THE EFFECTS OF DEPTH OF INCORPORATION OF EPTC CONTAINING ANTIDOTE AND EXTENDER ON CORN AND WEED CONTROL

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ABSTRACT

One objective of this study was to determine whether there were differences in the weed control produced by various formulations of EPTC containing no antidote, antidote, and antidote plus extender. Another objective was to ascertain whether incorporation depths had any effect on efficacy and longevity of these formulations. Two formulations of the antidote plus extender were used; in one the ratio of extender to active EPTC was 12:1, in the other 6:1.

Rates of 4 and 6 lb/A of the four formulations were applied to predesignated plot areas and subsequently incorporated to depths of 1 to 2 inches (shallow) and 3 to 4 inches (deep). Corn planting followed incorporation.

At emergence the experimental area was treated with cyanazine at 1.5 lb/A for broadleaf control thus making it easier to evaluate formulations and incorporation depths by the yellow nutsedge and annual grasses that were present which served as indicators.

From this study it was observed that deep incorporation was more effective than shallow incorporation for all formulations on all weed species. Regardless of the depth of incorporation, control of nutsedge was best from the formulation containing antidote alone and this difference persisted into the season. There were no great differences between the other formulations. With regard to annual grasses, there were no measurable differences in grass control between any of the formulations.

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EFFECTS OF INCORPORATION DEPTH ON ALACHLOR, ACETOCHLOR, AND CYANAZINE IN CORN

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ABSTRACT

Alachlor, acetochlor, cyanazine, and the combination of alachlor plus cyanazine were evaluated for weed control in corn. These herbicides and herbicide combinations were applied to the surface, lightly incorporated, and normally incorporated. From this study it was noted that control of redroot pigweed and grasses was not enhanced by incorporation depths for alachlor and acetochlor and for redroot pigweed by alachlor plus cyanazine. Control of lambsquarters and velvetleaf was improved by incorporation of alachlor but not with acetochlor. Incorporation of cyanazine had a beneficial effect on the control of lambsquarters and velvetleaf but not on the grasses.

INTRODUCTION

That incorporation improves weed control of some herbicides over surface applications is well known and has been demonstrated in many research findings. Conversely, incorporation can also decrease weed control efficacy with other herbicides. Furthermore, incorporation can improve control of some species germinating for depths greater than normal while not improving control of other species. The objectives of this study were to (1) to investigate whether the new acetanilide herbicide, acetochlor, compares favorably with alachlor, a closely related herbicide; (2) to determine whether weed control from these herbicides, as well as cyanazine, is affected by incorporation depths; and (3) to determine whether weed control activity of the combination, alachlor plus cyanazine, is affected by depths of incorporation.

MATERIALS AND METHODS

Corn (*Zea mays* L. 'Midstates 747') was planted on May 6 in a Freehold sandy loam soil, in 30-inch rows, at the Adelphia Research Center, New Jersey Agricultural Experiment Station, Adelphia, New Jersey. Prior to planting, the experimental site was marked into

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plot areas 4 rows wide x 20' in length to receive herbicide spray applications. Alachlor, acetochlor, cyanazine, and alachlor plus cyanazine were applied to predesignated plot areas in 40 gpa sprays with an experimental CO_2-propelled backpack sprayer. Immediately after herbicide applications, the treatments were incorporated with a tractor-drawn roterra to depths of one inch (surface blend) or 3 to 4 inches (incorporated). After this procedure corn was planted with a tractor-drawn planter at the usual depth for corn. Plots were then reestablished and those scheduled to receive preemergence treatments were then applied. All herbicide and incorporated depths used in this study are presented in Table 1.

Periodic observations were made during the study on crop response and weed control. Control of individual species was recorded on June 6 and August 5, approximately 3 and 11 weeks after herbicide application, respectively. Ratings were made using the scale 0 to 10, where 0 = no control and 10 = complete control. Weeds present on the experimental site included lambsquarters (Chenopodium album L.), redroot pigweed (Amaranthus retroflexus L.), velvetleaf (Abutilon theophrosti Medic), fall panicum (Panicum dichotomiflorum Michx.), and yellow foxtail (Setari lutescens (Weigel)).

On October 1, 1980, the two center rows of the four-row plots harvested and yields recorded after being corrected to 15-5% moisture.

RESULTS AND DISCUSSION

Weed control results for the two observation dates and yields of grain corn for the various herbicide-incorporation treatments are presented in Table 1. Since fall panicum and yellow foxtail were approximately in the same proportions on the experimental site and since they responded almost similarly to all treatments, they are summarized as "grasses" in the table. Corn was not adversely affected by any of the herbicide-incorporation treatments so these response data are not included in the summary.

From Table 1 it is evident that control of redroot pigweed and grasses was not improved with the two incorporation depths over surface applications for alachlor and acetochlor and for redroot pigweed for the combination alachlor plus cyanazine. Furthermore, the degree of control from these herbicides and herbicide combinations persisted until late in the growing season (August 5).

Acetochlor was more effective than alachlor on lambsquarters and velvetleaf and control of lambsquarters was slightly improved

Table 1. The effects of incorporation depth on early and late season weed control with alachlor, acetochlor, cyanazine, and alachlor plus cyanazine in corn.

Herbicide	Rate, lb/A	Incorporation depth	Weed Control								Yield* bu/A
			Lambsquarters		Redroot pigweed		Velvetleaf		Grasses		
			6/6	8/5	6/6	8/5	6/6	8/5	6/6	8/5	
alachlor	1.5	surface (pre)	5.0	4.3	10.0	10.0	6.1	9.0	9.2	9.8	66.52a
		surface blend	5.1	1.7	10.0	10.0	6.3	6.7	9.7	10.0	68.28a
		incorporated	5.5	4.2	10.0	10.0	7.1	8.3	9.1	9.3	76.72a
acetochlor	1.125	surface	7.8	6.3	10.0	10.0	8.3	4.0	9.8	9.6	76.73a
		surface blend	7.4	5.5	10.0	9.7	9.5	8.3	10.0	9.7	67.31a
		incorporated	7.8	7.7	10.0	7.0	8.0	6.3	9.3	9.7	89.44a
cyanazine	2.0	surface	6.8	7.5	9.9	7.3	7.0	8.0	4.2	0.0	58.24a
		surface blend	7.3	8.3	6.0	7.3	7.1	7.7	6.0	2.7	102.62a
		incorporated	8.0	9.5	8.3	7.0	8.5	7.8	5.9	4.3	102.37a
alachlor + cyanazine	1.5+1.5	surface	10.0	9.8	10.0	10.0	8.5	6.8	5.9	9.2	88.05a
		surface blend	8.4	8.0	10.0	10.0	9.0	6.2	9.4	9.0	104.01a
		incorporated	9.3	9.5	10.0	10.0	8.8	7.2	9.0	9.2	92.48a
Check - cultivated			10.0	6.7	10.0	10.0	10.0	9.0	10.0	7.7	54.74a

*Means with the same letter are not significantly different according to Duncan's New Multiple Rank Test.

with increasing depth of incorporation of alachlor but no such response was noted for acetochlor. Control of velvetleaf was not improved with incorporation depth of acetochlor but increased with incorporation of alachlor. This improved control of velvetleaf with acetochlor persisted at least until the last observation date (August 5) but was not evident with alachlor. With the latter, the initial differences due to depth of incorporation were obliterated.

Depth of incorporation had some effect on the performance of cyanazine used alone. As incorporation depth increased, control of lambsquarters and velvetleaf was improved but no such effect was noted for redroot pigweed of the grasses. Effectiveness of alachlor plus cyanazine was not improved with depth of incorporation over the surface application for lambsquarters, redroot pigweed, and velvetleaf; however, the two incorporated treatments were slightly better than the surface application for grasses.

Yields of corn were not significantly different among all treatments. Trends of increasing yields, however, appeared in treatments with incorporating cyanazine or alachlor plus cyanazine.

From this study it was learned that incorporation of alachlor, acetochlor, cyanazine, and the combination of alachlor plus cyanazine does not markedly improve the performance of these herbicide treatments although some improvement in control was observed.

SOME ACETANILIDE HERBICIDES AND INCORPORATED SEQUENTIALS IN CORN

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ABSTRACT

Preemergence alachlor and metolachlor were evaluated for weed control and crop response in corn. In addition, some additional plots of these herbicides were followed by postemergence directed sprays of pendimethalin and pendimethalin plus atrazine and incorporated immediately after application. Preemergence applications of alachlor and metolachlor produced almost comparable weed control but yields with alachlor were slightly greater than those with metolachlor. Weed control was improved with pendimethalin and pendimethalin plus atrazine and these effects were reflected in significant yield increases.

INTRODUCTION

The acetanilide herbicides, alachlor [2-chloro-2', 6'-diethyl-N-(methoxymethyl) acetanilide] and metolachlor [2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetanilide] are effective preemergence herbicides either surface applied or when incorporated prior to planting for use in corn, particularly for the control of annual grasses. Atrazine (2-chloro-4-ethylamine-6-isopropylamino-s-triazine) has also been widely used in a similar manner and is more effective on broadleaf weeds than grasses. Pendimethalin (N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzeneamine) a dinitroaniline herbicide, is effective on annual grasses, but can only be safely applied as a preemergence treatment because preplant incorporated applications often injure corn. The objectives of this study were as follows: (1) to compare alachlor and metolachlor as preemergence herbicides; (2) to determine whether incorporated atrazine plus pendimethalin can also be used with safety when sequentially applied over the acetanilide herbicides; and (3) to determine whether greater weed control could be obtained from the single and combination post-emergence treatments.

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MATERIALS AND METHODS

Corn (Zea mays L. 'Midstates 747') was planted in 30-inch rows on May 19, 1980, in Freehold sandy loam soil at the Adelphia Research Center, New Jersey Agricultural Experiment Station, Adelphia, New Jersey. Immediately after planting, plots 4 rows wide x 20' were established to receive herbicide treatments. Preemergence herbicides were applied the same day in 40 gpa water using a CO_2-propelled backpack sprayer. All plots that included alachlor and metolachlor were applied preemergence. On June 5, approximately three weeks after planting pendimethalin and pendimethalin plus atrazine were applied as post directed treatments in the same volume of spray and incorporated with a rototiller to a depth of 3 inches to simulate cultivation. All treatments were replicated three times in a randomized complete block design. All herbicide treatments are presented in Table 1.

Throughout the course of the investigation, observations were made on crop response and weed control and detailed ratings made on specific weeds on June 6 and August 5 using the scale 0 to 10, where 0 = no effect on crop and no weed control and 10 = elimination of crop or complete weed control. Weeds in the experimental area included lambsquarters (Chenopodium album L.), redroot pigweed (Amaranthus retroflexus L.), velvetleaf (Abutilon theophrasti Medic.), fall panicum (Panicum dichotomiflorum Michx.), and yellow foxtail (Setaria lutescens (Weigel)).

On October 3 the middle two rows were harvested for yield determinations and adjusted to bushels per acre at 15.5% moisture.

RESULTS AND DISCUSSION

In Table 1 are presented the herbicide treatments investigated, weed control data, and yields of corn. Since there was approximately equal amounts of fall panicum and yellow foxtail in the experimental area and since they responded similarly to the herbicides, they are both included as "grasses" in the table. Not included in this summary are the responses of corn to the various herbicide treatments since there were no adverse effects on the crop from any of the treatments. Weed control data are those from the August 5 observation date since there were no great differences in these data from those taken earlier on June 6. Furthermore, we were more interested in late season control than control produced early in the season.

From Table 1 it can be seen that there were no great differences in control of grasses from alachlor and metolachlor applied alone.

Table 1. Weed control in corn with preemergence alachlor and metolachlor applied alone and with postemergence incorporated overlays of pendimethalin and pendimethalin plus atrazine.

Herbicides	Rate, lb/A	Weed Control (1) Lambs-quarters	Redroot Pigweed	Velvet-leaf	Grasses	Yield (2) Bu/A
alachlor	1.5	7.7	10.0	3.0	9.5	75.0 b
	2.0	9.5	10.0	3.5	9.9	66.8 b
alachlor foll. by pendimethalin	1.5 + 1.0	9.9	10.0	9.9	9.8	115.6 a
	1.5 + 1.5	10.0	10.0	10.0	10.0	133.6 a
alachlor foll. by pendimethalin + atrazine	1.5 + (1.0 + 1.0)	10.0	10.0	10.0	9.9	121.6 a
metolachlor	1.5	2.0	10.0	0.3	9.8	32.8 c
	2.0	7.9	6.7	3.0	9.8	24.6 c
metolachlor foll. by pendimethalin	1.5 + 1.0	9.9	10.0	10.0	9.9	108.2 a
	1.5 + 1.5	10.0	10.0	10.0	10.0	114.4 a
metolachlor foll. by pendimethalin + atrazine	1.5 + (1.0 + 1.0)	10.0	10.0	10.0	10.0	126.6 a
Check - cultivated	-	10.0	10.0	10.0	10.0	44.8 b

(1) Based on scale 0 to 10 where 0 = no control and 10 = complete control.
(2) Yields followed by the same letter are not statistically significant.

There were differences in the control of velvetleaf and lambs-quarters, however.Alachlor effected better control of these broadleaf weeds than metolachlor and this was reflected in yields of corn. Follow-up applications of pendimethalin improved control of all weeds but particularly of velvetleaf and lambsquarters. It is recognized that during the incorporation process some mechanical control was obtained on these weeds; however, it is felt that the herbicides, too, effected control of these species since the plots were essentially weed-free late in the growing season.

The same rationale may be applied to the combination treatment of pendimethalin plus atrazine. This combination was very effective in improving the control of alachlor and metolachlor when used alone. It is apparent that the combination of pendimethalin plus atrazine did not improve the degree of weed control produced by pendimethalin alone. Mechanical tillage may have contributed to this in large measure.

SEQUENTIAL USE OF DICAMBA IN CORN FOLLOWING ACETANILIDE HERBICIDES

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ABSTRACT

Weed control from dicamba significantly enhanced corn yields when used after alachlor or metolachlor. Yields of corn were significantly greater with alachlor alone than with metolachlor alone.

There was no significant difference in corn yields between early or late postemergence dicamba treatments following alachlor or metolachlor.

INTRODUCTION

The acetanilide herbicides, alachlor and metolachlor, have been found to be effective when applied preemergence to annual grasses and some broadleaf weeds. They do not control lambsquarters or velvetleaf. Preemergence applications of dicamba gives good control of the above weeds but is injurious to corn. With these principles in mind, an experiment was designed in which preemergence alachlor and metolachlor were followed by non-directed overall postemergence applications of dicamba at the 2 to 4 leaf and 8 to 10 leaf stages of corn development.

MATERIALS AND METHODS

The experiment is a continuation of a series of experiments to determine efficient combinations of herbicides as well as proper timing of application. Preemergence applications of alachlor (2-chloro-2',6'-diethyl-N-(methoxymethyl) acetanilide and metolachlor 2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl) acetanilide were combined with early and late postemergence applications of dicamba (3,6-dichloro-0-anisic acid). The acetanilides at preemergence rate of 2 lb/A (2.24 kg/ha) were followed by dicamba after 13 and 27 days at 0.5 lb/A (0.56 kg/ha) and 0.25 lb/A (0.28 kg/ha), respectively. The objectives of this experiment were to evaluate the effectiveness of the herbicides alone and in combination.

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The experiment was conducted on a Holmdel loam at the Soils and Crops Research Center, New Jersey Agricultural Experiment Station, Adelphia, N. J., with 1.5% organic matter. The 4-row plots were 12' x 20' (3.7 x 6.1 m) with yield determined from two middle rows. There were 3 replicates of all treatments in a randomized complete block design. Herbicides were applied using a CO_2-propelled backpack sprayer. Preemergence treatments were applied May 9 after corn planting on May 7. Early and late post-emergence dicamba treatments were made on May 22 and June 5. Corn and weeds were rated twice using a system with 0 = no crop injury or weed control, 10 = complete crop stand or vigor reduction or total weed kill (see Table 2). Soil and weather conditions were favorable for all treatments.

RESULTS AND DISCUSSION

Combining a postemergence dicamba treatment with alachlor or metolachlor significantly increased corn yields and reduced competition by lambsquarters and velvetleaf as reflected in weed ratings. Corn yelds on acetanilide plots were significantly better with alachlor alone rather with metolachlor alone. Alachlor alone, alachlor with dicamba and metalachlor with dicamba produced significantly higher yields than metolachlor alone, the unweeded check or dicamba alone. The yields from metolachlor alone were significantly higher (at .05) than with dicamba alone. Alachlor alone or in combination with dicamba at both rates (see Table 1) or metolachlor with dicamba at all rates were not significantly different.

Table 1. Herbicide Treatments and Corn Yields.

Herbicide	Rate		Yield	
	lb/A	Kg/ha	bu/A	Kg/ha
alachlor	2.00	2.24 (pre)	113.6	7014.3
alachlor dicamba	2.00 0.50	2.24 (pre) 0.56 (early post)	119.5	7378.6
alachlor dicamba	2.00 0.25	2.24 (pre) 0.28 (late post)	111.2	6866.1
alachlor dicamba dicamba	2.00 0.50 0.25	2.24 (pre) 0.56 (early post) 0.28 (late post)	119.0	7347.7
metolachlor	2.00	2.24 (pre)	73.0	4507.4**
metolachlor dicamba	2.00 0.50	2.24 (pre) 0.56 (early post)	118.6	7323.0
metolachlor dicamba	2.00 0.25	2.24 (pre) 0.28 (late post)	112.5	6946.4
metolachlor dicamba dicamba	2.00 0.50 0.25	2.24 (pre) 0.56 (early post) 0.28 (late post)	101.3	6254.8
dicamba	0.50	0.56 (early post)	60.8	3754.1**
dicamba	0.25	0.28 (late post)	47.0	2902.0**
cult. check	-	- -	97.6	6026.4**

a = .05, LSD = 1568.3; **a = .01, LSD = 2136.4

Table 2. Weed Ratings for Postemergence Dicamba Corn Experiment.

Herbicide	Rate lb a.i./A	Weed Control			
		Lambs-quarters S	Pigweed S	Velvet-leaf S	Grasses S
alachlor LASSO 4E	2.0	4.7	10.0	0.3	10.0
metolachlor DUAL 8E	2.0	3.3	9.9	0.0	10.0
alachlor (pre) foll. by dicamba (E. post; 2-leaf)	2.0 (pre) + 0.5 (post)	10.0	10.0	2.3	10.0
alachlor (pre) foll. by dicamba (L. post; 12-24")	2.0 (pre) + 0.25 (post)	9.4	10.0	0.3	10.0
alachlor (pre) foll. by dicamba (E. post; 2-leaf) foll. by dicamba (L. post; 12-24" tall)	2.0 (pre) + 0.5 (post) + 0.25 (post)	10.0	10.0	6.7	10.0
metolachlor (pre) foll. by dicamba (E. post; 2-leaf)	2.0 (pre) + 0.5 (post)	10.0	10.0	2.7	10.0
metolachlor (pre) foll. by dicamba (L. post; 12-24")	2.0 (pre) + 0.25 (post)	5.7	10.0	0.0	10.0
metolachlor (pre) foll. by dicamba (E. post, 2-leaf) foll. by dicamba (L. post; 12-24" tall)	2.0 (pre) + 0.5 (post) + 0.25 (post)	10.0	10.0	6.7	10.0
dicamba (E. post; 2-leaf)	0.5 (post)	10.0	10.0	3.0	1.7
dicamba (L. post; 12-24" tall)	0.25 (post)	0.3	9.0	0.0	0.3

THE SITE OF UPTAKE OF ATRAZINE, CYANAZINE, AND PENDIMETHALIN BY VELVETLEAF

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ABSTRACT

Studies were conducted to determine the preemergence and postemergence site of uptake of atrazine, cyanazine and pendimethalin by velvetleaf. Velvetleaf seedlings possess two distinct zones when growing through the soil soon after germination: the root zone and the shoot zone. These two zones were separated by a charcoal buffer zone to prevent herbicide movement from one zone to the other. Atrazine completely controlled plants when applied only to the shoot zone. When it was applied only to the root zone, however, there was very littel effect (Figure 1). Cyanazine also provided excellent control when applied to the shoot zone, and gave good control in root zone, with root applications taking only slightly longer to kill the plants. Pendimethalin stopped all shoot growth when applied in the shoot zone and stopped root growth in the root zone when applied there. The shoots of plants treated with pendimethalin in the root zone were healthy and were living on extensive roots that had developed in the shoot zone.

Postemergence site of uptake work showed that both atrazine and cyanazine are primarily root absorbed (Figure 2), and have very little effect when applied to the foliage under glasshouse humidity conditions. Pendimethalin exhibited both foliar and root absorption, with foliar absorption being slightly more effective.

