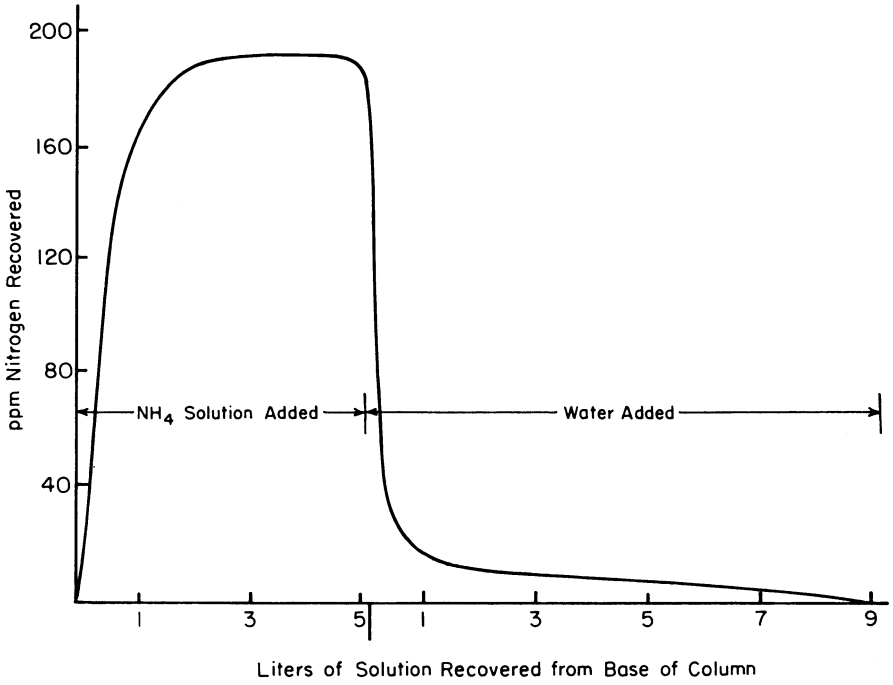

Fig. 1. Nitrogen eluted from a column of milled pinebark when added over a 7 hr period as 200 ppm N from $(NH_4)_2SO_4$, then flushed with water.

um nitrogen from a pine bark medium. The ammonium N levels in a pine bark substrate are reduced below optimum levels for plant growth with as few as 3 irrigations. The amount of ammonium remaining in a pine bark substrate after leaching is small.

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Preemergent Herbicides for Seeded Nursery Crops[1]

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Abstract. **Ten preemergent herbicides were applied to the medium surface of nursery containers 1 day after seeds of *Gymnocladus dioicus* (L.) K. Koch, *Gleditsia triacanthos* L., and *Robinia pseudoacacia* L. were planted to test herbicide effects on seedling survival and growth. Species varied in response to herbicides, with *Robinia* most affected by treatments. Most herbicides did not reduce seedling survival, plant height, or dry weight.**

High labor costs have made hand weeding non-economical for tree seedling production. Abbott and Fitch (1) reported that hand weeding can represent 10 to 90% of total production costs in seedling nurseries. Much of the past weed control research on woody plants has focused on preemergent herbicides on established stock, which do not eliminate the need for hand weeding during germination and early seedling stages (2, 4, 5, 7).

Studies by the Prairie Farm Rehabilitation Administration (PFRA) demonstrated that diphenamid + dinoseb applied at seeding did not significantly reduce germination of *Ulmus pumila* L., *Ulmus americana* L., or *Elaeagnus angustifolia* L. (8). In later studies, the PFRA noted that trifluralin at 2.2 kg/ha was not phytotoxic to germinating seeds of *Fraxinus pennsylvanica* Marsh., but reduced the stand of *Ulmus pumila* (3). Dill and Carter (6) reported that *Robinia pseudoacacia* was tolerant of 2× the rates of trifuluralin and EPTC applied to seedbeds. South, Crowley, and Gjerstad (9) also found that *Pinus* species were tolerant of herbicides applied after planting and mulching. Trifluralin at 1.1, diphenamid at 4.5, and profluralin at 2.2 kg/ha controlled weeds without affecting seedling production, but *Pinus* seedlings were nontolerant of oryzalin at 2.2 kg/ha and napropamide at 6.7 kg/ha.

