (Table 2). Height growth in a 365-day field test showed significant improvement with use of alachlor (Lasso), chloroxuron (Tenoran 50W), DCPA (Dacthal), and napropamide (Devrinol) as compared to the control (6). These herbicides reduced broadleaf weed competition, thus allowing better tree seedling growth (6). Generally, treatments in our current greenhouse trials did not cause individual dry weight to differ from the control (Table 3), except for oxadiazon (Ronstar), with which survival was low in the sandy loam soils (35 to 45%). The few surviving seedlings, with less competition, grew to a large size. Chloroxuron (Tenoran) was the one herbicide treatment that was less than the control.

Growth effects between herbicides within various soil types followed similar patterns. Except for oxadiazon (Ronstar), herbicides applied one day after seeding did not decrease honey locust survival and height in our greenhouse studies. Herbicide applications improved height in a single field test (6). However, with all preemergent herbicides, supplemental water must be applied naturally or by irrigation soon after seeding, before weed seeds germinate.

Table 1. Survival of honey locust 60 days after herbicide treatment in different soils.

		Soil type				
Herbicide Type	Rate, ai	Eudora Silty clay loam	Keith Silt loam	Shell. Sandy loam	Cass Sandy loam	Waldeck Sand
	kg/ha (lb/a)			%		
Alachlor (Lasso)	2.2(2.0)	73a[z]	68a	67a	64a	81a
Chloroxuron (Tenoran 50W)	2.2(2.0)	81a	60a	82a	76a	67a
DCPA (Dacthal)	11.2(10.0)	75a	69a	76a	73a	67a
EPTC (Eptam)	4.5(4.0)	68a	55a	75a	68a	60a
Napropamide (Devrinol)	1.1(1.0)	73a	67a	77a	61a	71a
Oxadiazon (Ronstar)	4.5(4.0)	68a	59a	45b	35b	60a
Profluralin (Tolban 4E)	0.6(0.5)	82a	71a	77a	75a	63a
Control	—	84a	51a	65a	72a	84a

[z]Means within a column followed by the same letter or letters do not differ significantly using Duncan's multiple range test, 5% level.

Table 2. Plant height of honey locust 60 days after herbicide treatment in different soils.

		Soil type				
Herbicide Type	Rate, ai	Eudora Silty clay loam	Keith Silt loam	Shell. Sandy loam	Cass Sandy loam	Waldeck Sand
	kg/ha (lb/a)			cm		
Alachlor (Lasso)	2.2(2.0)	17.8[z]	18.3	7.0	13.6ab	20.1a
Chloroxuron (Tenoran 50W)	2.2(2.0)	16.2a	19.1a	7.8a	14.8a	18.3ab
DCPA (Dacthal)	11.2(10.0)	17.1a	16.4a	7.1a	13.1ab	17.3ab
EPTC (Eptam)	4.5(4.0)	15.3a	18.7a	6.3a	13.0ab	18.5ab
Napropamide (Devrinol)	1.1(1.0)	16.1a	16.4a	7.5a	15.1a	20.3a
Oxadiazon (Ronstar)	4.5(4.0)	15.3a	18.8a	6.8a	11.1b	19.4a
Profluralin (Tolban 4E)	0.6(0.5)	15.6a	19.0a	7.6a	14.7a	20.6a
Control	—	15.0a	14.6a	7.0a	14.4a	14.6b

[z]Means within a column followed by the same letter or letters do not differ significantly using Duncan's multiple range test, 5% level.

Table 3. Individual plant dry weight of honey locust 60 days after herbicide treatment in different soils.

Herbicide Type	Rate, ai	Soil type: Eudora Silty clay loam	Keith Silt loam	Sandy Sandy loam	Cass Sandy loam	Waldeck Sand
	kg a.i./ha (lb/a)			(mg)		
Alachlor (Lasso)	2.2(2.0)	280a[y]	560a	670bc	210a	450a
Chloroxuron (Tenoran 50W)	2.2(2.0)	220a	650a	560c	240a	540a
DCPA (Dacthal)	11.2(10.0)	280a	520a	600bc	220a	590a
EPTC (Eptam)	4.5(4.0)	230a	840a	610bc	190a	600a
Napropamide (Devrinol)	1.1(1.0)	250a	600a	610bc	270a	540a
Oxadiazon (Ronstar)	4.5(4.0)	260a	640a	1000a[z]	230a	600a
Profluralin (Tolban 4E)	0.6(0.5)	250a	550a	600bc	250a	610a
Control	—	230a	750a	750b	280a	420a

[y]Means within a column followed by the same letter or letters do not differ significantly using Duncan's multiple range test, 5% level.

[z]Low survival, more growing space resulted in heavier individual trees.

Significance to the Nursery Industry

These data show that herbicides may be a safe alternative to the expensive operation of hand weeding necessary for the production of quality tree seedlings. Some preemergent herbicides, including alachlor (Lasso), chloroxuron (Tenoran 50W), DCPA (Dacthal), EPTC (Eptam), napropamide (Devrinol) and profluralin (Tolban 4E) can be used in honey locust seeding without affecting germination or growth. Further testing is necessary to evaluate weed species control in specific areas. Tank mixes with one or more herbicides may be necessary, and we are presently testing promising combinations with several tree species.

(*Ed. note*: This paper reports the results of research only, and does not imply registration of a pesticide under amended FIFRA. Before using any of the products mentioned in this research paper, be certain of their registration by appropriate state and/or federal authorities.)

Literature Cited

1. Abbott, H.G. and S.D. Fitch. 1977. Forest nursery practices in the United States. J. Forestry 75:141-145.

2. Anderson, H.W. 1968. Two herbicides reduce weeding costs in Washington nursery trials. USFS Tree Planters' Notes. 19:10-14.

3. Dill, T.R. and M.C. Carter. 1972. Screening test of herbicides in white pine, short-leaf pine, Fraser's fir, black locust, ponderosa pine, and Austrian pine seedbeds. Proc. South Weed Control Conf. 25: 217. (Abstr).

4. Geyer, W.A., L. Melichar and C. E. Long. 1987. Preemergent herbicide trials with direct-seeded black locust grown in different soils. J. Arboriculture 13(4).

5. Warmund, M.R., C.E. Long and W.A. Geyer. 1980. Preemergent herbicides for seeded nursery crops. HortScience 15: 825-826.

6. Warmund, M.R., W.A. Geyer and C.E. Long. 1983. Preemergent herbicides for direct seeded Kentucky coffeetree, honeylocust, and black locust. USFS Tree Planters' Notes. Summer, 24-25.

7. White, T.A. and G.L. Rolfe. 1982. Tolerance of direct seeded black locust (*Robinia pseudoacacia* L.) to herbicides. Univ. of Ill. AES For. Res. Rep. 82-100. Urbana, IL. 4 p.

8. White, T.A. and G.L. Rolfe. 1983. A test of tolerance: 1982 greenhouse herbicide trials with direct-seeded black locust. Univ. of Ill. AES. Urbana, Ill. 5 p.