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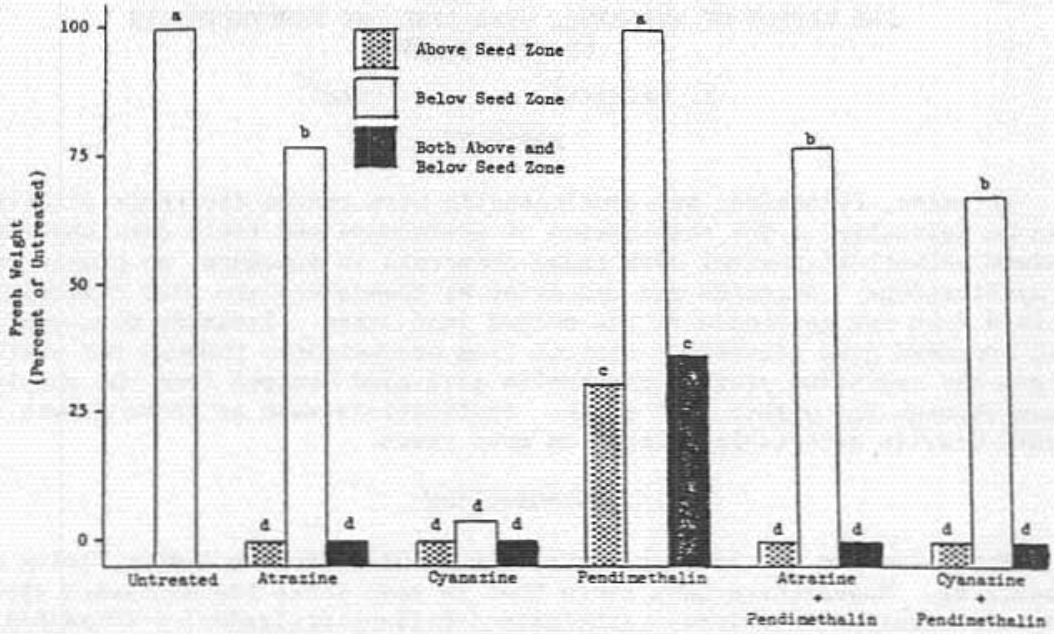

FIGURE 1 The effect of atrazine, cyanazine and pendimethalin applied above the seed, below the seed, or both above and below the seed. Data represents the mean of 6 replications. Bars having similar letters are not significantly different at the 5% level.

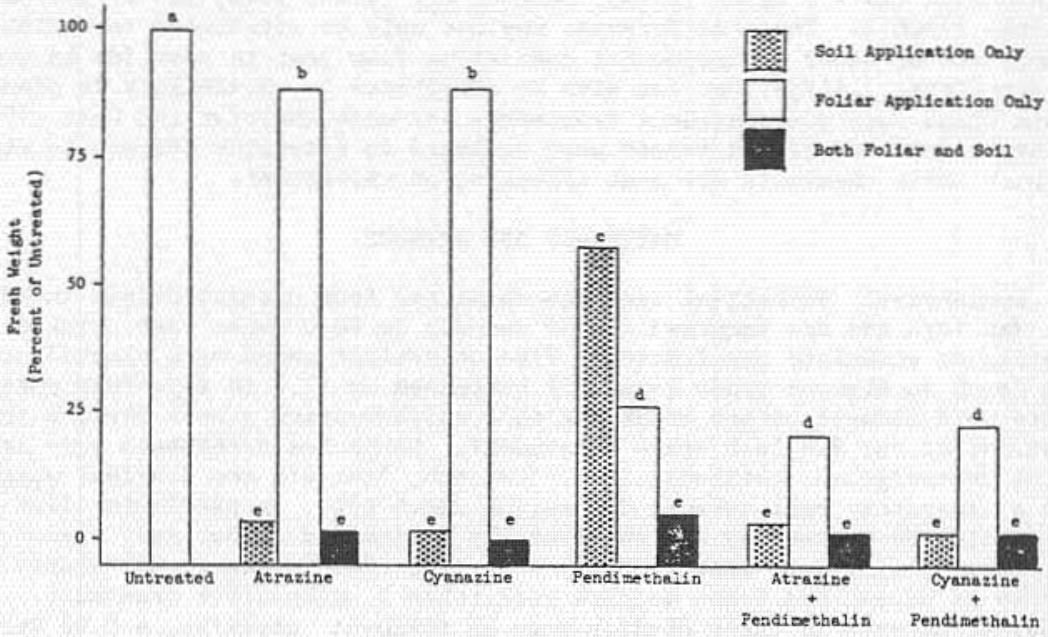

FIGURE 2 The effect of atrazine, cyanazine and pendimethalin applied to the soil, foliage, or both soil and foliage at the 3rd leaf stage. Data represents the mean of 6 replications. Bars having similar letters are not significantly different at the 5% level.

THE EFFECT OF ATRAZINE, CYANAZINE AND PENDIMETHALIN ON VELVETLEAF

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ABSTRACT

Atrazine, cyanazine, and pendimethalin were tested for their effectiveness on velvetleaf. The combination of greenhouse and field data shows that maximum velvetleaf control with these chemicals is dependent on proper timing of applications. Atrazine and cyanazine by themselves are most effective when applied from the cotyledon to the second leaf stage. Atrazine plus pendimethalin provided good velvetleaf control from preemergence through the sixth leaf stage, and cyanazine plus pendimethalin gave good control from the cotyledon stage through the eighth leaf stage. Applications made at these growth stages should provide acceptable control in most years.

INTRODUCTION

The effective use of many herbicides is dependent on proper timing of applications. Researchers have shown that in some years postemergence applications of atrazine [2-chloro-4(ethylamino)-6-(isopropylamino)-5-triazine], cyanazine [2[[4-chloro-6-ethylamino-5-triazine-2-yl] amino [-2-methylpropionitrile [2-chloro-4-(1-cyano-1 methylethylamino)-5-triazine]] and pendimethalin [N-Cl-ethylpropyl)-3,4 dimethyl-2,6 dinitrobenzeneamine] to velvetleaf (Abutilon theophrasti Medic.) may be more effective than preemergence treatments; while in other years preemergence and postemergence treatments both provide good control, or postemergence treatments may fail and preemergence applications work well (Harvey and Ruscoe [1974], Harvey et al. [1977], Donald et al. [1976], Illnicki and Micheika [1977], Bayer [1978], Duke et al. [1977, 1978, and 1979], Malefyt and Duke [1980]). These differences may not only be attributed to variability in moisture or other environmental conditions from year to year (de la Cruz and Staniforth [1969]), but can also be attributed to variability in plant growth stage when postemergence treatments are made (Malefyt and Duke [1980]). The experiments described herein were designed to determine the growth stage at which these chemicals are most effective on velvetleaf.

MATERIALS AND METHODS

Greenhouse: Velvetleaf seed was collected from natural origin in Waterloo, New York and was immersed for 30 seconds in 80 C water just prior to planting to stimulate germination. Five velvetleaf seeds were planted at a 2 cm depth in Elmwood sandy loam soil contained in 12.7 cm styrofoam pots. Plants were thinned before treatment to 2 uniform-sized plants per pot (one plant/pot at the 8th leaf stage treatment). Herbicide treatments were applied at the preemergence, cotyledon, 2nd, 3rd, 4th, 5th, 6th and 8th-leaf stages with a laboratory belt sprayer delivering 280.6 L/ha. A particular leaf stage was considered reached by a plant when the designated number leaf opened from the cupped position to approximately 1 cm from edge to edge. All plants were watered as needed and fresh weights were taken 3 weeks after treatment. The formulations used in these studies were as follows: atrazine, a 0.68 kg/l

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flowable liquid; cyanazine, an 80% wettable powder; and pendimethalin, a 0.68 kg/l emulsifiable concentrate.

Field: An experiment was conducted on Honeyoye-Lima silt loam soil located on the agronomy research farm in Aurora, New York. The field was plowed and disked in the spring and later received a broadcast application of 136.2 kg/ha of 15-15-15 fertilizer, which was incorporated by disking. Velvetleaf seed was planted in 76.2 cm rows with a "John Deere" sugarbeet planter. Plants were spaced approximately 6 cm apart. All plots received a 2.24 kg/ha application of alachlor (2-chloro-2'6'-diethyl-N-(methoxymethyl) acetanilide) preemergence and a 0.56 kg/ha application of dinoseb (2-sec-butyl-4, 6-dinitrophenol) on June 14, 1980 when the velvetleaf had approximately 3 leaves. Specific herbicide treatments for velvetleaf control were applied at the preemergence, 1st, 3rd, 4th, 5th, 6th and 8th leaf stages. These treatments were made with a bicycle sprayer which delivers approximately 233.8 L/h. Four weeks after treatment (or emergence in the preemergence treatment) 25 plants were harvested from the center two rows of each plot. These plants were then dried and dry weights were taken. The experiment was established in a randomized block design with 3 replications and plot sizes 3.05 m x 3.55 m. Herbicides were applied on the following dates: preemergence - May 15, 1980; 1st leaf stage - May 30, 1980; 3rd leaf stage - June 11, 1980; 4th leaf stage - June 17, 1980; 5th leaf stage - June 23, 1980; 6th leaf stage - June 26, 1980; and 8th leaf stage - July 1, 1980.

RESULTS AND DISCUSSION

In general, all herbicide treatments provided less control the longer applications were delayed (Table 1 and Table 2) irrespective of whether plants were evaluated under greenhouse or field conditions. Growth conditions did however, have a dramatic effect on general herbicide performance in that some chemicals provided more activity under glasshouse conditions and some provided more activity under field conditions. In order to more completely elucidate and differentiate these and other specific effects, results below will be given by individual chemicals.

Atrazine: Atrazine was most effective, both in the greenhouse and in the field, when applied at the cotyledon, 1st or 2nd leaf stage (Table 1.1 and 1.2). At these growth stages in the greenhouse, even 0.56 kg/ha provided extremely effective control. Atrazine at 2.24 kg/ha also provided excellent control preemergence and at the 3rd leaf stage (Tables 1.1 and 1.2). The 4th and 5th leaf stages also gave greater than 75% control both in the greenhouse and field situations, but treatments after the 5th leaf stage, in either situation, did reduce growth somewhat, but not enough to be commercially acceptable.[3]

Cyanazine: Under greenhouse conditions cyanazine was extremely effective from preemergence to the 8th leaf stage (Table 1.1). Even the 0.56 kg/ha rate gave greater than 75% control at the 8th leaf stage. The 2.24 kg/ha rate provided complete control at every growth stage tested, producing completely necrotic plants within 2 weeks after treatment.

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[3]Commercially acceptable control shall be defined as a reduction in yield greater than 75% from the untreated plants.

Table 1.1 The effect of atrazine, cyanazine, and pendimethalin on greenhouse grown velvetleaf plants treated at different leaf stages.*

Treatment	Rate kg/ha	Pre	Coty.	2nd lf.	3rd lf.	4th lf.	5th lf.	6th lf.	8th lf.
		Stage of Treatment (% Reduction)							
1) Atrazine	2.24	100c	100d	100f	87def	84de	77ef	70bcde	32b
2) Atrazine	1.12	86c	100d	100f	54c	64cd	47c	50bc	37b
3) Atrazine	0.56	46b	100d	90e	27b	36b	14ab	50bc	38b
4) Cyanazine	2.24	100c	100d	100f	100f	100e	100g	100f	100f
5) Cyanazine	1.12	100c	100d	100f	100f	100e	100g	89def	85f
6) Cyanazine	0.56	100c	100d	100f	98f	93e	89efg	66bcd	76ef
7) Pendimethalin	2.24	43b	100d	80d	71cde	62cd	42c	49bc	43bcd
8) Pendimethalin	1.12	7a	98c	65c	67cd	64cd	7ab	54bc	40b
9) Pendimethalin	0.56	1a	91b	48b	55c	37b	31bc	47b	36b
10) Atrazine Pendimethalin	2.24 2.24	100c	100d	100f	89f	96e	84efg	86def	72def
11) Atrazine Pendimethalin	1.12 1.12	97c	100d	98f	88ef	78de	52cd	76cdef	49bcde
12) Atrazine Pendimethalin	0.56 0.56	59b	100d	90e	54c	46bc	43c	65bcd	42bc
13) Cyanazine Pendimethalin	2.24 2.24	100c	100d	100f	100f	100e	100g	100f	98f
14) Cyanazine Pendimethalin	1.12 1.12	100c	100d	100f	100f	98e	96fg	95ef	88f
15) Cyanazine Pendimethalin	0.56 0.56	96c	100d	100f	95f	92e	74de	87def	69cdef
16) Untreated	—	0a	0a	0a	0a	0a	0a	0a	0a

*Data represents the mean of 6 replications. Numbers followed by similar letters within a column are not significantly different at the 5% level as determined by Duncan's multiple range test.

Table 1.2 The effect of atrazine, cyanazine, and pendimethalin on field grown velvetleaf plants treated at different leaf stages.*

Treatment	Rate kg/ha	Pre	1st lf.	3rd lf.	4th lf.	5th lf.	6th lf.	8th lf.
		Stage of Treatment (% Reduction)						
1) Atrazine	2.24	100c	100c	91c	75de	86d	58c	56b
2) Atrazine	1.12	57b	96c	58b	68cd	51bc	18ab	0a
3) Cyanazine	2.24	20a	89c	72b	58bc	34b	4ab	6a
4) Cyanazine	1.12	0a	55b	51b	44b	34b	30b	0a
5) Pendimethalin	2.24	50b	95c	93c	92f	89d	93d	76cb
6) Pendimethalin	1.12	51b	92c	85c	73cde	68cd	74dc	64cb
7) Atrazine Pendimethalin	2.24 2.24	100c	100c	99c	97f	98d	98d	88c
8) Atrazine Pendimethalin	1.12 1.12	66b	99c	97c	86fe	87d	85dc	71cb
9) Cyanazine Pendimethalin	2.24 2.24	69b	100c	98c	98f	98d	94d	85c
10) Cyanazine Pendimethalin	1.12 1.12	61b	98c	91c	87fe	87d	88d	63cb
11) Untreated	--	0a	0a	0a	0a	0a	0a	0a

*Data represents the mean of 3 replications. Numbers followed by similar letters within a column are not significantly different at the 5% level as determined by Duncan's multiple range test.

Field conditions dramatically reduced cyanazine activity in comparison to greenhouse conditions. Only at the 1st leaf stage did the 2.24 kg/ha rate reduce growth by more than 75% (Table 1.2). Treated plants often showed some chlorotic mottling, but eventually proved to be only slightly affected.

These very different results between greenhouse and field conditions may be attributed to one or all of the following reasons: First, cyanazine applied postemergence is primarily absorbed through the roots (Malefyt and Duke [1981]). Sprayed on the soil surface, cyanazine is then dependent upon leaching by rainfall to get down to the root zone, where it can be absorbed by velvetleaf roots and then translocated to the leaves. The soil used in the greenhouse was an Elmwood sandy loam with a cation exchange capacity of 9.2 me/100 g soil. The Honeoye silt loam soil in the field had a cation exchange capacity of 19.5 me/100 g soil. Therefore more leaching would occur in the sandy loam, providing easier passage of cyanazine to the root zone. In addition, the amount of water applied to pots in a greenhouse is far greater than the amount of rainfall received in the field. Second, the root zone of velvetleaf plants grown in pots is restricted to a shallow depth. In the field, however, there is no depth restriction and the majority of the velvetleaf roots may be well below the depth of cyanazine movement. Finally, although the roots are the primary site of uptake for cyanazine, there is also some uptake through the leaves (Malefyt and Duke [1981]). In the greenhouse, night temperatures never dropped below 15.6 C, so the plants were never subjected to cool temperatures where they might develop a thicker cuticle. Therefore, the leaves may be much more susceptible to foliar penetration of cyanazine than field plants, which may have a thicker cuticle due to cooler night temperatures.

Therefore, one must be conservative in any concluding discussions on the use of cyanazine for velvetleaf control. Based on these data, cyanazine appears to be generally effective when applied early postemergence from the cotyledon to the 2nd leaf stage. While this should control all velvetleaf which has emerged and is at that growth stage, one must remember that velvetleaf often emerges in flushes throughout the growing season (Stoller and Wax, 1973), and any later flush in germination would be faced with a preemergence cyanazine treatment, which was not effective in the field, and according to other reports may or may not be effective (Harvey and Ruscoe [1974], Harvey et al. [1977], Donald et al. [1976], Ilnicki and Micheika [1977], Bayer [1978], Duke et al. [1977, 1978, 1979], Malefyt and Duke [1980].

Pendimethalin: Under greenhouse conditions pendimethalin was most effective when applied just after emergence of velvetleaf plants (Table 1.1). At the 2.24 kg/ha rate it also provided greater than 75% control at the 2nd leaf stage (Table 1.1). Preemergence control was poor in these studies which agrees with data of Donald et al. (1976) and Ilnicki and Micheika (1977). When applied at later growth stages, pendimethalin stopped shoot growth at the apical meristem, caused lateral branching of the shoot, stem thickening, and leaf crinkling to occur, but it did not reduce growth enough to be commercially acceptable.

In the field, pendimethalin gave poor preemergence control. Unlike the greenhouse, however, it gave greater than 75% control through the 8th leaf stage at the 2.24 kg/ha rate (Table 1.2). Typical symptoms again were no growth or slowed growth at the apical meristem, lateral branching, stem thickening and leaf crinkling.

This difference between greenhouse and field results may be explained by a combination of factors. Pendimethalin severely stunts velvetleaf plants by stopping growth at the apical meristem. It also affects root growth. At later growth stages, untreated plants grown in 12.5 cm pots rapidly produce more root mass than can be handled by the soil volume so shoot growth is stunted. In the field there are not nearly so many limitations and the plants are able to accumulate much more dry matter in less time. Therefore, since pendimethalin nearly stops velvetleaf growth at the point where it is treated, and untreated velvetleaf plants can grow much bigger in the field, one can see a greater growth differential in the field than in the greenhouse. This may explain why pendimethalin reduced velvetleaf growth more in the field than in the greenhouse.

Based on both field and greenhouse data, pendimethalin is most effective early postemergence from the cotyledon to the 3rd leaf stage. Preemergence application should be avoided, since poor control often results. Any application made after the 3rd leaf stage may still be effective, as field results show, but then other weed control, such as annual grasses, may be forfeited.

Atrazine and Pendimethalin: This combination gave best control when applied early postemergence from the cotyledon to the 3rd leaf stage. The 2.24 kg/ha combination rate of both herbicides gave greater than 75% control from preemergence to the 6th and 8th leaf stages in the greenhouse and field, respectively (Tables 1.1 and 1.2). Typically plants exhibited a combination of injury symptoms both chlorosis and necrosis from the atrazine and the stunting, thickening, branching, and crinkling from the pendimethalin.

Greenhouse and field data indicate that atrazine plus pendimethalin is an extremely good treatment. It gives growers a large amount of flexibility, because not only did the combination completely control velvetleaf both preemergence and early postemergence, but it also was highly effective at later growth stages. If it is applied early postemergence, one can expect not only good control of the velvetleaf plants present, but also good control of plants that emerge from later flushes of germination.

Cyanazine and Pendimethalin: Under greenhouse conditions, this combination provided similar control to that obtained with cyanazine alone (Table 1.1). Complete control was attained by the 2.24 kg/ha combined rate for both herbicides from preemergence through the 8th leaf stage.

In the field, neither herbicide by itself worked very well preemergence, therefore the result of poor preemergence control with the combination is not surprising (Table 1.2). The combination was most effective at the 1st leaf stage, but maintained greater than 75% control at the 2.24 kg/ha rate through the 8th leaf stage. The combination in the field performed somewhat less effectively than the same treatment in the greenhouse, but this could be expected from the greatly reduced cyanazine activity in the field.

Cyanazine plus pendimethalin would be a good substitute for atrazine plus pendimethalin for velvetleaf control, especially for a grower who wants to avoid atrazine carryover. Applied from the cotyledon stage to the 8th leaf stage it provided excellent control in both field and greenhouse situations. Its biggest weakness may be preemergence and therefore if used early postemergence, a later flush in germination may not be effectively controlled.

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FALL PANICUM COMPETITION IN CONVENTIONAL AND NO-TILL CORN

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ABSTRACT

A competition study was established on Freehold sandy loam at the Soils and Crops Research Center, New Jersey Agricultural Experiment Station, Adelphia, N. J. The soil organic matter content is 1.5 - 2.0% and soil test results for P, K, Ca and Mg reflect high to very high levels. The main plot size was 20' x 30' with one-half fall panicum and the other a 4-row 10' x 30' corn plot with fall panicum. A randomized complete block experimental design using 3 replicates of weed infestation levels was utilized. The variables evaluated were two tillage methods, three planting dates, and four weed infestation levels. Panicum infestation levels were established by using combinations of atrazine and alachlor. Destructive samplings of fall panicum alone and under corn were made on three dates. Corn was harvested for silage and grain yields. Planting dates were 1, 11 and 21 days after disking conventional tillage plots.

Fall panicum yields increased with early planting dates and no tillage. Corn and fall panicum biomass yields were greater in no-till than conventional tillage within each weed infestation level. Corn silage yields increased with later planting dates in conventional tillage and decreased with later planting date in no-tillage plots. Corn grain yield decreases with later planting dates and no-tillage.

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COMPETITIVE CONTROL OF GIANT FOXTAIL BY EARLY AND LATE PLANTED CORN

R. T. Campbell, L. A. Perera and N. L. Hartwig[1/]

ABSTRACT

The competitive control of giant foxtail by early and late planted field corn with varying rates of alachlor did not differ significantly. Average control due to corn competition was 24% at a mid-September giant foxtail harvest. With the application of 1 to 1.33 lb/A of alachlor, giant foxtail control in corn was improved to 53% for a July and September weed harvest.

INTRODUCTION

Competition provided by a corn crop is important in maintaining season long weed control. It has been reported that 75% control of the annual grasses fall panicum (Panicum dichotomiflorum Michx.), giant foxtail (Seteria faberii Herrm.), and johnsongrass (Sorghum halepense (L.) Pers.) from seed can be obtained by competition from corn (Zea mays L.) (1).

The objective of this trial was to measure differences in the competitive ability of corn with giant foxtail between early and late planted corn treated with different rates of alachlor [2-chloro-2', 6' diethyl-N-(methoxymethyl) acetanilide].