Results from these studies indicate that preemergent herbicides may be used on selected woody plants without affecting germination, however, tolerance to herbicides varies with tree species.

The purpose of this study was to test survival and growth of *Gymnocladus dioicus, Gleditsia triacanthos,* and *Robinia pseudoacacia* treated with preemergent herbicide 1 day after seeds were planted.

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Table 1. Survival, plant height, and dry weight of *Gymnocladus dioicus*, *Gleditsia triacanthos*, and *Robinia pseudoacacia* 60 days after planting.[z]

Treatment	Rate (kg a.i./ha)	*Gymnocladus dioicus* Survival	*Gymnocladus dioicus* Plant ht (cm)	*Gymnocladus dioicus* Dry wt (mg)	*Gleditsia triacanthos* Survival	*Gleditsia triacanthos* Plant ht (cm)	*Gleditsia triacanthos* Dry wt (mg)	*Robinia pseudoacacia* Survival	*Robinia pseudoacacia* Plant ht (cm)	*Robinia pseudoacacia* Dry wt (mg)
Alachlor	2.2	24.3a[y]	23.4ab	730abc	21.8abc	19.6ab	380abc	16.0bcde	8.0abcd	170b
	4.5	22.5ab	25.5ab	830ab	19.8abcde	19.7ab	410ab	15.5cde	6.7cd	140b
Chlorpropham	3.6	22.8ab	23.5ab	690abc	19.3abcde	16.4d	370abc	5.3gh	6.4d	330ab
	6.7	17.8de	17.6c	600c	17.5def	11.3ef	200d	2.8h	6.2d	610a
Chloroxuron	2.2	24.0a	25.1ab	720abc	21.0abcd	19.8ab	390abc	17.5abcd	10.0ab	150b
	4.5	23.8a	25.3ab	780abc	19.8abcde	19.0abc	390abc	15.3cde	10.0ab	170b
DCPA	6.7	24.5a	26.1ab	720abc	18.8bcdef	17.9bcd	390abc	16.3bcde	9.4abc	140b
	11.2	22.5ab	22.8b	740abc	23.0a	20.7a	440a	17.8abcd	9.9ab	240ab
Diphenamid	4.5	23.3ab	26.3ab	750abc	21.3abcd	18.8abc	370abc	15.5cde	8.4abcd	150b
	9.0	22.3ab	25.8ab	670abc	19.5abcde	18.0bcd	290bcd	11.8ef	8.5abcd	240ab
EPTC	2.2	17.5de	24.5ab	880a	17.8cdef	12.4e	280cd	18.0abcd	8.5abcd	130a
	4.4	15.8e	22.3b	840ab	11.0g	10.1f	270cd	20.8ab	7.9bcd	90b
Napropamide	1.1	21.5abc	24.4ab	670abc	20.0abcde	19.2abc	420ab	16.5bcde	10.2ab	130b
	2.2	21.8abc	23.2b	670abc	22.5ab	19.2abc	340abc	13.0de	9.5abc	140b
Oryzalin	1.1	22.8ab	25.7ab	810abc	21.5abcd	19.1abc	350abc	15.3cde	6.7cd	120b
	2.2	23.3ab	23.0b	640bc	23.0a	16.9cd	300bcd	8.0fg	2.2e	510ab
Oxadiazon	2.2	19.8bcd	27.5a	740abc	16.8ef	19.0abc	390abc	14.8cde	9.6ab	150b
	4.5	18.8cde	23.0b	780abc	15.3f	18.5abcd	450a	16.3bcde	9.9ab	130b
Profluralin	0.6	24.0a	24.5ab	760abc	20.5abcde	17.9bcd	370abc	21.8a	10.0ab	100b
	1.1	24.8a	23.1b	690abc	18.3cdef	19.2abc	450a	15.8bcde	10.8a	180b
Control	–	23.8a	26.2ab	760abc	21.3abcd	18.9abc	380abc	19.8abc	10.9a	150b

[z]Means represent 4 replications of 25 seedlings.