MATERIALS AND METHODS

This trial was conducted in 1980 on a Hagerstown silt loam soil (Typic Hapludult) containing 10% sand, 67% silt, 20% clay and 2.5% organic matter at the Pennsylvania State University research farm. The trial area had a history of giant foxtail infestation and was almost a pure stand in 1980. 'Pioneer 3780' (100 day) corn was planted conventionally to a stand of about 27,000 plants/A on two dates: May 6 and May 28. Three hundred lb/A of urea was broadcast after planting and 150 lb/A of 15-15-15 fertilizer was row applied at planting time. The soil pH was 6.3 and no lime was applied. Alachlor was applied preemergence on May 7 for the early planted corn and on May 28 for the late planted corn at rates of 0 to 1.33 lb/A with an 8001 LP nozzle at 23 psi. Atrazine [2-chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine] and dicamba (2-methoxy-3,6-dichlorobenzoic acid) were applied early postemergence as a blanket treatment at 1 lb/A and .25 lb/A respectively, with an 8004 nozzle at 30 psi, when the early planted corn was at the eight leaf stage and late planted corn was at the four leaf stage.

The early and late planted corn were subdivided into with and without corn plots. Corn was hoed out of the no-corn plots and all other plots contained 21,000 to 24,000 plants/A.

The experiment was a split-split plot design with the time of planting as main plots, treatments with or without corn as the sub-plots and the herbicide levels as the sub-sub-plots with three replications. Plot size was 15 by 20 ft with 6(30 inch) corn rows per plot.

RESULTS AND DISCUSSION

There was no significant difference in giant foxtail dry weight between the early and late planted corn for either the July or September weed harvests. (Figure 1).

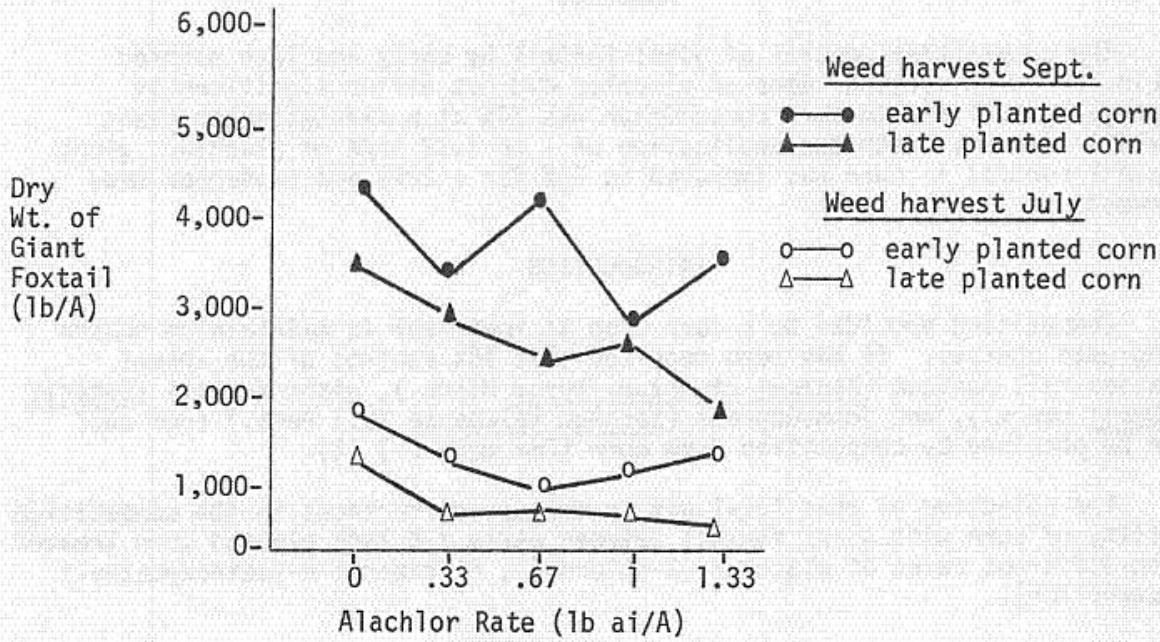

Figure 1. Dry weight yield of giant foxtail measured in July and September in early and late planted corn.

Since the area was disked just prior to each planting date, the giant foxtail and corn germinated about the same time. The initial flush of giant foxtail seedlings was destroyed by disking prior to the late corn planting, which should have favored the late planted corn and hence would not be expected to compete as much with the giant foxtail. With the help of a late disking, however, the competitive control of the late planting was equal to that of the early planting.

No significant difference was found in corn yields between the early and late planted corn (Figure 2). Since corn yields were similar for each planting date, this would indicate that competition from uncontrolled giant foxtail was about equal for both early and late planted corn. This is further evidence that giant foxtail dry matter yields and competitive control provided by early and late planted corn is about equal.

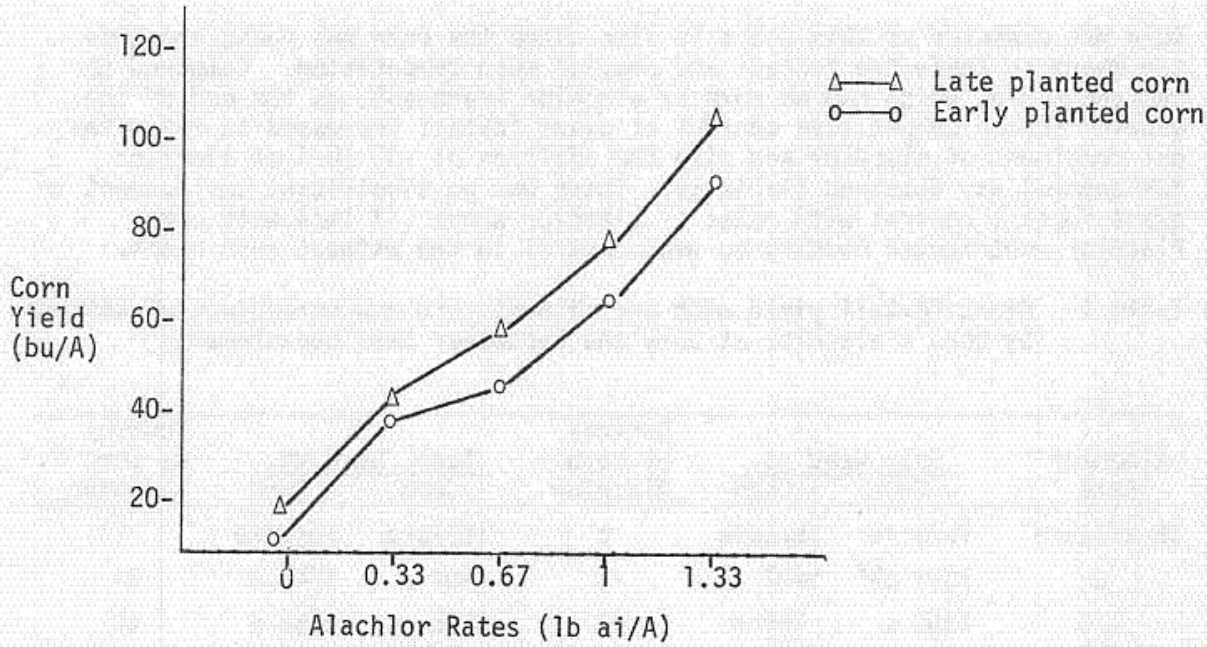

Figure 2. Corn yields of early and late planted corn at five alachlor rates.

For the mid-July weed harvest, there was no significant difference in giant foxtail yield between treatments with and without corn (Figure 3).

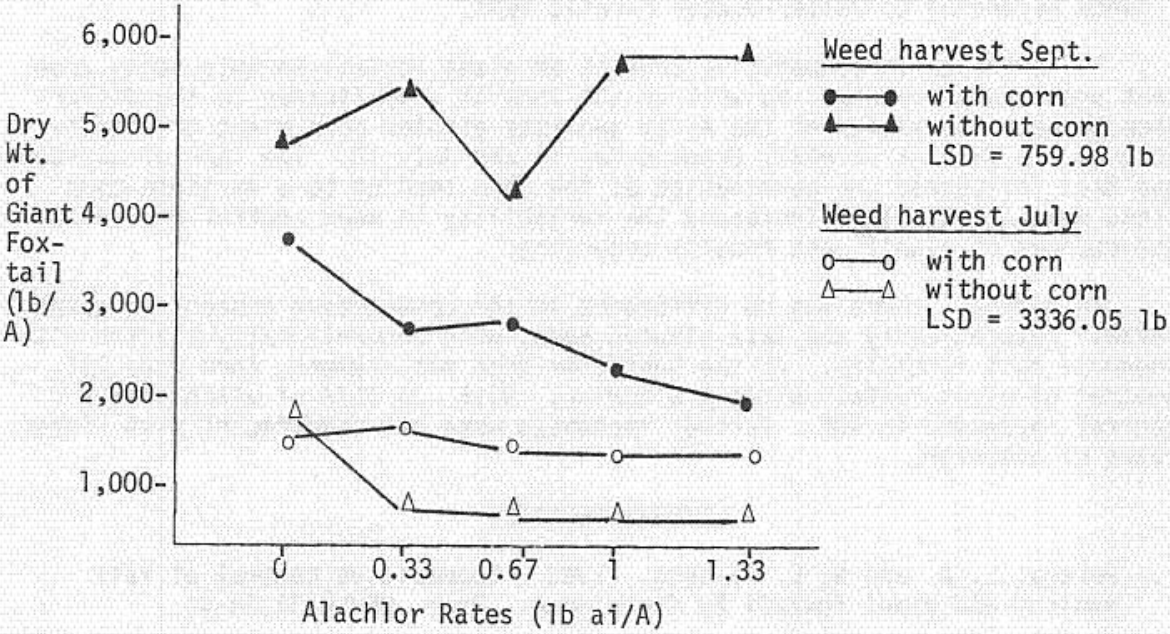

Figure 3. Dry weight of giant foxtail measured in July and September with or without early and late planted corn.

This was expected at this point in time since the corn was young and thus too short to shade the foxtail and provide much competition. Compared to the check plot which had no corn or alachlor treatment, by the end of the growing season competitive control of giant foxtail increased to 24% without treatment of alachlor and with the addition of .33 lb/A of alachlor 40% control was obtained (Table 1). There was no significant improvement in giant foxtail control with rates of alachlor above .33 lb/A with corn. Alachlor contributed nothing to weed control in the without corn plots.

Table 1. Giant foxtail yield with and without corn and percentage of control by corn + alachlor at July and September weed measurements.

Alachlor Rate	July Weed Wt. - Corn	July Weed Wt. + Corn	Control by Corn + Alachlor	Sept. Weed Wt. - Corn	Sept. Weed Wt. + Corn	Control by Corn + Alachlor
lb ai/acre	lb/acre	lb/acre	%	lb/acre	lb/acre	%
0	1393 a[a/]	1407 a	-1	4904 a	3746 a	24
1/3	1395 a	744 b	47	5595 a	2956 a	40
2/3	1217 a	654 b	53	4408 a	3013 a	39
1	1268 a	654 b	53	5626 a	2496 a	49
1 1/3	1208 a	738 b	47	5629 a	2329 a	53

[a/] Means followed by the same letter do not differ at the 5% level of significance according to Waller-Duncan K-ratio test.

The decrease in competitive control of giant foxtail in this study from that previously reported, as well as the lack of significance in the difference between the yields of the early and late planted corn might be attributed to the lack of rainfall between May 15 and July 12. The lack of moisture may have influenced the germination of the corn leading to a variable corn stand population. This increased the variability in weed control and reduced the chances of significant results occurring.

In summary, there was no difference in the competitive control of giant foxtail between early and late planted corn, when conventionally planted with adequate soil fertility. At the September weed measurement, corn gave 24% control of giant foxtail without alachlor. With .33 lb/A of alachlor the control increased to 40%. Further increases were not significant with higher rates of alachlor.

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INFLUENCE OF NITROGEN AND CORN POPULATION ON NO-TILLAGE CORN YIELD WITH AND WITHOUT CROWNVETCH

J. Cardina and N. L. Hartwig[1/]

ABSTRACT

No-tillage corn was grown with and without a crownvetch cover crop at four levels of N and corn populations ranging from 10 to 25 thousand plants per acre to measure competition and possible N contribution from the cover crop. There was no N contribution by crownvetch to the associated corn crop, even at low levels of N fertilization. Competition between crownvetch and corn for N was evident at low nitrogen levels and increased with increasing corn populations. There was little or no competition between corn and crownvetch at high levels of N since sufficient N was apparently available for the corn and the cover crop. There was a general trend toward increasing response of corn yield to population as N levels increased, with a corresponding decrease in competition between corn and crownvetch for N.

INTRODUCTION

Permanent crownvetch (*Coronilla varia* L.) cover crops for continuous no-tillage corn (*Zea mays* L.) have contributed to weed control and to reduced losses of herbicide, soil and water by erosion (3, 4, 5). Crownvetch is a legume which fixes atmospheric N_2 in association with symbiotic bacteria. It should not compete with corn for N and could conceivably make N available to the corn through decay of nodules and above ground herbage. Although first year corn in a 3 to 5 year old crownvetch stand yielded as well without added N as conventional corn with 100 lb N per acre, yields of unfertilized continuous corn decreased over time as the crownvetch apparently contributed less N to the corn (4). In addition, increased crownvetch yields have been associated with decreased corn yields (2, 4, 5). This suggests that the cover crop may compete with corn for N and/or other growth requirements. The objectives of this study were to measure the influence of crownvetch competition on corn yields at four levels of N fertilization and to evaluate the possible N contribution from crownvetch to the corn.

MATERIALS AND METHODS

No-tillage corn was grown over a range of populations and fertilized at four levels of N in plots with and without a crownvetch cover crop in 1976 and 1977. Treatments were assigned to the same plots both years. Plots were located on a Hagerstown silt loam soil (Typic Hapludult) with 10% sand, 67% silt, 20% clay and 2.5% organic matter. When the crownvetch was established in 1973 the soil was limed and fertilized according to soil test recommendations. Soil pH of 7.0 was measured before the 1976 and 1977 growing seasons.

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Corn ('Pioneer 3780') was planted at a high density on May 6, 1976 and May 5, 1977 and thinned to a range of populations from 10,000 to 25,000 plants per acre. Four rates of Nitan were broadcast to provide 20, 70, 120 and 170 lb N/acre. All treatments received 150 lb/acre 10-30-10 in the row in 1976, and 200 lb/acre 10-30-10 in the row plus 400 lb/acre 0-15-30 broadcast in 1977.

Herbicide treatments for 1976 included preplant butylate [S-ethyl diisobytylthio carbamate] and atrazine [2-chloro-4-(ethylamino)-6-(isopropylamino)-2-triazine] 18.6 G at 5.5 lb ai/acre applied in a 7 in band in front of the fluted coulter on the corn planter. An early post-emergence treatment on June 11 consisted of 1.4 lb ai/acre cyanazine [2-(4-chloro-6-)ethylamino)-s-triazine-2-y)amino)-2-methylpropionitrite] 4WDL + .01 lb ai/acre dicamba [3,6-dichloro-o-anisic acid] + 0.3 lb ai/acre 2,4-D amine [(2,4-dichlorophenoxy) acetic acid] for annual weed and Canada thistle (Cirsium arvense L.) control. Herbicide applications for 1977 began on November 10, 1976 with pronomide [3,5-dichloro(N-1, 1-dimethyl-2-propynyl)benzamide] + metribuzin [4-amino-6-test-butyl-3-(methylthio)-as-triazin-5(4H)-one] at 1 + 1 lb ai/acre. On April 13 (32 days preplant), simazine [2-chloro-4,6-bis(ethylamino)-s-triazine] + pendimethalin [N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine] at 2 + 2 lb ai/acre was applied followed by a postemergence application of 0.25 lb ai/acre dicamba on June 30 for Canada thistle control. A late postemergence application of 0.75 lb ai/acre bentazon [3-isopropyl-1H-2,1,3-benzothiadiazin-4 (3H)-one 2,2-dioxide] was made on July 6 to control yellow nutsedge (Cyperus esculentus L.). Soil moisture was sufficient for herbicide activation and early spring growth both years. Granular herbicides were applied with a Gandy Spreader and liquid herbicide applications were made with a small plot sprayer at 25 psi in 20 gal water per acre with an 8001 LP nozzle for postemergence treatments and an 8003 nozzle for pre and late postemergence applications.

The experiment was arranged in a split-split plot design with three replications. Treatments with or without crownvetch comprised main plots, with N levels as sub-plots and corn populations as sub-sub-plots. Plots were 20 ft long with five 30 in corn rows per plot. Stand counts were taken from the three center rows which were later harvested for grain yield. Differences among treatment means were measured by analysis of variance using the Duncan K ratio test. Regression analyses were performed using the General Linerar Model procedure of the Statistical Analysis System (1).

RESULTS AND DISCUSSION

Postemergence herbicide applications reduced crownvetch recovery, growth and competitiveness in most treatments both years. There were significant differences in corn yield due to N levels when averaged over populations indicating a range of N levels sufficient to show yield differences due to competition for N. Significant differences in corn yield for corn populations averaged over N levels suggested a range of populations great enough to associate differences in corn yield with corn stand.

Regression of corn yield on corn stand for 1976 showed a trend toward increasing slope of the regression line and increasing coefficient of determination (r^2) with increasing rate of N (Figure 1 A-D). These data

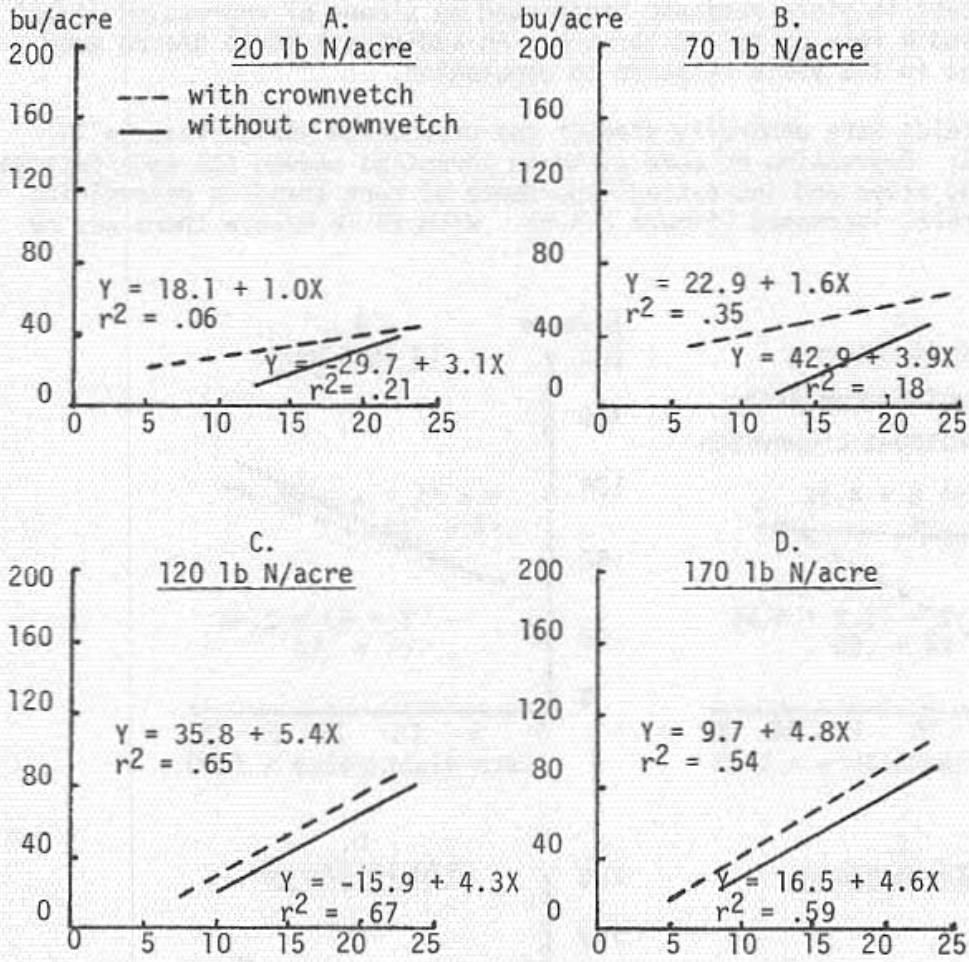

Figure 1. Yield of no-tillage corn over a range of plant populations at four nitrogen levels with (---) and without (——) crownvetch cover crop in 1976.

suggest little relation between corn stand and yield at low N levels, though corn stand became increasingly important in producing a yield response as N rates increased. With 20 lb N/acre, corn yields in treatments with and without crownvetch followed similar trends with increasing corn stand and did not differ significantly in yield. Thus, crownvetch did not appear to contribute N to the corn, but rather appeared to compete with corn for N. With 170 lb N/acre the response of corn yield to stand was similar in

treatments with and without crownvetch, which suggests that there was sufficient N to provide for both corn and crownvetch growth. Thus, at this level of nitrogen, there was no evidence of competition between corn and crownvetch. At 120 lb N/acre there appeared to be little competition between crownvetch and corn at low corn populations but there was a trend toward increased competition with crownvetch and reduced corn yields at higher corn populations. In treatments without crownvetch there was an increase in yield response (indicated by slopes of regression lines) with increased N rate up to 120 lb/acre. An additional 50 lb N/acre made little change in the yield response to population.

Corn yields were generally greater and crownvetch yields less in 1977 than in 1976. Regression of corn yield on cornstand showed the same pattern of increasing slope and increasing importance of corn stand in determining yield as N rates increased (Figure 2 A-D). With 20 lb N/acre there was no

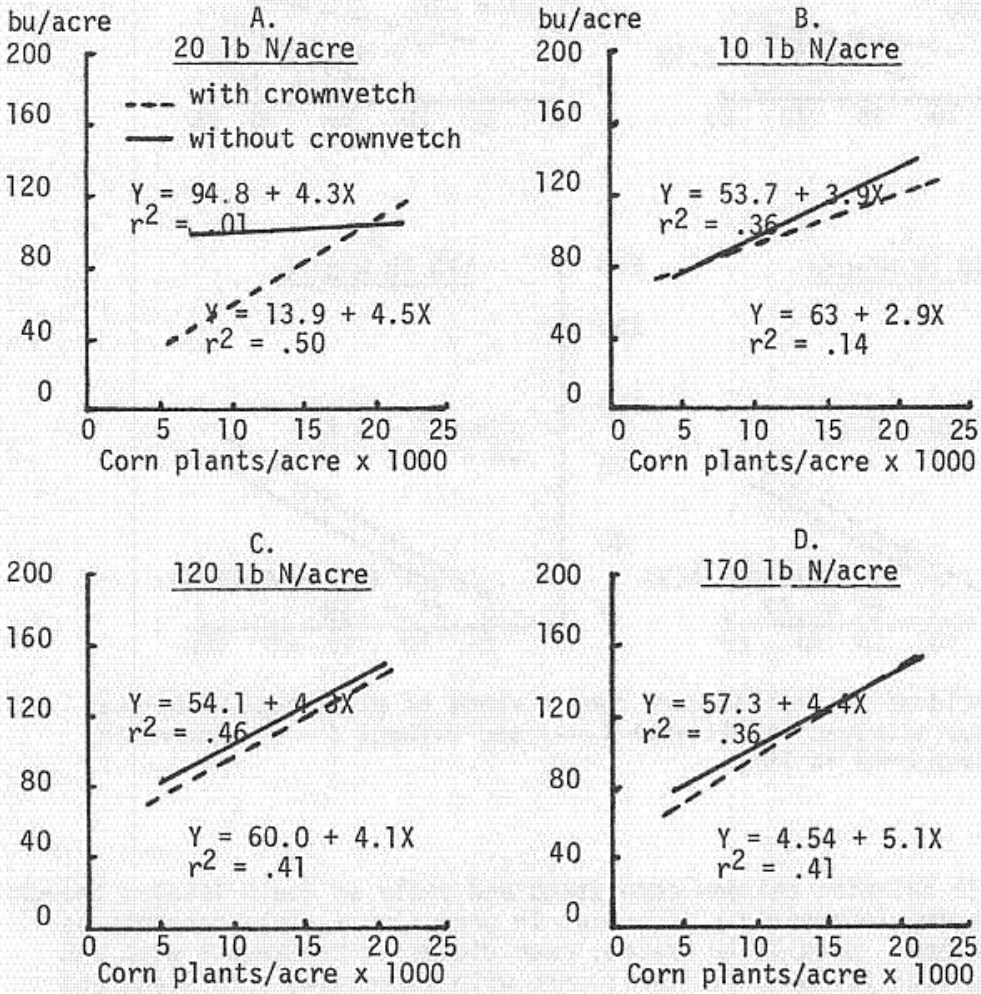

Figure 2. Yield of no-tillage corn over a range of plant populations at four nitrogen levels with (---) and without (——) crownvetch cover crop in 1977.

effect of corn stand on yield without crownvetch, but there was a good yield response with increasing stand in treatments with crownvetch. Thus N did not appear to be limiting at the lowest rate where crownvetch was present. It is possible that since corn grew poorly on these low N treatments in 1976, it offered little competition to crownvetch which produced over 1000 lb/A recovery growth. Vigorously growing crownvetch may have been able to take up large quantities of N (from the soil and by N_2 fixation) which may subsequently have been made available to the 1977 corn crop to account for the yield response in 1977. Treatments with and without crownvetch which received 70, 120, and 170 lb N/acre showed similar relationships between corn yield and corn stand as indicated by the slopes of the regression lines, the r^2 values, and the actual corn yields. The generally higher yields in 1977 over 1976 and the lack of an apparent N response over 20 lb N/acre may have been due to N carryover from the previous season. There was an increase in the slopes of the regression lines with increasing N in treatments with crownvetch, suggesting that competition between corn and crownvetch for N decreased with increasing rates. Additional N above 120 lb/acre did not show an additional yield response which implies that sufficient N was available at 120 lb/acre to support both the corn and the crownvetch.

In summary, crownvetch appeared to contribute little N to corn even at the lowest level of fertilizer N. Although first year corn in an established crownvetch sod yielded well without additional N (5), the N contribution from crownvetch in continuous corn did not substitute for any of the fertilizer N normally needed for no-tillage corn. The crownvetch cover crop tended to compete with corn for N at low and intermediate levels both years. However, at or above 120 lb/acre sufficient N was available to provide for growth of corn and the cover crop without a significant reduction in corn yield due to the presence of crownvetch.

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THE EFFECT OF GLYPHOSATE AND SURFACTANT CONCENTRATIONS ON QUACKGRASS

C. G. Erickson and W. B. Duke[1/]

ABSTRACT

An extended series of field studies has indicated that surfactant additions of 0.5 to 1.0% can increase the efficacy on glyphosate of quackgrass, especially at lower rates. The surfactant effect is masked by a 2.22 kg/ha rate of glyphosate. Optimum conditions of glyphosate control of quackgrass also mask the surfactant effect at lower rates.

It is concluded that the major benefit obtained by the addition of surfactant is to maximize control of quackgrass when glyphosate applications are applied after the six-leaf stage, or when the quackgrass is under temperature or drought stress. Surfactant additions also help to reduce within field variation.

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THE EFFECT OF GLYPHOSATE AND SURFACTANT CONCENTRATIONS ON SUBSEQUENT PENETRATION AND TRANSLOCATION IN QUACKGRASS

C. G. Erickson and W. B. Duke[1/]

ABSTRACT

C^{14}-methyl glyphosate was used to study penetration of glyphosate through isolated quackgrass cuticles with 4 glyphosate and 5 surfactant concentrations. The effects of temperature were also investigated. Movement of glyphosate through the cuticles against time was found to be linear in this system. Glyphosate concentration increases produced an almost linear increase in movement across the cuticle. Surfactant concentration increases produced slight increases in glyphosate movement across the cuticle. However, these increases were statistically insignificant. There also appeared to be some temperature differences.

Translocation of the labeled glyphosate to the quackgrass reproductive tissues was also measured to determine the amount of increase resulting from increased glyphosate and surfactant concentrations.

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CONTROL OF BURCUCUMBER IN CORN AND SOYBEANS

F. Webb and G. Johnston[1/]

ABSTRACT

Burcucumber (Sicyos angulatus L.) is a summer annual weed that is increasing in its occurrence throughout much of lower Delaware's crop land. This plant is not generally a strong competitor for light and nutrients thus directly reducing yields but is a very aggressive vining plant that pulls corn and soybean plants to the ground creating a severe harvest loss. Burcucumber germinates in mid to late April and seeds continue to germinate throughout the entire growing season. Even at very low populations (one per sq. yard) burcucumber can render corn and soybean fields unharvestable. The seeds are readily scattered by mechanical harvesters, animals and by farmer sold soybean seed.

During 1979 and 1980 numerous chemicals, combinations and sequential treatments have been evaluated for use in corn and soybeans to gain information to develop a control program. Good progress has been made for corn with little success for soybeans.

Effective control has been obtained with 2x rates of atrazine applied pre-plant incorporated with a post-directed follow-up with dicamba (0.25 lbs/a) plus .5% volume to volume surfactant or a surfactant, crop oil combination at the same rate. Ten percent better kill was obtained with the combination, with no greater epinasty of the corn from the dicamba. Ametryn (1.6 lbs/a) post-directed with surfactant (.5% volume to volume) provided a quicker kill of the burcucumber. Lower rates of ametryn may be effective but were not included in these studies.

Metribuzin incorporated at 1x rate was about 90% effective in its control of burcucumber in soybeans. This percentage of control is not satisfactory with this weed and with much of lower Delaware's soils being loamy sands, its use is very limited because of soybean injury. Acifluorfen post-emergence, at 0.5 lbs/a of the 2 LS was effective in killing 4 leaf and younger burcucumber, especially when combined with 3 lbs/a of ammonium sulfate. There was about a 20% soybean injury factor with this combination. Dinoseb, post-emergence, was as effective as acifluorfen used at .76 lbs/a with about the same injury rating.

None of these treatments were totally satisfactory because of the very rapid germination of new seeds that generated new populations in just a few days after treatment. This work has not revealed a satisfactory control for burcucumber in soybeans.

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POTENTIAL INJURY FROM LATE HERBICIDE APPLICATIONS IN NO-TILLAGE CORN

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ABSTRACT

Today it is estimated that over 50% of the corn planted in Maryland is done by no-tillage techniques. In following conventional type situations, farmers usually plant their crop and then apply their herbicides. Unfortunately, rain may occur during or shortly after planting and delay herbicide application. Preemergence herbicides could still be used since many of them provide control of small, recently germinated vegetation without injurying the corn crop. The problem exists with larger vegetation. A knock down herbicide is needed, but if the corn has germinated, serious injury may result. This experiment, conducted in 1980 at the Plant Research Farm in Silver Spring, MD, was designed to examine what effect herbicides in combination with Paraquat, as well as Paraquat by itself would have upon the early stages of corn growth.

Corn ('Pioneer 3382') was planted on May 7 in 30 inch rows into corn stubble utilizing a no-tillage planter. The soil was a Christiana silt loam (pH 6.0, O.M. 1.5). Plots were 6 rows wide and 25 feet long arranged as a randomized complete block design with three replications. Herbicides were applied at four growth stages; preemergence, spike stage, three-leaf stage, and five-leaf stage. Paraquat was tank mixed with commercially available herbicides using water as a carrier. Paraquat was also sprayed by itself utilizing liquid nitrogen as a carrier. All herbicide treatments were applied with a CO_2 pressurized back pack sprayer that delivered 20 gpa at 20 psi using SS-8003 flat fan nozzles. Visual ratings were made throughout the growing season. Ratings were based on a scale of 0 to 100 with 0 = no crop injury and 100 = total crop dessication. Yields were taken from all plots and obtained with a standard field combine.

Preemergence applications and applications made during the spike stage resulted in little to no injury to the corn crop. Corn yields were not reduced. Applications made to three-leaf and five-leaf corn injured corn severely and resulted in significant yield reductions.

Within the three-leaf and five-leaf application time periods, when Paraquat was applied by itself in liquid nitrogen, injury was less severe than when it was applied in herbicide combinations. There was little to no difference in crop injury and yield among the Paraquat plus herbicide combinations. All resulted in severe crop injury and reduced yields when applied during the three-leaf and five-leaf stages.

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TRIAZINE RESISTANT BARNYARDGRASS CONTROL IN FIELD CORN IN MARYLAND

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D. L. Greene, and S. W. Pruss

ABSTRACT

A biotype of barnyardgrass [Echinochloa crus-galli(L.) Beauv.] which was not controlled by preemergence or postemergence applications of atrazine, simazine, or ametryn was found in central Maryland. Greenhouse and laboratory studies conducted in 1979 confirmed that this strain of barnyardgrass is resistant to atrazine. The results of field trials conducted in 1979 and 1980 with conventional and no-tillage corn (Zea mays L.) indicate that this biotype can be controlled by preplant incorporated applications of butylate or EPTC; preemergence treatments of alachlor, metolachlor, or pendimethalin; or post-directed applications of linuron or paraquat. Cyanazine did not control this biotype whether applied preemergence or postemergence.

INTRODUCTION

In recent years, the resistance of several biotypes of weed species to control by the triazine herbicides has been observed. These include species such as common groundsel (Senecio vulgaris L.) (3,4,5,6), common lambsquarters (Chenopodium album L.) (2,7), smooth pigweed (Amaranthus hybridis L.) (2), and redroot pigweed (Amaranthus retroflexus L.) (2,8). In 1978, near Westminster, Maryland, a biotype of barnyardgrass was noted growing in a corn field which had been treated with atrazine [2-chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine] + simazine [2-chloro-4,6-bis(ethylamino)-s-triazine]. Attempts to control this biotype with postemergence applications of atrazine or ametryn [2-(ethylamino)-4-(isopropylamino)-6-(methylthio)-s-triazine] were fruitless while either paraquat (1,1'-dimethyl-4,4' bipyridinium ion) or linuron [3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea] was moderately effective.[2]

In 1979 and 1980, greenhouse and field studies were initiated to determine if this biotype of barnyardgrass was truly resistant to the triazine herbicides and if it could be controlled by other herbicides such as butylate (*S*-ethyl diisobutylthiocarbamate), EPTC (*S*-ethyl dipropylthiocarbamate), cyanazine [2-[[4-chloro-6-(ethylamino)-s-triazin-2-yl]amino]-2-methylpropionitrile], alachlor [2-chloro-2',6'-diethyl-*N*-(methoxymethyl)acetanilide], metolachlor [2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)acetamide], or pendimethalin [*N*-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine].

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MATERIALS AND METHODS

A greenhouse study was conducted using suspected resistant barnyardgrass seed obtained near Westminster, Maryland and susceptible barnyardgrass seed obtained near Centreville, Maryland. The seeds were collected and tested in the fall of 1979 by planting in 20 cm diam. by 18 cm high plastic pots containing Leon sand (2.6% OM) under greenhouse conditions. Daily temperatures varied between a low of 22C and a high of 28C. Supplemental lighting with flourescent and incandescent bulbs was added to have a minimum 14-h day length. Overhead irrigation was added to maintain a moist soil condition. Atrazine treatments were applied either preemergence or postemergence (grass 5-8 cm tall). Experimental design was a randomized complete block with four replications. Visual ratings, based on a 0-10 scale (0=no control, 10=complete kill), were made 14 and 21 days after the preemergence and postemergence applications, respectively. Leaf disks from both barnyardgrass biotypes were cut with a 3 mm diam. cork borer and tested for atrazine resistance using the flotation method originally described by Truelove et al. (9) and modified by Hensley (1).

Three field studies were conducted in 1979 near Westminster, Maryland on a Chester Silt Loam having 2.5% organic matter and one study was conducted in 1980 near Hagerstown, Maryland on a Hagerstown Silt Loam having 2.5% organic matter. At both locations, barnyardgrass was not controlled the previous year by atrazine or simazine applications. Plot size in all studies was 3.7 m wide by 6.2 m long with 4 rows of corn per plot. Treatments were replicated 3 times in a randomized complete block design. Field corn varieties Dekalb XL-72 (1979) and Dekalb XL-61 (1980) were seeded at a depth of 4-5 cm with a no-tillage planter. There was no tillage performed except in the case of the 1979 conventional tillage study, where the soil was plowed and disked prior to planting. All herbicides were applied with a CO_2 powered hand sprayer in 280-L of water per ha. Herbicides were incorporated using a tandem disk within 1 hour after application. Planting and application dates accompany the tables for each test.

Postemergence applications were made when the corn was 10 cm tall and the barnyardgrass was 4 cm tall (1-3 leaf stage). Application of the post-directed treatments was accomplished when the corn and barnyardgrass were at a height of 40 and 20 cm (4-6 leaf stage), respectively.

Visual evaluations were made at intervals noted in the respective tables and ratings made on a 0-10 scale where 0=no control or phytotoxicity, 10= complete crop or weed kill with 7 representing minimum commercially acceptable weed control.

RESULTS AND DISCUSSION

Greenhouse study. A comparison of both triazine susceptible and resistant barnyardgrass is shown in Table 1. The susceptible strain was controlled with either preemergence or postemergence applications of 2.24 kg/ha atrazine. As much as 16.8 kg/ha atrazine were required to control the resistant strain in preemergence treatments, while acceptable control was not obtained with any rate applied postemergence. Shown in Table 2 is a

comparison of the two barnyardgrass biotypes which were assayed by the floating disk method. The presence of atrazine resulted in a failure to regain buoyancy of 100% of the leaf disks from the susceptible biotype indicating an inhibition of photosynthesis while 80% of the leaf disks from the resistant strain became buoyant indicating this biotype is very slightly susceptible to atrazine. These results agree with the greenhouse study which indicate that atrazine gives some control of the resistant biotype at extremely high rates that are not feasible for field use. For practical purposes, this strain of barnyardgrass can be considered resistant to atrazine.

Table 1 Control of triazine susceptible (S) and resistant (R) barnyardgrass in a greenhouse study. Vero Beach, Florida. 1979.

Atrazine Rate	Barnyardgrass Preemergence		Control Postemergence	
kg/ha	S	R	S	R
0.00	0.0	0.0	0.0	0.0
2.24	8.5	0.0	8.0	0.0
4.48	10.0	0.0	10.0	0.0
6.72	10.0	0.0	10.0	2.0
11.20	10.0	6.5	10.0	3.8
16.80	10.0	8.5	10.0	6.5

Table 2 Effect of atrazine on the buoyancy of leaf disks from several biotypes of barnyardgrass.

Species	Biotype	Atrazine 10^{-4} M	Leaf disks floating after 60 min. exposure[a]
			%
Barnyardgrass	Susceptible	-	100
Barnyardgrass	Susceptible	+	0
Barnyardgrass	Resistant	-	100
Barnyardgrass	Resistant	+	80

[a]Data are the means of four replications with 20 leaf disks per replication.

Field studies. Results of the conventional tillage field trial are shown in Table 3. As might be expected from the greenhouse study, none of the triazine herbicides were effective in controlling the barnyardgrass biotype present at this site. Application of combinations of triazines with EPTC, butylate, pendimethalin, alachlor, or metolachlor resulted in acceptable control, however, the most effective treatments were those containing metolachlor.

Similar response to the triazine herbicides are noted in the no-tillage studies conducted in 1979 and 1980 (Tables 4 and 5). Combinations of

alachlor with a triazine herbicide gave marginal to unacceptable control while metolachlor combinations provided good to excellent control. Pendimethalin was included in the Westminster test and gave acceptable control.

The effects of several herbicides applied postemergence are shown in Table 6. Similar to the previous studies, none of the triazine herbicides, when applied alone, were effective in controlling barnyardgrass. Pendimethalin in combination with cyanazine gave slight control but caused considerable reduction in corn stand. Linuron, applied post-directed was slow to provide knockdown, however, it gave a fair degree of control and caused only slight corn phytotoxicity. It appeared to be a feasible rescue treatment. Paraquat, applied post-directed, resulted in the best control in this test with the corn injury being restricted to a burning of the lower leaves.

SUMMARY AND CONCLUSIONS

Based on greenhouse and laboratory studies, it can be concluded that there is a biotype of barnyardgrass present in central Maryland that is resistant to control by the triazine herbicides. Field studies indicate that other classes of herbicides such as the thiocarbamates, chloroacetamides, or dinitroanilines are effective, especially where conventional tillage is practiced. In no-tillage corn, alachlor combinations did not provide acceptable control while pendimethalin was rated commercially acceptable. Metolachlor combinations were the most effective herbicide treatments at all locations over a two-year period. Post-directed applications of paraquat appear to be the most feasible method for controlling escaping barnyardgrass.