[y]Means separation in columns by Duncan's multiple range test, 5% level.

Seed of all 3 species was scarified with concentrated sulfuric acid. *Gymnocladus* seed was acid treated for 120 min, *Gleditsia* and *Robinia* for 60 min. Twenty-five seeds of each species were planted in individual 3.8 liter plastic nursery containers in a medium of 2 sand:1 peat (by vol). *Gymnocladus* seeds were planted at 2.5 cm depth, *Gleditsia* at 1.3 cm, and *Robinia* at 0.6 cm.

The following day 4 replications of each treatment were applied to the soil surface and containers were randomized by tree species. Treatments in kg/ha were alachlor (2-chloro-2′, 6′-diethyl-N-(methoxymethyl) acetanilide) at 2.2 and 4.5, chlorpropham (isopropyl m-chlorocarbanilate) at 3.4 and 6.7, chloroxuron (3-[p-(p-chlorophenoxy) phenyl]-1, 1-dimethylurea) at 2.2 and 4.5, DCPA (dimethyl tetrachloroterephthalate) at 6.7 and 11.2, diphenamid (N, N-dimethyl-2, 2-diphenylacetamide) at 4.5 and 9.0, EPTC (S-ethyl dipropylthiocarbamate) at 2.2 and 4.5, napropamide (2-(α-napthoxy)-N, N-diethyl propionamide) at 1.1 and 2.2, oryzalin (3,5-dinitro-N^4, N^4-dipropylsulfanilamide) at 1.1 and 2.2, oxadiazon (2-tert-butyl-4-(2,4-dichloro-5-isopropoxyphenyl)-Δ^2-1,3,4-oxadiazolin-5-one) at 2.2 and 4.5, and profluralin (N-(cyclopropylmethyl)-α,α, α-trifluoro-2, 6-dinitro-N-propyl-p-toluidine) at 0.6 and 1.1.

Procedure for herbicide application was to prepare chemical stock solutions for each treatment. A 1 ml aliquot of stock solution was withdrawn and mixed with 232 ml of water to simulate a 1.3 cm irrigation per pot. Applications were made with a plastic bottle topped with a sprinkler can head. Water and fertilizer was provided as needed throughout the experimental period. Seedling counts were made at 6 day intervals. Sixty days after seeding, plant height and final survival counts were taken. Plants were cut at the soil surface and oven dried at 65°C for 48 hr for dry wt measurements.

Chlorpropham at 6.7 kg/ha, EPTC, and oxadiazon significantly reduced *Gymnocladus* seedling survival (Table 1). The growing point was necrotic in EPTC treatments. Dead plants in the oxadiazon treatments had constricted necrotic stems. Chlorpropham at 6.7 kg/ha resulted in shorter plants than the control, while seedlings in medium treated with oxadiazon at 2.2 kg/ha were taller, with thin stems and leggy growth. Treatments did not cause dry weight to differ from control.

EPTC at 4.5 kg/ha and oxadiazon at both rates reduced survival of *Gleditsia* seedlings Both rates of chloropropham and EPTC caused *Gleditsia* seedlings to be shorter than the control. Dry weight of *Gleditsia* seedlings grown in medium treated with chlorpropham at 6.7 kg/ha was significantly less than control seedlings.

Robinia seedlings grown in medium treated with chlorpropham at both rates, napropamide at 2.2, oryzalin at 2.2, and diphenamid at 9.0 kg/ha had decreased survival. *Robinia* seedlings were shorter than control in medium treated with chlorpropham, oryzalin, EPTC at 4.5, and alachlor at 4.5 kg/ha. In EPTC treatments *Robinia* leaves were deformed, reduced in size, and never fully expanded. Dry weight of surviving plants grown in chlorpropham at 6.7 kg/ha was greater than the control.

The 3 species responded differently to each herbicide treatment. These results indicate that selectivity is dependent upon the herbicide and species. Most herbicides used in this study did not decrease seedling survival or growth. Thus, herbicide application 1 day after planting may be an alternative to hand weeding in seedling nurseries. However, weed control evaluations under field conditions are necessary before such a practice is recommended.

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