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Table 3 Barnyardgrass control in conventional tillage corn with preplant and preemergence herbicide treatments. Westminster, Maryland. 1979[a]

Treatment	Herbicide Rate (kg/ha)	Appl. Method	Barnyardgrass Control 6/4	7/2	9/20
EPTC+R-25788+atrazine	4.5+0.4+1.1	PPI	6.0	7.8	7.0
butylate+R-25788+atrazine	4.5+0.4+1.1	PPI	5.5	7.3	7.5
pendimethalin+atrazine	1.7+1.7	PRE	7.5	7.7	8.0
alachlor+cyanazine	2.2+1.7	PRE	7.8	7.3	6.9
alachlor+atrazine	1.7+1.7	PRE	7.3	7.2	7.1
alachlor+atrazine	2.2+1.7	PRE	7.3	7.2	7.0
metolachlor+atrazine	1.7+1.7	PRE	8.2	8.7	8.3
metolachlor+atrazine	2.2+1.7	PRE	8.5	9.0	8.9
metolachlor+simazine	1.7+1.7	PRE	7.2	8.7	8.3
metolachlor+atrazine+ simazine	1.7+0.9+0.9	PRE	7.5	8.7	8.1
atrazine+simazine	1.7+1.7	PRE	1.0	0.0	1.3
atrazine+cyanazine	2.2+2.8	PRE	2.0	0.0	0.0
Control			0.0	0.0	0.0

[a]Planted and treated - 5/10/79

Table 4 Barnyardgrass control in no-tillage corn with preemergence herbicide treatments. Westminster, MD. 1979[a]

Treatment	Herbicide Rate (kg/ha)	Barnyardgrass Control 6/4	7/2	9/20
atrazine+simazine+paraquat[b]	2.2+2.2+0.6	2.0	1.7	1.5
atrazine+simazine+paraquat	1.5+3.0+0.6	1.3	1.3	1.7
metolachlor+atrazine+paraquat	2.5+2.2+0.6	8.0	8.5	7.7
metolachlor+simazine+paraquat	2.5+2.2+0.6	7.8	9.0	7.7
metolachlor+simazine+ atrazine+paraquat	2.5+1.7+ 1.7+0.6	8.0	8.7	7.9
pendimethalin+atrazine+ paraquat	1.7+1.7+0.6	7.2	7.2	7.2
alachlor+atrazine+paraquat	2.2+2.2+0.6	6.8	6.5	6.7
alachlor+atrazine+paraquat	2.8+2.2+0.6	6.8	5.0	4.3
metolachlor+cyanazine+ paraquat	2.5+2.2+0.6	8.3	9.0	7.5
cyanazine+atrazine+paraquat	2.8+2.2+0.6	4.8	5.7	5.7
paraquat	0.6	5.0	0.0	0.0
Control		0.0	0.0	0.0

[a]Planted and treated - 5/10/79

[b]All paraquat applications included X-77 at 0.23 L/ha

Table 5 Barnyardgrass control in no-tillage corn with preplant herbicide treatments. Hagerstown, MD. 1980[a]

Treatment	Herbicide Rate (kg/ha)	Barnyardgrass Control 6/6	7/7
atrazine+simazine+paraquat[b]	2.2+2.2+0.6	3.3	1.3
metolachlor+atrazine+paraquat	2.5+2.2+0.6	7.5	9.1
metolachlor+atrazine+paraquat	2.8+2.2+0.6	8.8	9.3
metolachlor+simazine+paraquat	2.5+2.2+0.6	5.8	6.7
metolachlor+simazine+paraquat	2.8+2.2+0.6	8.7	8.9
metolachlor+atrazine+ simazine+paraquat	2.5+1.7+ 1.7+0.6	7.3	7.9
metolachlor+atrazine+ simazine+paraquat	2.8+1.7+ 1.7+0.6	6.7	7.5
metolachlor+atrazine+ simazine+paraquat	3.4+1.7+ 1.7+0.6	7.7	8.3
alachlor+atrazine+paraquat	2.8+2.2+0.6	5.7	5.7
alachlor+atrazine+paraquat	3.4+2.2+0.6	6.1	5.7
alachlor+atrazine+ simazine+paraquat	2.80+1.7+ 1.7+0.6	5.3	3.7
paraquat	0.6	1.0	0.0
Check		0.0	0.0

[a]Treated - 5/7/80, Planted 5/10/80

[b]All paraquat treatments included X-77 at 0.23 L/ha.

Table 6 Barnyardgrass control in no-tillage corn with postemergence and post-directed herbicide treatments. Westminster, MD. 1979

Treatment[a]	Herbicide Rate (kg/ha)	Appl. Method	Field Corn Injury 7/2	7/13	Barnyardgrass Control 7/2	7/13	9/20
paraquat[b]	0.6	Post-dird[d]	-	2.7	-	8.0	7.3
ametryne[b]	1.7	Post-dird	-	1.0	-	3.0	0.0
linuron[b]	1.1	Post-dird	-	0.7	-	4.3	6.8
cyanazine	2.2	Post[e]	1.0	0.0	0.0	0.0	0.0
atrazine[c]	2.2	Post	0.0	0.0	0.0	0.0	1.3
pendimethalin+ cyanazine	1.7+ 2.8	Post	2.7	1.0	5.8	5.3	1.7

[a]Test area treated preemergence with atrazine (1.68 kg/ha) + simazine (1.68 kg/ha) + paraquat (0.6 kg/ha) + X-77 (0.23 L/ha) on 5/10/79.

[b]Applied with X-77 (0.23 L/ha)

[c]Applied with AL-411F (0.95 L/ha)

[d]Applied 7/2/79

[e]Applied 5/23/79

CONTROL OF TRIAZINE RESISTANT REDROOT PIGWEED IN CONVENTIONAL AND NO-TILLAGE CORN

R. L. Ritter and T. C. Harris[1/]

ABSTRACT

This experiment, conducted in 1980 at the Plant Research Farm in Silver Spring, MD, was designed to examine herbicide control programs for triazine resistant redroot pigweed in conventional and no-tillage corn.

In the fall of 1979, a site that was heavily infested with triazine resistant redroot pigweed was selected for this study and sown with rye for a cover crop. In April, 1980, the land to be conventionally planted was disced and prepared for planting. On April 24, corn ('Pioneer 3184') was planted in 30 inch rows utilizing a no-tillage planter. The soil was a Beltsville silt loam (pH 6.3, O.M. 1.5). Plots were 6 rows wide and 25 feet long. Both tests were randomized complete block designs with three replications. Herbicides were applied following planting with a CO_2 pressurized back pack sprayer that deliverd 20 gpa at 20 psi using SS-8003 flat fan nozzles. Paraquat was used with the preemergence herbicides in the no-tillage test in order to obtain quick kill of the rye cover crop. The postemergence herbicides were not applied until the pigweed was 1 to 2 inches high and had 3 to 4 leaves. Visual ratings were made throughout the growing season. Ratings were based on a scale of 0 to 100 with 0=no control or no crop injury and 100=total control or crop dessication. Yields were taken from all plots and obtained with a standard field combine.

The triazine herbicide combinations used in these studies afforded no control of the pigweed. Even at a 2X rate (atrazine plus simazine at 2½ plus 2½ lb ai/A), the triazines gave minimal control of the pigweed for approximately 1 month.

Metolachlor and alachlor provided good season long pigweed control in the conventional study. In the no-tillage study, metolachlor or combinations with metolachlor afforded good control for about 6 weeks.

Metolachlor followed by an early postemergence application of dicamba resulted in season long control in conventional plots, but control dropped off by the end of July in no-tillage plots.

Pendimethalin was also included in this study. Good pigweed control was obtained in the conventional study. In the no-tillage study control started to drop off by the eighth week.

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EFFECT OF CHEMICALS ON THE ESTABLISHMENT OF DIRECT PLANTED ALFALFA

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ABSTRACT

The no-till method for introduction of forage legumes into both sod and stubble situations is potentially very cheap and very effective. Problems in the past have been mainly concerned with inadequate competition control, however, current herbicide recommendations have largely eliminated weed control as a serious limitation to success of no-till seedings.

But recent studies have shown that even with satisfactory weed control, the proportion of successful stands of no-till alfalfa has been far less than expected. Failures are characterized by uneven and poor emergence, and damage is particularly evident on sod sites within 30 days after seeding. We report here a number of field experiments which attempted to determine the major causes of these early seedling losses.

Both spring and fall seedings were conducted on four sites, each representing a distinctive form of vegetation: i) oat stubble, crop harvested in previous year; ii) annual weed area, wheat harvested two years earlier. Vegetation composition was predominantly common ragweed (Ambrosia artemisiifolia L.), yellow rocket (Barbarea vulgaris R. Br.), and yellow foxtail (Setaria glauca (L.) Beauv.); iii) quackgrass (Agropyron repens L. Beauv.); and iv) a mixed hay sod consisting primarily of timothy (Phleum pratense L.), Kentucky bluegrass (Poa pratensis L.), quackgrass and orchardgrass (Dactylis glomerata L.). All sites were located on an Erie-Ellery channery silt loam. Glyphosate (2.2 kg/ha ai) was applied 11 to 15 days before seeding the alfalfa with a John Deere Powr Till(tm) at a rate of 8.8 kg/ha.

Spring seedings. Seeding was over the period 2 to 4 June with chemicals being applied 1 to 2 days after seeding, except for methyl bromide (MeBr) which was applied 6 to 8 days before seeding (1 kg/22m^2). Carbofuran and dyphonate were applied as sprays (1.1 kg/ha ai), diazinon as a powder (1.1 kg/ha ai), ridomil, a fungicide as granules (2.2 kg/ha ai) and the molluscicides, mesurol and metaldehyde, as pellets (.95 kg/ha ai).

A general finding from these experiments was that application of mesurol significantly reduced seedling losses and the proportion of plants damaged and improved yield and average plant development. The response to mesurol and MeBr was relatively greater on those sites where the soil had been more recently disturbed by plowing (stubble, annual weeds), whereas the response to insecticides tended to be relatively greater on the sod and quackgrass sites. However, the response to the insecticides was less than that obtained from mesurol. It was also evident that where a molluscicide was combined with carbofuran, plant response was invariably greater than where either chemical was applied alone, and most of this additional response was attributed to the molluscicide component. The fungicide was ineffective.

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Fall seedings. The most promising chemicals from the spring seedings (mesurol, carbofuran) were incorporated into our fall program, and in addition, a vegetative cover variable was included. The chemicals were applied at or on the day after seeding, and vegetation where necessary was mowed and removed 2 to 3 days before seeding.

Plant response to both chemicals tended to be more striking with the fall seedings compared to the spring seedings (Table 1), and as with the spring seedings, response to mesurol was greater than that obtained with carbofuran. It was also apparent from these seedings that the level of vegetative cover present also exerted a large influence on seedling performance. At all four sites, the presence of cover increased seedling losses and proportion of seedlings damaged while its effect on seedling development was variable.

We concluded that two major reasons for the poor performance of no-till alfalfa seedings are insects and molluscs. While we are uncertain as to the identity of the insect group responsible, we have collected data relating slug numbers to plant performance and treatments applied. Certainly other molluscs are present (small snails) but these numbers do not seem to be large enough to account for the field damage observed.

In addition to chemical manipulation of these organisms, it was apparent that their numbers or activity could be significantly altered by varying the level of vegetation present. From these and other studies we consider the relative influence of these two groups of organisms on no-till seedings to vary with site and year, and from early to late in the season. The status of no-till for forage seeding can be greatly improved by raising the reliability of the method. This we feel can be achieved by identifying the organisms responsible for seeding failures and controlling their activity where necessary by chemical or cultural means.

Table 1. The effect of carbofuran, mesurol and vegetative cover on the proportion of spring and fall seedings differing significantly from the control ($P<0.05$) for the various plant characters measured. Each value is based on four estimates.

	Plants Per Meter		Average Leaf per plant		% Plants Damaged		Yield (kg/ha)	
	Spr	Fall	Spr	Fall	Spr	Fall	Spr	Fall
Carbofuran	0	25	25	50	25	75	25	--
Mesurol	100	100	50	50	100	100	75	--
Vegetative Cover	--	100	--	75	--	--	100	--

PREEMERGENCE PENDIMETHALIN IN COMBINATION WITH CHLORAMBEN, LINURON, AND METRIBUZIN IN SOYBEANS

D. Vitolo, R. D. Ilnicki, and P. Sollazzo[1/]

ABSTRACT

Pendimethalin, metribuzin, linuron, and chloramben, alone and in various combinations, were evaluated in 1980 for their effects on weed control and yields in soybeans. None of the herbicides caused injury to the crop. Excellent weed control was obtained with pendimethalin combined with either chloramben or metribuzin. Significant yield increases were obtained when pendimethalin at 1.0 lb/A was applied in combination with chloramben at the 2.0 lb/A and 2.5 lb/A rates, and with pendimethalin at 0.75 lb/A + metribuzin at 0.5 lb/A.

INTRODUCTION

Soybeans (Glycine max L.) are becoming increasingly important to Northeast agriculture. It is well-established that weed control is very important in establishing this crop, particularly during early stages of development. Many new herbicides are being investigated for use in this crop, and many are approved for use. Since all herbicides have some inherent weakness, it seemed feasible to investigate some of the more important ones in various combinations. It was the objective of this study to investigate pendimethalin (N-(1-ethylpropyl)3,4-dimethyl-2,6-dinitrobenzencimine), a relatively new dinitroaniline herbicide which is effective on grasses as well as some broadleaf weeds, in combination with chloramben (3-amino-2,5-dichlorobenzoic), linuron (3-(3,4 dichlorophenyl)-1-methoxy-1-methylurea), and metribuzin (4-amino-6-1-butyl-3-(methylthio)as-triazin-5-(4H)-one), which are more effective on broadleaf weeds than grasses.

MATERIALS AND METHODS

This study was conducted at the Rutgers University research farm at Adelphia, N. J., on a Sassafras loam soil. The study was conducted utilizing a randomized complete block design with three replications.

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Plots were 7.5' by 20'. Soybeans (Midstates 250) were planted June 3 in 30-inch rows, three rows per plot. Standard agronomic practices were observed in preparing the field for planting. Herbicide treatments were applied at 40 gpa, June 5, using a backpack CO_2-propelled sprayer with water as carrier.

The dominant weed species growing in the experimental area were common lambsquarters (Chenopodium album L.), Ladysthumb smartweed (Polygonum persicaria L.), and fall panicum (Panicum dichlotomiflorium Michx.). Plots were rated on July 18 using a scale of 0 to 10, where 0 is no effect on weed or crop stand and 10 is complete control. The center row of each plot was harvested by hand on October 30. All herbicide treatments evaluated are listed in Table 1.

RESULTS AND DISCUSSION

No significant soybean injury was observed with any of the treatments investigated (Table 1).

Pendimethalin applied alone provided excellent control of lambsquarters. Smartweed control was adequate at the 1.0 lb/A rate. Fall panicum was not controlled at either rate. Pendimethalin in combination with chloramben provided excellent broad spectrum weed control at all rates evaluated. Significant yield increases were obtained when pendimethalin at 1.0 lb/A was applied in combination with chloramben at the 2.0 lb/A and 2.5 lb/A. Chloramben applied alone gave good control of lambsquarters at both rates; fall panicum was adequately controlled at the 3.0 lb/A rate. Smartweed was not controlled at either rate.

Pendimethalin + metribuzin produced excellent broad spectrum weed control at rates of 0.75 + 0.50 lb/A, 1.0 + 0.25 lb/A, and 1.0 + 0.50 lb/A. The combination of pendimethalin and metribuzin at 0.75 + 0.25 lb/A gave good broadleaf weed control but was not adequate on fall panicum. Significant yield increases were obtained with the 0.75 + 0.50 lb/A rate. Metribuzin alone did not provide adequate control of broadleaves or fall panicum. The excellent control of broadleaves at the 0.25 lb/A rate may be attributed to competition from the fall panicum.

Pendimethalin + linuron gave good weed control of lambsquarters and fall panicum at all rates. With an increased rate of pendimethalin, increased smartweed control resulted. Linuron alone did not adequately control any of the weeds. Yields were not significantly differently for either linuron alone or pendimethalin + linuron.

Table 1. The effects of pendimethalin, linuron, metribuzin, and chloramben alone and in various combinations on weed control and soybean yield. Adelphia, N. J. 1980.

Herbicide	lb.a.i./A	Weed Control [a]			Yield	
		Lambs-quarters	Smartweed	Fall Panicum	Bu/A [b]	Duncan's [c] Grouping
pendimethalin, 4ec	0.75	9.1	6.7	6.5	35.7	DEF
	1.00	9.6	8.3	5.3	37.0	CDEF
metribuzin, 50 wp	0.25	9.0	8.3	1.7	26.9	FG
	0.50	6.5	6.7	5.7	40.2	BCDE
pendimethalin + metribuzin	0.75 + 0.25	8.9	8.3	5.3	44.6	ABCDE
	0.75 + 0.50	9.8	9.7	9.0	50.0	AB
	1.0 + 0.25	9.7	9.7	8.8	44.2	ABCDE
	1.0 + 0.50	10.0	9.7	8.7	48.1	ABC
linuron, 50 wp	0.75	6.5	6.7	1.7	27.3	FG
	1.00	5.2	7.7	2.7	33.3	EFG
pendimethalin + linuron	0.75 + 0.50	8.8	6.7	9.0	42.4	ABCDE
	0.75 + 0.75	9.6	6.7	8.7	41.4	ABCDE
	1.00 + 0.50	9.4	9.7	9.0	42.4	ABCDE
	1.00 + 0.75	9.2	9.7	7.2	43.0	ABCDE
chloramben, 2S	2.5	9.4	6.7	7.2	40.8	ABCDE
	3.0	9.5	6.7	8.9	44.6	ABCDE
pendimethalin + chloramben	0.75 + 2.0	9.8	10.0	9.7	48.3	ABC
	1.00 + 2.0	10.0	10.0	9.5	52.7	A
	0.75 + 2.5	10.0	9.0	10.0	48.4	ABC
	1.00 + 2.5	10.0	10.0	10.0	50.2	AB
Check - cult.		10.0	10.0	10.0	47.2	ABCD
Check - uncult.		1.0	0.0	0.8	22.6	G
LSD						
0.05					9.97	
0.01					11.96	

a. Weed Control Ratings (0.0 = no control, 10.0 = complete control). Made July 18.

b. Soybean Harvest October 30.

c. Yields With Same Letters Are Not Significantly Different.

ESTABLISHING SOYBEANS IN A NO-TILLAGE DOUBLE-CROP SYSTEM WITH SEVERAL HERBICIDE COMBINATIONS

P. Chitapong, R. D. Ilnicki and L. C. Horng[1/]

ABSTRACT

Herbicide combinations were evaluated in no-till double-crop soybeans following barley. Paraquat and glyphosate, knockdown herbicides, were used with residual herbicides that included oxyfluorfen; oxyfluorfen in combination with alachlor or oryzalin; oryzalin in combination with linuron or metribuzin; and metribuzin. Acetochlor was also compared to alachlor in three-way combinations that included glyphosate and linuron. Weeds present were volunteer barley, common ragweed, lambsquarters, a number of grasses, and curly dock.

Oxyfluorfen with glyphosate effected very good control of broadleaf weeds but better control of grasses was produced when applied with paraquat. When alachlor was included in the mixtures, weed control was improved more with paraquat than with glyphosate.

When oryzalin was substituted for alachlor there was a slight improvement in control of curly dock and grasses but no improvement in control of other weeds. Control was slightly better with glyphosate than paraquat.

Metribuzin with either glyphosate or paraquat proved effective and control of most weeds was slightly better with glyphosate. However, control of volunteer barley was better with paraquat.

When oryzalin was added to metribuzin, control was not improved much over oryzalin alone when the mixture included paraquat; however, control was slightly improved with glyphosate. Where linuron was substituted for oryzalin control was improved with no great difference between glyphosate or paraquat; however, the improved control was slightly better with paraquat.

Acetochlor was compared to alachlor in three-way combinations which included linuron and glyphosate. Control was slightly better with acetochlor.

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WEED CONTROL IN DOUBLE CROP NO-TILL SOYBEANS

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ABSTRACT

Herbicides were selected and applied in the spring for weed control in fall-sown barley. These herbicides were also evaluated for residual effects and weed control in soybeans and snapbeans which were planted following the barley harvest. DPX 4189 effected very good corn chamomile control in barley but its residual characteristic was such that injury to snapbeans and soybeans resulted. Control of a number of weed species in snapbeans and soybeans was effective. Herbicides which gave good control in barley and were effective for snapbeans and soybeans included oryzalin, oryzalin plus metribuzin, and oryzalin plus 2,4-D, as well as each of these treatments followed by paraquat or glyphosate, applied as overlays following legume planting.

INTRODUCTION

No-till farming continues to be of interest to researchers and farmers alike. Reduced soil erosion, improved water relations and enhanced time and energy efficiency are attractions of no-till farming. This study is a continuation of a series to evaluate combinations and rates of herbicides which are best suited to small grain-legume double cropping. It was the objective of this study to reevaluate conventional herbicide combinations in a no-till small grain situation as well as to determine their residual effects on the soybeans.

MATERIALS AND METHODS

Soybeans (Glycine max L. 'Elf') and snapbeans (Phaseolus vulgaris L. 'Tendercrop') were planted on June 23 into barley stubble which had been planted in the fall of 1979 and harvested June 18. This study was conducted on Sassafras loam soil containing 1.5% organic matter at the Soils and Crops Research Center, New Jersey Agricultural Experiment Station, Adelphia, N. J. One row each of soybeans and snapbeans occupied a plot 7' x 13' (2.1 x 4.0m). There were 4 replicates of herbicide treatments in a randomized block design. On April 17, herbicide applications in the small grain were made at 40 gpa (167 L/ha) with a CO_2-propelled backpack sprayer. A rating system with 0 = no crop injury or weed control and 10 = complete reduction of crop stand or vigor or total weed

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kill was used on May 20 to evaluate infestation levels of corn chamomile (Anthemis arvensis L.) in the barley and on July 2 and August 15 in the legume stands for populations of lambsquarters (Chenopodium album L.), redroot pigweed (Amaranthus retroflexus L.), yellow nutsedge (Cyperus esculentus L.), and grasses which were composed of fall panicum (Panicum dichotomiflorum Michx.), stinkgrass (Eragrostis cilianensis (All.) Lutati), and large crabgrass (Digitaria sanguinalis (L.) Scop.). The snapbeans and soybeans were hand harvested on October 20 and September 12 respectively, and dry seed weight determined. Weather and soil conditions on April 17 were: clear, 64°F. (17.8°C.), wind 10-12 mph, gusts to 20 mph and the soil surface at 52°F. (11.1°C.) was moist. On June 24 when the contact herbicides were sprayed, the weather was clear and air temperature was 90°F. (32.2°C.) and the soil was dry and 82°F. (27.8°C.).

RESULTS AND DISCUSSION

Highest barley yields were obtained using 0.03 lb/A (0.03 kg/ha) DPX-4189 and were not significantly different at the 1% level from 2,4-D + DPX-4189 at rates of 0.5 lb/A (0.56 kg/ha) and 0.125 lb/A (0.14 kg/ha) respectively or oryzalin at 1.5 lb/A (1.68 kg/ha).

Oryzalin at 2.0 lb/A (2.24 kg/ha) + 2,4-D at 1.0 lb/A (1.12 kg/ha) gave yields of soybeans which were not significantly different than oryzalin at 1.0 and 1.25 lb/A (1.12 kg/ha and 1.4 kg/ha) combined with metribuzin at 0.38 lb/A (0.43 kg/ha) (see Table 1).

Table 1. Herbicide treatments, weed ratings, and yields for winter barley-soybean experiment

Herbicide	Rate lb.a.i./A	Lambs-quarters	Pigweed	Grasses	Corn Chamomile	Barley Bu/A	Barley kg/ha	Soybeans Bu/A	Soybeans Kg/ha
oryzalin + 2,4-D	1.00 + 0.5	7.5	4.3	5.3	5.1	77.2	850.1	8.3	91.4
	1.25 + 0.5	9.3	4.5	6.8	4.9	73.7	811.6	12.6	138.8
	2.00 + 1.0	9.9	7.3	8.0	8.1	68.5	754.3	14.1	155.3**
metribuzin	0.38	7.2	4.7	1.5	5.7	73.5	809.4	6.7	73.8
oryzalin + metribuzin	1.00 + 0.38	7.6	7.6	6.3	5.8	75.3	829.2	13.4	147.6**
	1.25 + 0.38	9.7	9.7	8.0	8.0	71.4	786.3	13.6	149.8**
alachlor	1.5	7.2	4.8	3.0	2.9	70.9	780.8	7.9	87.0
	2.0	8.1	5.3	2.0	2.0	72.6	799.5	9.0	99.1
DPX 4189	1/64 (1/4 oz)	10.0	10.0	6.2	8.0	71.2	784.1	5.5	60.6
	1/32 (1/2 oz)	10.0	10.0	2.2	7.9	82.4**	907.4	9.9	109.0
	1/16 (1 oz)	10.0	10.0	6.0	8.4	76.1	838.0	4.0	44.0
	1/8 (2 oz)	10.0	7.7	4.0	8.3	72.8	801.7	0.6	6.6
	1/4 (4 oz)	8.0	9.8	4.8	7.0	75.5	831.4	1.2	13.2
2,4-D + DPX 4189	0.5 + 0.125	8.0	8.8	2.0	5.4	78.9**	868.9	6.8	74.9
oryzalin foll. by paraquat after harvest	1.50 + 0.5	9.2	3.8	8.7	3.9	78.2**	861.1	16.1	177.3**
oryzalin foll. by glyphosate after harvest	1.50 + 0.5	10.0	6.2	8.7	2.5	63.6	700.4	14.6	160.8**
oryzalin + 2,4-D foll. by paraquat after harvest	(1.5 + 0.5) + 0.5	10.0	6.2	6.7	5.1	74.2	817.1	17.4	191.6**
oryzalin + 2,4-D foll. by glyphosate after harvest	(1.5 + 0.5) + 0.5	9.7	5.4	7.8	5.7	76.8	845.7	14.4	158.6**
oryzalin + metribuzin foll. by paraquat after harvest	(1.25 + 0.38) + 0.5	7.4	4.9	6.6	7.6	76.7	844.6	14.1	155.3**
oryzalin + metribuzin foll. by glyphosate after harvest	(1.25 + 0.38) + 0.5	8.1	6.2	6.6	6.6	76.3	840.2	14.8	163.0**
Check	--	2.5	2.1	1.0	0.3	71.0	781.9	10.3	113.4

** = Significant at 1% level.
LSD = 4.4 Bushels/A Barley
122.6 Bushels/A Soybeans

PRELIMINARY STUDIES IN EARLY PLANTED NO-TILLAGE SOYBEANS

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ABSTRACT

Tillage has historically been an important aspect of crop production. Purposes of tillage were primarily seed bed preparation and weed control. Areas of the U. S., including Virginia, with long growing seasons can double-crop, producing two crops a year. A typical rotation has been wheat or barley followed by soybeans. With the development of the no-till planting technique whereby seed is placed directly into a slit cut in the soil by a coulter, double-cropping has increased. In 1979, research was initiated at the Virginia Truck and Ornamentals Research Station, Painter, to investigate the feasibility of producing full-season, single crop soybeans using the no-till system of planting. Soybeans were planted on May 18 into stubble from the previous year's soybean crop. Planting was with unit planters on 18-inch row spacings into slits cut in the soil by 2-inch fluted coulters. Herbicide treatments included either paraquat + 0.25% surfactant or glyphosate for control of existing vegetation and linuron, plus either alachlor or metolachlor for residual control. Rainfall within two hours following herbicide applications resulted in generally poor control of horseweed (Conyza canadensis (L.) Cronq.) with both paraquat and glyphosate, although control of other existing annuals, as well as residual control, was good. In 1980, soybeans were planted on May 27 in 10-inch row spacings with a no-till drill with 2-inch fluted coulters, into a rye cover that had been treated on April 22 with paraquat + 0.25% surfactant. After planting, plots were sprayed with either paraquat + 0.25% surfactant or glyphosate and residual herbicides. Both paraquat and glyphosate provided good control of existing vegetation. As the season progressed, fall panicum (Panicum dichotomiflorum (L.) Michx.) emerged in plots receiving no residual herbicides but was controlled by all pre-emergence herbicides. Notwithstanding an extremely dry summer in 1980, soybean yields averaged approximately 40 bushels per acre in each year of the study. High yields and good weed control obtained indicated that much potential exists for production of soybeans planted no-till as a full-season crop.

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COMBINATIONS OF FLOWABLE LIGNIN AND METRIBUZIN FOR WEED CONTROL IN SOYBEANS

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ABSTRACT

The use of metribuzin as a preemergence herbicide in soybeans for control of broadleaf weeds and some grasses is a practice among some growers. However, metribuzin has been found to produce some crop injury to emerging plants particularly on light sandy soils. In this study, various rates of metribuzin in combination with flowable lignin (PC 671) were evaluated for phytotoxicity and weed control in soybeans grown on Freehold sandy loam at the Adelphia Research Center, New Jersey Agricultural Experiment Center, Adelphia, New Jersey, in 1980. The normal use rate of metribuzin in combination with flowable lignin showed little phytotoxicity but as the metribuzin rates were increased, a reduction in crop vigor was evident. Although there seemed to be no strong evidence of a safening effect using lignin at low concentrations, a definite trend of increased soybean tolerance was noted using rates of 6 pints/acre of lignin with the higher than normal use rate of metribuzin.

INTRODUCTION

The use of 4-amino-6-tert-butyl-3-(methylthio)-*as*-triazin-5 (4H)-one (metribuzin) as a preemergence herbicide in soybeans, (*Glycine max* (L.) Merr.), is well established. On coarse soils sometimes some initial injury from the herbicide to the crop may result particularly following excessive rainfall. Recently, it has been reported (1) that lignin, in a flowable form, when added to metribuzin, can reduce the initial phytotoxic response of soybeans to the herbicide. It was the objective of this study to determine whether flowable lignin added to metribuzin spray applications can reduce the initial phytotoxic response of soybeans to high rates of metribuzin and whether the recovery of the crop is enhanced by these additions.

MATERIALS AND METHODS

Midstates 250 soybeans were planted in Freehold sandy loam on May 23, 1980, at the Adelphia Research Center, New Jersey

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Agricultural Experiment Station, Adelphia, New Jersey, in 30-inch rows. Experimental plots, 3-rows wide by 20 feet, were established to receive metribuzin in combination with flowable lignin immediately after planting. The use rate of metribuzin for this soil was established at 0.5 lb/A. Rates of 0.25, 0.5, 1.0 and 1.25 lb/A of metribuzin (respectively, 0.5x, x, 2x and 2.5x the normal use rate) were applied alone and in combination with flowable lignin at 0, 1, 2, 4 and 6 pt/A. All applications were made in 40 GPA using an experimental backsack sprayer with compressed CO_2 as the propellant. All treatments were replicated three times in a randomized complete block design.

Response of soybeans and weed control observations were made throughout the course of the investigation. Detailed notes were taken on June 12 and July 23, approximately 3 and 9 weeks, respectively, after spray applications. A scale of 0 to 10 was used where 0 = no effect on crop or weeds and 10 = complete control or elimination of all plants. The experimental area included the following weeds: lambsquarters (Chenopodium album L.), black nightshade (Solanum nigrum L.), jimsonweed (Datura stramonium L.) and velvetleaf (Abutilon theophrasti Medic). All treatments used are presented in Table 1.

All plots were harvested on October 22 by hand and threshed using an experimental thresher. Yields were recorded and expressed in bushels per acre.

RESULTS AND DISCUSSION

In Table 1 are summarized weed control and crop response data. From this table it can be seen that vigor of soybeans on the first observation date was not seriously affected by metribuzin at the normal use rate. Reduction of vigor was observed with metribuzin rates of 1 lb/A or more. However, there was no significant difference in crop yield among all treatments. Furthermore, as the rate of lignin was increased, there was no significant reductions in crop injury at rates below 6 pts/A. However, at the 6 pts/A rate of lignin, there seemed to be a safening effect on the phytotoxicity of metribuzin. It is also interesting to note that on the second observation date some nine weeks after spray application, the initial injury to vigor on soybeans at the high rate of metribuzin were almost completely outgrown. Weed control ratings showed an increasing trend as the rates of metribuzin increased. This trend can be seen in Table 1 as a gradual improvement with rates ranging from approximately 60% at .25 lb/A (.5x rate) to nearly 95% control

Table 1. Response of soybeans and weeds to metribuzin applied alone and in combination with flowable lignin (PC 671).

metribuzin, WP lb/A	lignin (PC 671) pt/A	Soybeans 3 Weeks S (1)	Soybeans 3 Weeks V (2)	Soybeans 9 Weeks S	Soybeans 9 Weeks V	Weed Control (3) LBQS (4) S	Weed Control BN S	Weed Control JW S	Weed Control VL S	Yield Bu/A
0.25	0	0.1	0.1	0.0	0.0	1.3	5.0	10.0	3.3	27.74
	1	0.0	0.1	0.0	0.0	0.0	5.6	7.6	0.6	26.88
	2	0.0	0.0	0.0	0.0	3.3	6.0	10.0	7.0	28.02
	4	0.0	0.0	0.0	0.0	6.0	6.3	6.6	5.0	28.39
	6	0.0	0.0	0.0	0.0	2.3	7.3	6.6	5.3	29.54
0.5	0	0.0	0.2	0.0	0.0	9.0	6.5	6.6	4.0	29.83
	1	0.0	0.2	0.0	0.0	9.0	5.0	9.8	8.6	28.96
	2	0.0	0.3	0.0	0.0	8.6	7.1	6.6	9.3	30.21
	4	0.0	0.1	0.0	0.0	9.1	9.8	10.0	7.3	29.32
	6	0.0	0.5	0.0	0.0	9.0	9.0	2.0	10.0	25.70
1.0	0	0.0	1.0	0.0	0.0	9.0	8.6	4.1	9.6	30.20
	1	0.0	0.8	0.0	0.0	10.0	8.0	9.8	10.0	32.17
	2	0.0	1.1	0.1	0.0	10.0	8.6	9.3	9.3	28.75
	4	0.5	1.2	0.0	0.5	4.7	7.0	5.0	9.5	28.28
	6	0.0	0.9	0.0	0.0	10.0	9.3	6.0	9.8	26.41
1.25	0	0.2	1.9	0.3	0.3	10.0	6.9	4.6	10.0	33.64
	1	0.0	3.0	0.9	0.0	9.3	8.7	10.0	9.8	27.55
	2	0.0	1.5	0.3	0.0	10.0	6.5	10.0	10.0	29.31
	4	0.1	2.0	0.0	0.0	10.0	9.1	10.0	10.0	26.73
	6	0.0	0.0	0.7	0.0	10.0	10.0	9.8	9.8	29.34
Check - cult.	-	0.0	0.0	0.0	0.0	10.0	10.0	10.0	10.0	28.01
Check - uncult.	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.34

(1) Stand ratings expressed on scale 0 to 10; 0 = no effect, 10 = complete loss of stand
(2) Vigor ratings expressed on scale 0 to 10; 0 = no effect, 10 = complete loss of vigor
(3) Weed control expressed on scale 0 to 10, 0 = no control, 10 = complete control
(4) LBQS = common lambsquarters; BN = Black nightshade; JW = Jimsonweed; VF = Velvetleaf

at the 1.25 lb/A (2.5x rate). Likewise, an increase in weed control was seen as the lignin rates increased.

Although these data are not conclusive, there seems to be some safening effect of lignin on high rates of metribuzin and that recovery of soybeans is apparently enhanced. Additional experimental data are necessary before any definite conclusions can be made.

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SOYBEAN PROTECTION FROM TRIAZINE INJURY BY PENDIMETHALIN

T. Malefyt[1/] and W.B. Duke[2/]

ABSTRACT

Experiments were conducted in the glasshouse to evaluate pendimethalin and trifluralin as protectants of soybeans from triazine injury. Pendimethalin at 2.24, 1.68 and 1.12 kg/ha and trifluralin at 1.12, 0.84 and 0.56 kg/ha were tested for protection from atrazine injury following incorporation into the soil of 0.42, 0.28 and 0.14 kg/ha of atrazine with the selected dinitroanaline. At the 0.28 kg/ha level of atrazine, both pendimethalin and trifluralin reduced atrazine injury by as much at 14% and 33% respectively. The best rate for portection was pendimethalin at 1.68 kg/ha and trifluralin at 0.84 kg/ha.

Pendimethalin and trifluralin were also tested as soybean protectants from metribuzin injury. Metribuzin was either applied preplant incorporated or preemergence at .70 and .28 kg/ha. When metribuzin was applied preplant incorporated both pendimethalin and trifluralin failed to provide significant protection. When metribuzin was applied preemergence, however, pendimethalin and trifluralin reduced injury 42% and 27% respectively.

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GIANT FOXTAIL CONTROL IN SOYBEANS

R. R. Hahn[1/]

ABSTRACT

Preemergence herbicide combinations were evaluated for giant foxtail (Setaria faberi Herrm.) and common ragweed (Ambrosia artemisiifolia L.) control in soybeans in Seneca County, New York in 1978 and 1980. The soil type was a Honeoye silt loam with 4.1% organic matter in 1978 and an Ilion silty clay loam with 5.3% organic matter in 1980. In both cases, the plot area was heavily infested with giant foxtail with a moderately heavy infestation of common ragweed. Conventional tillage was used and soybeans were planted in 30-inch rows. Herbicide treatments were applied in water to 10 by 25 foot plots using a compressed air plot sprayer calibrated to deliver 25 gpa of spray solution. A randomized complete block design with four replications was used in both experiments.

'Amsoy' soybeans were planted June 1 and herbicide treatments applied on June 4, 1978. Rainfall total for the 2 weeks following herbicide application equaled 0.82 inches with 0.52 inches falling on June 13. An additional 0.57 inches fell during the third week. Giant foxtail and common ragweed control ratings were made on September 19. Application of metolachlor in combination with linuron provided good giant foxtail control (Table 1). Metolachlor plus metribuzin and alachlor plus linuron or metribuzin provided only fair control of this annual grass. Combinations of oryzalin or pendimethalin with linuron or metribuzin did not provide adequate giant foxtail control. Common ragweed control was commercially acceptable with all herbicide treatments except the combination of oryzalin plus linuron. Top soybean yields were obtained when alachlor or metolachlor were used in combination with linuron or metribuzin.

In 1980, 'V.R. Classic I' soybeans were planted on June 13 and herbicide treatments applied that same day. Precipitation during the 2 weeks following application was 1.67 inches with 0.92 inches on June 16. Giant foxtail and common ragweed control ratings were made on July 19 and September 18. The September ratings are shown in Table 1. Excellent giant foxtail control was obtained with alachlor, metolachlor, MON-097 or ORTHO 28269 in combinations with linuron or metribuzin. Rates of the acetanilide herbicides varied from 1.5 lb/A for MON-097 and ORTHO 28269 to 2.5 lb/A for alachlor. Common ragweed control ranged from poor to good with the combination of 2.0 lb/A of MON-097 plus 0.38 lb/A of metribuzin receiving an 8.5 rating. Of the treatments shown in Table 1, only the control yielded significantly less soybeans than the other treatments.

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Table 1. Soybean yields and control ratings for common ragweed and giant foxtail with various herbicide combinations in 1978 and 1980.

Herbicides		Rates lb/A	Control Ratings[a] Common Ragweed	Giant Foxtail	Yield bu/A
		1978			
Alachlor	+ Linuron	2.0 + 1.0	8.3	7.0	23.8
Alachlor	+ Metribuzin	2.0 + 0.38	10.0	6.3	22.7
Metolachlor	+ Linuron	2.0 + 1.0	7.3	8.3	22.4
Metolachlor	+ Metribuzin	2.0 + 0.38	8.8	7.3	22.5
Oryzalin	+ Linuron	1.5 + 1.0	4.0	4.5	14.3
Oryzalin	+ Metribuzin	1.5 + 0.38	8.5	5.0	18.1
Pendimethalin	+ Linuron	1.0 + 1.0	7.0	5.0	20.4
Pendimethalin	+ Metribuzin	1.0 + 0.38	7.0	5.3	19.1
Control		-	0.0	0.0	11.4
LSD (0.05)			3.4	1.6	5.5
LSD (0.01)			4.5	2.2	7.4
		1980			
Alachlor	+ Linuron	2.5 + 1.0	6.0	9.0	32.4
Alachlor	+ Metribuzin	2.5 + 0.38	7.5	9.5	34.6
Metolachlor	+ Linuron	2.0 + 1.0	5.3	9.0	31.0
Metolachlor	+ Metribuzin	2.0 + 0.38	5.7	9.3	31.2
MON-097	+ Metribuzin	1.5 + 0.38	7.7	9.3	28.4
MON-097	+ Metribuzin	2.0 + 0.38	8.5	9.7	31.5
ORTHO 28269	+ Metribuzin	1.5 + 0.38	5.7	9.0	28.5
Oryzalin	+ Metribuzin	1.5 + 0.38	5.3	7.7	29.2
Pendimethalin	+ Metribuzin	1.5 + 0.38	6.0	7.0	30.4
Control		-	0.0	0.0	8.9
LSD (0.05)			1.6	1.4	6.1
LSD (0.01)			2.1	1.8	8.2

[a]Control ratings: 0 = no effect on weeds, 10 = complete kill.

COMPETITIVE EFFECTS OF FALL PANICUM ON SOYBEANS

P. J. Sollazzo and R. D. Ilnicki[1/]

ABSTRACT

This study was undertaken to determine the competitive effects of fall panicum on soybeans and of soybeans on fall panicum as influenced by several cultural practices which included row spacing (20, 40, 60, and 80 cm), planting dates (early, mid and late season), and levels of fall panicum infestation (no control, total control, and two intermediate levels) which were established by various levels of alachlor. Broadleaf weeds were eliminated by hand weedings.

Factors studied included plant heights, numbers of pods per plant, branching, height to first pod, lodging, and biomass of both species and yield.

From this study it was noted that row spacing had a significant effect on soybean factors studied and on growth and development of fall panicum. Narrower row spacings had an effect on reducing numbers of pods and branching but effected greater competition on fall panicum at all levels of infestation. This effect was such that little or no competition of fall panicum was observed.

The wider row spacings exerted little competitive effect on fall panicum. In this environment fall panicum exerted severe competition to soybeans and this contributed to decreases in yield, numbers of pods, and branching.

Planting date also produced some significant results. Early planted soybeans were less affected by weed competition but more competitive to fall panicum. Late planted soybeans were significantly affected by fall panicum and was greatest late in the growing season.

From this study, some significant principles were made obvious. Planting soybeans in narrow rows and early in the growing season puts the crop in a better competitive posture to fall panicum than late planting in wide rows.

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PERFORMANCE OF ACIFLUORFEN FOLLOWING PRETREATMENT WITH MEFLUIDIDE

B.J. Hook and S. Glenn[1/]

ABSTRACT

Herbicides applied postemergence in soybeans have not yet reached their full potential for broad spectrum control. Some specific combinations of herbicides result in increased activity and control of weeds which are normally not controlled by these herbicides when applied individually, whereas, other herbicide combinations result in antagonistic effects.

Greenhouse studies were conducted examining the activity of mefluidide and acifluorfen applied in combination and as sequential treatments on a variety of plants including johnsongrass, ivyleaf morningglory, velvetleaf, cocklebur, jimsonweed and soybeans. Plants were treated with combinations of mefluidide and acifluorfen or sequential treatments. Sequential treatments consisted of initial treatment of plants with either 0.14 kg/ha or 0.28 kg/ha of mefluidide. After an interval ranging from one to three days, plants were then treated with acifluorfen at rates ranging from 0.28 kg/ha to 0.56 kg/ha.

Mefluidide/acifluorfen combinations gave better control of all the weedy plants tested compared with mefluidide and acifluorfen applied separately but with severe soybean injury. Mefluidide/acifluorfen sequential treatments gave better control of johnsongrass, morningglory and velvetleaf than the control obtained with either chemical alone with reduced soybean injury from that obtained with the combination. The control obtained with the sequential treatments varied with treatment rate, interval between applications, and stage of growth of weeds. Seedlings could be controlled with a short interval while older plants needed a longer interval in order to get complete kill. The sequential treatment of mefluidide/acifluorfen showed the greatest effect on velvetleaf. Treatments of 0.28 kg/ha mefluidide followed three days later with 0.42 kg/ha acifluorfen provided 100% velvetleaf (5 cm high) control, whereas 0.28 kg/ha mefluidide and 0.42 kg/ha acifluorfen applied separately only provided 0 and 40% control, respectively.

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EFFICACY OF POSTEMERGENCE SPRAY DATES IN SOYBEANS

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ABSTRACT

Four combinations of BAS 9052 OH with bentazon were sprayed postemergence on five dates ranging from 22 days to 50 days after planting soybeans. Soybeans were planted in Sassafras loam (1.5%organic matter) in 3-row, 30-inch plots on June 19, 1980. The experiment was conducted at the Soils and Crops Research Center, New Jersey Agricultural Experiment Station, Adelphia, N.J. The plot size was 7.5' x 20' and the experimental design was a randomized complete block with herbicide treatments replicated three times. The weather conditions for all spray dates were clear, calm and between 80-90°F. The soil was wet to damp. Soybeans were harvested October 10. A rating system with 0 = no crop injury or weed control was 10 = complete reduction of crop stand or vigor or total infestation levels of fall panicum, lambsquarters, redroot pigweed and stinkgrass.

The grass control was excellent at higher levels of BAS 9052 OH (0.25 and 0.50 lb/A) and reduction of yields even at the last spray date were low. Bentazon was not effective at lower rates or at later dates. Highest yields were obtained with 0.5 lb/A BAS 9052 OH and 0.5 lb/A bentazon.

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EFFECTS OF SEVERAL ADJUVANTS ON THE ACTIVITY OF SOME GRASS HERBICIDES

L. C. Horng and R. D. Ilnicki[1/]

ABSTRACT

Investigations on the control of annual grasses with three new experimental herbicides in combination with several experimental adjuvants were conducted in the greenhouse and field.

In greenhouse studies BAS 9052 OH, RO 138895, and KK 80, each at two rates, were combined with several concentrations of phytoblend oils and several blends of surfynol[⊗] surfactants and applied to barnyardgrass when in the 3- to 4-leaf stage. BAS 9052 OH and RO 138895 at 0.28 and 0.56 kg/ha and KK 80 at 0.56 and 0.84 kg/ha with 0.1% v/v of the adjuvants produced only a slight effect on barnyardgrass. Control was improved for all herbicides when the concentration of the blends was increased to 1%; however, control with the oils was not improved.

In a soybean field experiment BAS 9052 OH and RO 138895 at 0.22 and 0.44 kg/ha and KK 80 at 0.44 and 0.83 kg/ha were applied with Blend C[⊗], Surfynol 465[⊗], and oil at 0.25 and 0.5% v/v at several stages of fall panicum growth. In order to get a better measure of grass control bentazon at 0.84 kg/ha or acifluorfen at 0.56 kg/ha were also applied but after the grass herbicides. All herbicides effected excellent control at all stages up to tillering of fall panicum and better control resulted with use of Blend C and Surfynol 465 than with the oils. Bentazon produced excellent control of all broadleaf weeds except lambsquarters and acifluorfen produced excellent control of broadleaf weeds but also effected some slight temporary injury to soybeans.

⊗ Experimental surfactants provided by Air Products Co., Piscataway, N. J.

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INTERACTIONS OF POSTEMERGENCE SOYBEAN HERBICIDES

R. L. Ritter and T. C. Harris[1/]

ABSTRACT

This experiment, conducted in 1980 at the Wye Institute, Queenstown, MD, was designed to evaluate the level of weed control and soybean tolerance obtained from tank mix combinations of postemergence grass and broadleaf herbicides.

Soybeans (var. 'Essex') were planted in 30 inch rows on May 30 in a Matapeake silt loam soil (pH 6.3, O.M. 1.5). Plots were either 4 rows or 6 rows wide and 25 feet long. All experiments were established as randomized complete block designs with three replications. Herbicides were applied with a CO_2 pressurized back pack sprayer that deliverd 20 gpa at 20 psi (preemergence treatments) or 30 gpa at 40 psi (postemergence treatments) using SS-8003 flat fan nozzles. Visual ratings of weed control and crop injury were made at 1, 2 and 4 weeks after herbicide application. Ratings were based on a scale of 0 to 100 with 0=no control or no crop injury and 100=total control or crop dessication. After the last rating the plots were cultivated. Yields were taken from all plots and obtained with a standard field combine.

With diclofop (1 lb ai/A), a tank mix combination with bentazon (0.75 lb ai/A) resulted in a significant reduction in giant green foxtail [*Setaria viridis* var. *major* (Gaud.) Posp.] control as compared to diclofop alone. This antagonism did not occur with a diclofop (1 lb ai/A) plus acifluorfen (0.375 lb ai/A) combination.

A similar response occurred with Bas-9052 (0.3 lb ai/A) and bentazon (0.75 or 1 lb ai/A) tank mix combinations. Foxtail control was significantly reduced as compared to control obtained with Bas-9052 alone. This did not occur with a Bas-9052 (0.3 lb ai/A) plus acifluorfen (0.375 or 0.5 lb ai/A) combination.

KK-80 (0.5 lb ai/A) plus acifluorfen (0.5 lb ai/A) also exhibited an antogonistic response to grass weed control. Good foxtail control was observed when applications were made to small foxtail (1-3 leaf stage). When applications were made to large foxtail (5-7 leaf stage) a significant decrease in grass control was observed. This did not occur when KK-80 was applied alone.

One other herbicide combination where antagonism was observed was a tank mix combination of acifluorfen plus Ro 13-8895. With a steady rate of acifluorfen (0.375 lb ai/A), as the rate of Ro 13-8895 was increased from 0.125 to 0.25 lb ai/A, morningglory (*Ipomoea* sp.) control decreased. This trend was not observed when the rate of acifluorfen was increased to 0.5 lb ai/A.

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SELECTED HERBICIDES FOR JOHNSONGRASS CONTROL IN CROPPING SYSTEMS

Barbara J. Hook and S. Glenn[1/]

ABSTRACT

Several herbicides were evaluated for the control of johnsongrass in corn and soybeans. The herbicides evaluated in corn were preplant incorporated treatments of EPTC + R-25788, butylate + R-25788 and vernolate + R-25788. These herbicides were tested with and without R-33865, which was being evaluated as an extender. Trifluralin applied post plant incorporated (POPI) when corn was 30 cm high was also evaluated. The soybean herbicides examined were preemergence applications of MBR-22359 and postemergence applications of BAS-9052, CGA-82725 and mefluidide. Data presented for both corn and soybean experiments are a mean of two studies. The experiments were randomized complete block designs with four replications.

EPTC + R-25788 at 6.7 kg/ha provided better johnsongrass control than the other thiocarbamates evaluated, however, the johnsongrass control obtained with all the thiocarbamate treatments without R-33865 decreased between the 3 and 6 week ratings. When R-33865 was added to EPTC + R-25788 the johnsongrass control obtained 6 weeks after application (83%) was greater than the control obtained with EPTC + R-25788 alone (58%). R-33865 did not have the same effect on the other thiocarbamates tested. Trifluralin applied POPI provided 50 to 75% johnsongrass control through 6 weeks while causing no visual injury to corn. Control of johnsongrass between the rows was very good, however, johnsongrass was not controlled within the rows.

In soybeans, preemergence applications of MBR-22359 (1.12 to 3.36 kg/ha) provided 80 to 88% johnsongrass control. MBR-22359 at 3.36 kg/ha did cause 30% soybean injury 3 weeks after application, however, the soybeans recovered showing no visual effects 3 weeks later. Postemergence applications of BAS-9052 (0.34 and 0.45 kg/ha) + 1% v/v crop oil applied when the johnsongrass was 30 cm high (EP) provided 100% johnsongrass control through 6 weeks after application with no soybean injury. When BAS-9052 applications were made at the 60 cm stage (LP) some regrowth occurred. The LP treatments provided 85% johnsongrass control through 6 weeks. Postemergence applications of mefluidide + 0.5% surfactant and CGA-82725 were generally not as effective as BAS-9052.

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THREE YEAR SUMMARY OF NO-TILL FORAGE ESTABLISHMENT[1/] RESEARCH ON NEW YORK FARM SITES

E. B. Rayburn, J. F. Hunt, D. L. Linscott[2/]

ABSTRACT

Over a three year period (1978-1980) twenty eight experiments were established on commercial farms across New York State to evaluate the effectiveness of no-till forage establishment programs under a broad range of soil, weather, weed and insect pest conditions. Plots of approximately 1/2 hectare were established to birdsfoot trefoil (Lotus corniculatus, L.), alfalfa (Medicago sativa, L.), and red clover (Trifolium pratense, L.) on sod and grain stubble situations. Plots were fertilized and limed according to soil tests and Cornell recommendations for conventional tillage. Herbicide treatments varied between plots. In most cases glyphosate was compared to paraquat for pre-plant weed control while 2,4-D or dicamba were used for broadleaf weed control. Stands were generally planted with a John Deere Powr Till(tm) drill. Data taken from plots included 30-day stand counts and ratings and harvest yield and botanical composition the year after establishment.

Problems in establishment were generally similar to those experienced in experiments established on University sites. Where glyphosate was compared to paraquat for plant establishment at 30 days, plants per meter row were equal in 85% of the cases and greater with glyphosate use in 15%. Weed control was greater with glyphosate in 90% of the cases. Of eight experiments harvested to date for yield and legume content, glyphosate treatments produced significantly greater yields than paraquat in 5 of 8 cases (5658 ± 2394 versus 4968 ± 1611 kg/ha dry matter respectively, overall means) and legume content was significantly greater with glyphosate than paraquat treatment in 6 of 8 cases (63 ± 21 versus 38 ± 26 percent planted legume).

Legumes were established successfully at twenty locations. Of eight experiments considered to have failed, four could have been alleviated by altered management, two by different species selection and two by improved technology. Of the four failures due to management, two were trefoil pastures which were over grazed in the spring following planting causing major damage to the trefoil stand. In one case, a soil of pH 5.4 and exchangable H of 28 had granular lime broadcast at 6 metric tons per hectare at planting. Use of standard agricultural lime and earlier application would give a better pH adjustment and the trefoil and clover stands planted may have survived. The fourth case was a broadcast planting on a scarified, glyphosate killed sod. Here failure was due to late planting, insufficient scarification and dry weather. In two experiments, alfalfa stands were lost to phytopthora root rot. If the severity of

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this disease at the site had been known, the planting of birdsfoot trefoil or red clover may have prevented failure on these sites. Of two stands lost due to lack of technology, one was an alfalfa stand lost to annual grasses. This site needed a post-emergent grass herbicide. The other was an alfalfa stand apparently lost to slug activity. An effective management system or a molluscicide would have been necessary to prevent damage.

A tentative interpretation of the farm site experiments include:

A. No-till planting systems can be used successfully and result in suitable establishment of forage legumes on farms in New York.

B. Herbicide management packages can be provided for the three major site situations of grain stubble, hay sods and pasture sods. These packages need to be effectively presented to farmers.

C. Problems remain to be solved in providing post-emergent annual grass control and providing management systems or pesticides for the effective control of insect and molluscs.

Comparative effectiveness of glyphosate and paraquat in the establishment of no-till forage plantings (1978-1980) as measured by the percent of experiments resulting in statistically significant treatment differences.

Statistical Differences in Effectiveness of Herbicide Treatment	30 Day Stand Rating		Dry Matter Yields Year After Planting	
	Number of Seedlings /meter row	Weed Control	Total Yield	Percent Legume
	%			
Glyphosate paraquat	15	70	62	75
Glyphosate paraquat	0	5	0	0
Not significantly different	85	25	38	25
Number of experiments	20	20	8	8

HERBICIDE AND TILLAGE EFFECTS ON LEGUME ESTABLISHMENT IN BROMEGRASS SOD[1/]

E. B. Rayburn, J. F. Hunt and D. L. Linscott[2/]

ABSTRACT

Bromegrass sod was treated with glyphosate (1/2, 1 and 2 kg/ha) and dalapon (3, 5 and 8 kg/ha) in fall and spring and with pronamide (1/2, 1 and 2 kg/ha) in fall and paraquat (1/2, 1 and 2 kg/ha) in spring to evaluate the herbicides effectiveness for grass control in no-till establishment of 'Viking' birdsfoot trefoil (Lotus corniculatis, L.). Glyphosate (1/2, 1 and 2 kg/ha) was also applied in fall and spring, and the sod tilled and plowed, to compare this herbicides effectiveness with EPTC (3 kg/ha) in sod control in establishing birdsfoot trefoil conventionally. Seedling broadleaf weeds were controlled on all plots by a post-emergent application of 2,4-DB (1 1/2 kg/ha).

Of fall applied herbicides, glyphosate at 2 kg/ha was the only one to control sod regrowth sufficiently to allow no-till planted birdsfoot trefoil establishment so that the following year yields were comparable to the conventionally tilled check. Of spring applied herbicides, no-till planted plots treated with glyphosate at 2 kg/ha, or dalapon at 8 kg/ha, produced birdsfoot trefoil and total yields comparable to the conventionally tilled plots. There was no effect of fall or spring application timing on the herbicidal effectiveness of glyphosate when trefoil was planted either conventionally or by no-till means. Under no-till planting, trefoil and total yields increased as glyphosate rate was increased from 1/2 to 2 kg/ha. Under conventional tillage trefoil yields were significantly greater on plots that received fall glyphosate at 1/2, or spring glyphosate at 1 kg/ha, as compared to check. Trefoil yields from plots receiving EPTC tended to be greater than those from the check, but not significantly so. Total yields were similar across treatments under conventional tillage except a significant decrease occured with spring applied glyphosate at the 2 kg/ha rate as compared to EPTC. This decrease was due to reduction in the grass component of the stand.

Effectiveness of no-till legume establishment as measured by plants per meter row and plant root weights in the fall of the seeding year were highly correlated to the effectiveness of grass control as measured by grass yield in August of the seeding year (r^2 = .70 and .75 respectively). Conventionally tilled plots did not vary appreciably in plants per meter row or legume root production per meter row from the no-till plots when grass control was taken into account. Plant population the seeding year was highly correlated to the potential productivity of the stand the following year (R^2 = .92) under both no-till and conventional tillage.

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Effects of herbicide and tillage on birdsfoot trefoil establishment in a bromegrass sod as measured by plant establishment the seeding year and total and legume dry matter yields the year after planting.

Tillage System	Herbicide Application, Timing	Herbicide and rate		30 day ratings: Plants/ meter row	30 day ratings: Weed Kill	Dry Matter Yields Year After Establishment: Total	Dry Matter Yields Year After Establishment: Birdsfoot Trefoil
					—%—	M.T./ha	
No-tilled	Fall	Check		50	0	5.2	2.2
		Glyphosate	1/2	70	62	5.5	3.4
			1	61	72	7.2	4.8
			2	82	70	7.2	6.1
		Dalapon	3	60	32	5.3	2.9
			5	79	55	6.3	4.1
			8	63	52	5.5	3.6
		Pronamide	1/2	66	7	5.4	3.0
			1	51	37	6.6	3.9
			2	77	73	6.2	4.1
	Spring	Check		25	0	4.3	1.0
		Glyphosate	1/2	34	54	6.1	2.9
			1	35	69	6.6	4.2
			2	45	89	7.4	6.5
		Dalapon	3	36	71	6.7	3.5
			5	41	85	7.4	5.1
			8	41	94	7.7	6.8
		Paraquat	1/2	42	70	7.1	4.4
			1	41	77	7.4	4.8
			2	39	81	7.5	4.9
Conventionally-Tilled	Fall	Check		51	7	7.4	6.2
		Glyphosate	1/2	47	48	7.7	7.3
			1	53	62	7.2	6.9
			2	46	49	7.1	6.8
	Spring	Glyphosate	1/2	52	59	7.2	6.8
			1	48	57	7.4	7.1
			2	47	81	6.7	6.5
		EPTC	3	40	33	7.6	6.9
		LSD_{05}		8	20	0.9	1.0

MUSK THISTLE CONTROL IN ALFALFA

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ABSTRACT

Selected herbicides were evaluated for musk thistle control in alfalfa. The herbicides evaluated were asulam, DPX-5648, terbacil and hexazinone. Applications were made when the alfalfa developed 5 cm of new spring growth (EP), 4 weeks later (LP), after the first alfalfa harvest (first cutting) and 14 days after the first cutting. Each plot was 7.6 m x 3 m. Yield of alfalfa and weeds was determined by harvesting an area 7.6 m x 1 m through the middle of each plot, separating the weeds from the alfalfa and weighing. Visual weed control ratings and alfalfa injury ratings were obtained prior to each harvest. The experiment consisted of 3 replications in a randomized complete block design.

Visual control ratings obtained prior to the first harvest showed that 0.04 to 0.28 kg/ha DPX-5648 applied EP provided 82 to 98% control of musk thistle, however, all EP treatments of DPX-5648 caused unacceptable alfalfa injury. Dry weight of alfalfa at the first harvest was reduced 40 to 70% with EP treatments of DPX-5648. Treatments of 0.02 to 0.14 kg/ha DPX-5648 first cutting provided 80 to 100% control of musk thistle at the third harvest and only 5 to 30% alfalfa injury. DPX-5648 at 0.02 kg/ha increased alfalfa yields at the third harvest 38%. Asulam at 5.0 kg/ha first cutting provided 100% musk thistle control prior to the third harvest with minimal alfalfa injury. Hexazinone applied at 0.5 and 1.0 kg/ha first cutting provided 100% control of musk thistle with no alfalfa injury. Hexazinone increased alfalfa yields up to 8%. Terbacil at 0.7 kg/ha first cutting did not provide adequate musk thistle control. All DPX-5648 and hexazinone treatments provided good season long giant foxtail control.

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COMPARISON OF THREE POSTEMERGENCE GRASS HERBICIDES ON A NEW ALFALFA SEEDING

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ABSTRACT

BAS 9052 OH at .28, .56, .84 and 1.12 kg/ha, KK 80 at .56 and 1.12 kg/ha and CGA-82725 at .28 and .56 kg/ha, three recently developed postemergence grass herbicides, were evaluated for selective control of large crabgrass in new seedings of alfalfa. The experiment was carried out on a May 19, 1980 alfalfa seeding at the Storrs Agricultural Experiment Station. All three herbicides significantly decreased the crabgrass yields over the control at both the early and late postemergence treatments. The yields of alfalfa were increased over that of the control for all three herbicides at the early postemergence application. For the late postemergence treatments, KK 80 and the highest rate of BAS 9052 OH showed a decrease in yield at the first harvest compared to the control. However, by the second harvest, the yields of alfalfa were significantly greater for all three experimental materials.

Low rates of paraquat showed no selectivity causing severe injury to the alfalfa as well as the crabgrass.

Results indicate that early grass control is essential in obtaining the greatest increase in alfalfa yields. Despite the fact that the late postemergence treatments provided good control of crabgrass, the greatest seasonal total yields were obtained from the early postemergence treatments.

Dandelion seedlings proliferated when the three experimental materials controlled the crabgrass opening up the canopy.

INTRODUCTION

Control of annual grasses have been a major problem in establishing new stands of alfalfa. Herbicides are available which are effective for grass control but they must be soil incorporated prior to alfalfa planting. Therefore, these preplant incorporated materials cannot be used for no-tillage. A postemergence grass killer for legumes is badly needed for grass control in no-tillage seedings.

BAS 9052 OH (2-[1-(ethoxyimino)-butyl]-5-[2-(ethylthio)-propyl]-3-hydroxy-2-cyclohexene-1-one) and KK 80 (chemistry not disclosed) have been reported as promising for both early and late postemergence control of annual grasses in soybeans (Glycine max (L.) Merr.). (2) Applications of KK 80 at the 4 and 8 leaf stages and BAS 9052 OH at the 4, 6-7, and 8 leaf stages on barnyardgrass

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(Echinochloa crusgalli (L.) Beauv.), bullgrass (Paspalum Boscianum Fluegge), and large crabgrass (Digitaria sanguinalis (L.) provided complete control of these grasses with little, if any, soybean injury.

CGA-82725 (chemistry not disclosed) has also been recently reported as a promising new herbicide for postemergence control of grasses.

BAS 9052 OH has been reported as being promising for both early and late postemergence control of crabgrass in new stands of alfalfa (Medicago sativa L.) (1) Complete crabgrass control was observed without any injury to alfalfa.

MATERIALS AND METHODS

The following experiment was carried out at the Agronomy Research Farm at Storrs, CT. The soil type was a Woodbridge fine sandy loam.

The field received an application of 2247 kg/ha lime, 450 kg/ha 46% superphosphate and 315 kg/ha muriate of potash on May 16, 1980. The experimental design was a randomized complete block with four replications. Plot size was 1.52 by 7.62 m. Iroquois alfalfa was seeded at 13.5 kg/ha with a Tye no-tillage seeder on May 19, 1980. The field was in no-tillage silage corn in 1979.

The early postemergence treatments were applied on June 18, 1980. Alfalfa was 5 to 8 cm tall in the 2 to 3 leaf stage. Crabgrass was 2.5 to 5 cm tall with 2 to 3 tillers. The late postemergence treatments were applied July 3, 1980. Alfalfa was 15 cm tall. Crabgrass was 10 cm tall. The field received an application of 2,4-DB (4-(2,4-dichlorophenoxy) butyric acid) on June 27, 1980 to control an infestation of lambsquarters (Chenopodium album L.).

The herbicides evaluated included BAS 9052 OH, KK 80, CGA-82725 and paraquat (1,1'-dimethyl-4,4'-bipyridinium ion).

Treatments were applied in 450 /ha of water with a small plot sprayer with SS 6504 nozzles at 40 psi. All rates are given in terms of the active ingredients.

Yields of dry matter were determined from samples cut on July 28 and September 17, 1980. Crabgrass samples were taken at both harvests for hand separations into alfalfa, crabgrass, and broadleaf weed components.

RESULTS AND DISCUSSION

The effectiveness of BAS 9052, KK 80 and CGA-82725 in controlling crabgrass is evident from the control ratings and yields given in Table 1. Both early and late postemergence treatments were effective despite the relatively large size of the crabgrass (10 cm tall) at the time of the late postemergence treatments.

The control ratings of July 18 and the yield data of July 28 indicated

little or no measurable crabgrass present from any of the BAS 9052, KK 80, or CGA-82725 treatments. There was a marked increase in crabgrass in most plots, however, by the time of the second harvest. Close inspection below cutter bar height indicated a reinfestation from germinating crabgrass and tiller regrowth from some treated plants.

Both rates of KK 80 and CGA-82725 at the high rate had the least crabgrass regrowth in the second harvest following the early postemergence treatments. The greatest regrowth followed the low rate of BAS 9052.

Following the late postemergence treatments regrowth of crabgrass was least following the KK 80, the .56, .84 and 1.12 kg/ha rate of BAS 9052 and the high rate of CGA-82725.

The competitiveness of crabgrass in new stands of alfalfa is shown by the yield data in Table 1. While in the first harvest the alfalfa dry matter in the control was 1 1/3 times as great as the crabgrass dry matter, in the second harvest the alfalfa was only 2/3 of the crabgrass dry matter.

All early postemergence treatments, except for paraquat, significantly increased the dry matter yields of alfalfa over the control in both harvests.

Late postemergence applications at .28, .56 and .84 kg/ha BAS 9052 and the high rate of CGA-82725 had significantly greater dry matter yields of alfalfa than in the control at both harvests. At the first harvest the KK 80 treatments and the highest rate of BAS 9052 had dry matter yields of alfalfa significantly lower than that of the control. However, by the second harvest all treatments had significantly greater dry matter yields of alfalfa than in the control.

It is evident that early grass control is essential in obtaining the greatest increase in alfalfa yields. Despite the fact that the late postemergence treatments provided good control of crabgrass, the greatest seasonal total yields were obtained from the early postemergence treatments. By delaying herbicide application the competition of crabgrass occurred over a greater span of time.

The impracticality of the use of low rates of paraquat as a postemergence grass killer is brought out in the yield data of Table 1. Paraquat showed no selectivity causing severe injury to both the alfalfa and crabgrass. At the time of the first harvest growth of alfalfa and crabgrass was extremely sparse. However, in the second harvest (Table 1) the data shows how successfully crabgrass will rapidly reinvade in open areas.

The broadleaf weed component in the first harvest included lambsquarters plants which had not been completely killed by the 2,4-DB treatments. These plants were removed by the first cut which accounts in large part for the lower broadleaf weed yields in the second cut.

In the second harvest, dandelion (Taraxacum officinale L.) was the

dominant broadleaf weed which was not controlled by the 2,4-DB treatment. In the control plots, which had a heavy crabgrass canopy, the dandelions were not released (Table 1). In the paraquat plots the seedlings were killed. By controlling the crabgrass the experimental materials opened up the canopy and gave the dandelions opportunity to proliferate.

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Table 1. Control ratings and yields of crabgrass and alfalfa following early and late postemergence applications of BAS 9052 OH, KK 80 and CGA-82725 on new seedings of alfalfa.

			Crabgrass					Alfalfa					Broadleaf Weeds	
			Control Ratings		Yields (DM)			Injury Ratings		Yields (DM)			Yields (DM)	
Herbicide	Rate	Time	July 18	July 28	July 28	Sept. 17	Total	July 18	July 28	July 28	Sept. 17	Total	July 28	Sept. 17
	kg/ha ai				kg/ha	kg/ha				kg/ha	kg/ha		kg/ha	kg/ha
BAS 9052 OH	.28	EP[1]	9.0[3]	8.8	10	400 e	410	0.0	0.0	1530 ab	1440 bf	2970	410 d-g	240 e-g
BAS 9052 OH	.56	"	9.8	9.0	--	190 ij	190	0.0	0.0	1490 bc	1340 e-j	2830	520 a-c	200 g-i
BAS 9052 OH	.84	"	9.8	9.0	--	230 g-i	230	0.0	0.0	1200 f-j	1380 b-i	2580	540 ab	170 i-n
BAS 9052 OH	1.12	"	9.8	9.0	--	260 f-h	260	0.0	0.0	1410 cd	1440 bc	2850	540 ab	310 cd
KK 80	.56	"	10.0	9.8	8	160 jk	168	0.0	0.0	1220 f-i	1470 b-d	2690	480 a-d	200 g-j
KK 80	1.12	"	10.0	9.8	--	70 m-o	70	0.0	0.0	1240 f-h	1490 b	2730	410 d-g	350 bc
CGA-82725	.28	"	9.8	9.0	8	320 f	328	0.0	0.0	1410 cd	1170 mn	2580	410 d-g	220 f-h
CGA-82725	.56	"	10.0	9.5	--	100 k-n	100	0.0	0.0	1620 a	1420 b-h	3040	350 g-i	200 g-m
Paraquat	.56	"	7.0	6.5	7	3110 a	3117	8.5	9.0	20 p	30 s	50	20 m	40 q
BAS 9052 OH	.28	LP[2]	7.5	8.0	10	260 fg	270	0.0	0.0	1300 ef	1420 b-g	2720	410 d-g	200 g-k
BAS 9052 OH	.56	"	10.0	9.3	8	40 m-o	48	0.0	0.0	1200 ef	1320 g-k	2620	370 f-h	280 de
BAS 9052 OH	.84	"	10.0	9.3	--	50 m-o	50	0.0	0.0	1350 de	1640 a	2990	290 h-k	200 g-k
BAS 9052 OH	1.12	"	10.0	10.0	--	30 o	30	0.0	0.0	930 lm	1030 op	1960	560 a	520 a
KK 80	.56	"	9.8	10.0	6	120 k-m	126	1.0	0.0	890 mn	1010 pq	1900	310 h-j	390 b
KK 80	1.12	"	10.0	10.0	--	30 no	30	0.0	0.0	870 mo	1300 i-l	2170	460 b-e	260 ef
CGA-82725	.28	"	7.0	7.3	30	660 d	690	1.3	1.8	1020 kl	1200 m	2220	370 f-h	100 p
CGA-82725	.56	"	8.5	8.5	8	150 j-l	158	0.0	0.0	1280 e-g	1490 bc	2770	440 c-f	170 i-o
Paraquat	.28	"	6.3	3.8	90	2060 b	2150	8.0	8.0	20 p	40 s	60	410 d-g	10 q
Control			0.0	0.0	720	1210 c	1930	4.8	4.0	1000 jk	720 r	1720	270 i-l	10 q

1/ Early postemergence June 18, 1980

2/ Late postemergence July 3, 1980

3/ Rating scale - 0 - no effect; 10 - complete kill

4/ Means followed by the same letter do not differ significantly at the 5% level using Duncan's multiple range test.

USE OF HERBICIDES IN MINIMUM TILLAGE TO IMPROVE ALFALFA COMPOSITION AND FEEDING VALUE

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ABSTRACT

Alfalfa was seeded using minimum tillage methods on a field in Lee, N.H. in May, 1979. The field was runout alfalfa/smooth bromegrass, heavily infested with quackgrass. The treatments were 1) an unseeded check plot fertilized with 34 kg of N the first year and 48 kg of N the second year, 2) a minimum tillage seeding of alfalfa where the sod was suppressed with paraquat prior to seeding, and 3) a minimum tillage seeding of alfalfa using glyphosate to kill the sod prior to seeding. No nitrogen was applied to treatments 2 and 3, but all treatments received the same level of phosphorus and potassium. Dry matter yields for the seeding year from three cuttings were 5.6, 2.68 and 2.73 t/ha respectively for treatments 1, 2, and 3. The percentage alfalfa in the plots on June 30, 1979 was 22% for the control plot, 40% for the alfalfa seeded following paraquat, and 80% for the alfalfa seeded following glyphosate treatment.

In the second year the plots were again harvested three times. The first cutting was harvested June 5, 1980 as wilted hay crop silage (35% DM). Dry matter yields were 2.80 t/ha for the control, 3.92 t/ha for the alfalfa seeded with paraquat treatment, and 2.80 t/ha for the alfalfa seeded with glyphosate treatment. The percent alfalfa was 26%, 40%, and 90%, respectively. The silages were stored in 1.4m diameter by 4.9m high silos for later use in a feeding trial to determine their nutritive value.

The second cutting was harvested as baled hay on July 24, 1980. Dry matter yields were 1.68 t/ha for the control, 2.07 t/ha for the alfalfa seeded with paraquat, and 2.84 t/ha for the alfalfa seeded with glyphosate. Percent alfalfa in the plots at this time was 30%, 74%, and 95%, respectively. Forage from this harvest was also stored for use in a feeding trial.

The two feeding trials were conducted using a 3 x 3 Latin Square design. The trials were run consecutively and the same animals were used in both trials. The animals used were Holstein dairy heifers weighing approximately 270 kg at the start of the first feeding trial. The measurements obtained in these trials include: total digestible nutrients, digestible protein, digestible ADF, digestible energy, and metabolizable energy for each of the silages and hays.

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IMPACT OF CARBOFURAN TREATMENT ON NO-TILLAGE ALFALFA ESTABLISHMENT

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ABSTRACT

No-tillage establishment of alfalfa following sod control with paraquat or glyphosate has given inconsistent results not always related to the degree of sod suppression. Insect injury has been evident in some situations where poor establishment occurred but visible indication of injury is not always seen.

Experiments were conducted at the Storrs (CT) Agricultural Experiment Station in 1979 and 1980 to determine the effect of carbofuran on no-tillage alfalfa establishment in sod controlled with paraquat or glyphosate. The 1979 seeding made on August 14, 1979 was seeded to alfalfa at a rate of 9 kg/ha.

Carbofuran 10G granules at a rate of 9 kg ai/ha was mixed with the seed in the seed box. Initial sod of the orchardgrass-quackgrass sod was over 80% from either paraquat 1 kg ai/ha or glyphosate 1½ kg ae/ha. Stand counts made in October 1979 indicated a greater number of plants in the carbofuran plots despite no ivsible indication of topgrowth injury to the plants. The yields in both hay harvests in 1980 were significantly greater following the use of the carbofuran.

Another alfalfa seeding was also made on August 16, 1980. In addition to a hopper box treatment of 9 kg ai/ha granular carbofuran mixed with 9 kg/ha of alfalfa seed and 9 kg ai/ha of granular carbofuran was banded in the row with a Gandy granule applicator. Acephate was also applied as a seed treatment. A rate of .7 kg ai/ha of the soluble powder was used. Sod control from paraquat 1 kg ai/ha or the glyphosate 1½ kg ae/ha was relatively poor. Alfalfa development was greatest following the seed box application of carbofuran, followed by the banded treatment. The acephate treatment caused a reduction in both the stand counts made on September 10, 1980 and in yields obtained on October 15, 1980. As in 1979 there was no visible evidence of injury to the alfalfa topgrowth.

The results of both experiments indicate that carbofuran should be considered as an adjunct treatment in addition to herbicidal treatments when making no-tillage sod seedings.

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ROLE OF WEED SCIENCE IN MARYLAND'S IPM PROGRAM

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ABSTRACT

Integrated pest management has been defined as the utilization of all suitable control methods and disciplines to keep pest populations below economically injurious levels. Unfortunately many weed scientists have scoffed at this new terminology, inferring that weed science has always been an "integrated" discipline. In a very limited sense this attitude is true; however, it ignores two important aspects of the IPM concept. First, weed science like other pest disciplines, has proposed separate control programs with little thought given to the total crop management system. The final integration of these fragments of information has been left completely to the farmer who generally does not understand the intricacies of all factors involved. Secondly, IPM advocates the effective, economical and environmentally sound use of pesticides. For this reason, many current IPM programs rely heavily on pest monitoring or scouting to determine the need and timing of pesticide applications. Although chemical weed control programs have been largely preventive, the current trend toward selective post emergence herbicides has increased the need for more precise weed monitoring activities. For farmers without the time, desire, or knowledge to examine for weeds, scouting services offered through a pest management program can provide accurate, timely information on weed conditions. Only with a thorough knowledge of weed species present and infestation levels can appropriate postemergence herbicides be applied at the proper time.

Early season weed scouting was a major component of the 1980 Maryland Field Crop IPM Program. Based on research and communications with other weed scientists, weed density/yield loss relationships were developed for several common weed species of soybeans and corn. Using these relationships, treatment thresholds were derived for each species and approximated the level of weed density and subsequent yield loss required to offset the cost of post emergence treatment. Weed scouting during the first six weeks after crop emergence indicated that as much as 60% of the acreage had weed densities greater than the thresholds. Of the fields reported to have economic infestations, less than half received cultural or chemical treatment even though strongly recommended.

This lack of response to treatment recommendations indicates that farmers are not convinced of the severity of losses attributable to weeds. In order to increase grower awareness, a series of experiments and field demonstrations are planned for 1981 to show the economic feasibility of postemergence herbicides and to evaluate thresholds for several common weeds. Through a strong educational/demonstration program with adequate threshold information, integrated pest management will play an important role in maximizing the economic returns of weed control.

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EFFECT OF FEEDING BY *LEMA TRIVITTATA* (COLEOPTERA: CHRYSOMELIDAE) ON THE GROWTH, REPRODUCTION AND COMPETITIVE ABILITY OF JIMSONWEED IN SOYBEANS.

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ABSTRACT

Defoliation experiments were conducted to determine the effect of feeding by *Lema trivittata* on jimsonweed (*Datura stramonium* L.) growth, reproduction and competitive ability in a soybean field. Treatments included both artificial and natural beetle defoliation at 3 time periods (early, late, and early/late) and at 4 levels (0, 25, 50, 100%).

Competition for light appeared to be the major factor in the soybean/jimsonweed interaction. Full season competition by one jimsonweed plant per 0.45 m of row reduced soybean stem and branch weight, yield and total biomass by 40, 50, and 44%, respectively. This response was significantly altered in favor of the soybeans when jimsonweed was defoliated both artificially and naturally. Early jimsonweed defoliation reduced side-shading, thus allowing for greater soybean vegetative growth and reproduction. Late defoliation did not significantly affect vegetative growth of soybeans, but enabled more light to penetrate, thus increasing photosynthetic activity during the critical pod development period. Jimsonweed subjected to both early and late defoliation were the least competitive.

Although regrowth was nearly complete by the end of the season, defoliation significantly affected the integrated growth and reproduction activities of the whole jimsonweed plant. During early defoliation there was apparently no major reserve of carbohydrates for leaf regrowth and all available photosynthates were diverted to the leaves; this resulted in a reduction in the rate of root and stem growth. After late defoliation, reductions in root and stem weight were largely due to the mobilization of stored materials to provide energy for leaf regrowth. At both defoliation times, photosynthetic activity in the remaining leaves and stems probably increased and was responsible in part for the rapid leaf regrowth. Reduced capsule and seed production (as much as 44% less seed weight) was the result of decreased photosynthesis after defoliation accompanied by the fact that the mobilized reserves used for leaf regrowth were not subsequently available for reproduction.

Considering the economic aspects of the soybean/jimsonweed interaction, *L. trivittata* defoliation can be beneficial in 3 ways. First the competitive ability of jimsonweed can be altered in favor of the soybeans, particularly if both generations of *L. trivittata* cause high levels of defoliation. Secondly, the number of seeds as potential contaminants and sources of future weed infestations can be reduced. And finally, the reduction in biomass, particularly stem weight, can be beneficial in that smaller plants offer less resistance to harvesting machines.

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A REVIEW OF POSTEMERGENCE BROADLEAF WEED CONTROL WITH ACIFLUORFEN DURING 1979 AND 1980

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ABSTRACT

Acifluorfen was commercially available as a postemergence soybean herbicide in Delaware, Maryland, and Virginia in 1979 and 1980. In 1979, rainfall was so abundant that it was often impossible to apply preemergence herbicides. This situation led to EPA approval for the postemergence use of acifluorfen under an emergency exemption. By 1980, acifluorfen had commercial registration for use on soybeans, and rainfall from May through July was approximately 40% below normal.

Weed control with acifluorfen during the dry 1980 season will be compared with the results from the moist 1979 season.

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RO 13-8895, A SELECTIVE POSTEMERGENCE HERBICIDE FOR GRASS CONTROL

G. L. Benson, R. W. Bagley, A. R. De Mur[1/]

ABSTRACT

Ro 13-8895 has been widely evaluated in postemergence applications for control of grasses in broadleaf crops. Annual grasses such as barnyardgrass, *Echinocloa crusgalli*; crabgrass, *Digitaria* spp.; foxtails, *Setaria* spp.; goosegrass, *Eleusine indica*; and fall panicum, *Panicum dichotomiflorum*, have been effectively controlled at rates of 0.125 to 0.5 lb/A of Ro 13-8895. Perennial grasses such as quackgrass, *Agropyron repens*; bermudagrass, *Cynodon dactylon*; and johnsongrass, *Sorghum halepense*, required slightly higher rates to obtain control. Repeat applications at low rates often gave better control of perennial grasses than a single application of a higher rate of Ro 13-8895.

Excellent selectivity was observed in trials on soybeans, potatoes, alfalfa, snapbeans, other broadleaf crops and certain monocot crops, asparagus and onions. Wheat, oats and barley were not tolerant. Corn and sorghum were particularly susceptible.

Broadleaf weeds were not controlled by this herbicide, but trials with Ro 13-8895 used in conjunction with other herbicides revealed that grasses and broadleaf weeds could be controlled in broadleaf crops.

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A PROPOSED METHOD FOR DELETING EXTREME VALUES IN WEED COUNT DATA

Woodland Hurtt and E. James Koch[1/]

ABSTRACT

Data from a 1979 field experiment in which weed emergence values were obtained after application of germination stimulators contained occasional atypical values in one of the random counts made in each plot. Weeds were counted in four areas (quadrats) in each plot and the mean from these subsample values was used in the analysis of variance (AOV) and Duncan's Multiple Range Test (DMR). Since these extreme values were attenuated by the rest of the data, they were not considered important. However, subsequent critical data examination suggested that one or more plots in each replication exhibited a pattern in which three values tended to group together and the fourth deviated from the others. If these outlying values reflected the natural variability in the emergence data, they should be included in the plot mean; if they represented the chance occurrence of a cluster of seeds in the soil within one of the four quadrats, then it would be appropriate to employ some mechanism for rejecting the atypical values.

Several mathematical techniques for rejecting extreme values exist. The one we chose has been used by chemists for rejecting anomalous values from analytical determinations and required that four values must be present before any rejection procedure could be considered. The method consisted of determining the mean of the data set without the suspect value, computing the deviations of all values from the mean, and rejecting the suspect value if its deviation was greater than four times the average deviation.

We applied a modified version of this method with the following results: the means of all treatments were generally reduced because the extreme values that were rejected tended to be high outliers; the standard deviations generally changed very little; and the resulting coefficients of variation typically increased. The trends substantiated the initial assumption that the anomalous data points had resulted from atypical clusters of weed seedlings. However, there were very few instances in which the significance of a treatment as tested by DMR was changed. In general we found that the rejection procedure had little overall effect on interpretation of the data. We attribute this to the fact that we had an adequate number of replications (six) and plot subsamples. The nonhomogeneous distribution of weed seeds in the soil was made clearly evident by this attempt at normalizing weed count data.

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THE EFFECTS OF CUTTING DATE AND HEIGHT ON ANTHESIS OF COMMON RAGWEED (AMBROSIA ARTEMISIIFOLIA L.)

B.M. Barbour and J.A. Meade 1/

ABSTRACT

An experiment was performed to test the effective control of anthesis of common ragweed at four cutting dates (July 11, 21, 31 and August 11) and three cutting heights (5,10 and 20 cm) in Sussex County, N.J. Although both factors gave significant results the patterns of regrowth and flowering exhibited by the cutting height treatments were contradictory. The effect of cutting date, however, was clear cut with progressively less regrowth and flowering down to the last treatment (August 11) whereupon 29 of the 30 replicates died and showed no regrowth at all. As of August 11 no anthesis or pollen shedding had occured and it is our conclusion that the optimum cutting date for control of ragweed pollen in this experiment was August 11. Clipping height was of relatively slight significance.

A high degree of positive correlation was found to exist between final cutting height measured and the number of racemes per plant.

INTRODUCTION

Common ragweed (Ambrosia artemisiifolia L.) is recognized, along with other members of its genus, as being the source of the most allergenic pollen in North America.[1] It also affects more of the population than any other plant in North America with the characteristic symptoms of hay fever including sneezing, runny nose, irritated and watery eyes and headache.[2]

A native of North America, common ragweed is widespread throughout the continent but is most common in the Eastern and North Central States.[3] The staminate and pistillate flowers are distinct and borne on separate parts of the same plant. The male flowers, which concern us here, are borne in small inverted heads which are arranged in a raciform inflorescene. The fertile (pistillate) heads are borne below the staminate ones in the axils of leaves or bracts.

Local control of ragweed populations has been recommended and practiced for many years in the urban and suburban sections of the Northeast. The objectives of these programs have been to decrease local pollen count and prevent senstization of non-allergic individuals caused by exposure to massive doses of fresh ragweed pollen.

The herbicide 2,4-D has been commonly recommended for chemical control along roadsides and in vacant lots, but, clipping and mowing have also been important cultural means of control.[4] Little reference to the timing of cuttings is found in the literature. Therefore this study was initiated to determine when to clip ragweed for best control and also whether the height of cutting affects the subsequent regrowth and flowering of the plant.

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MATERIALS AND METHODS

A relatively pure stand of ragweed located on soil recently disturbed by construction near Newton, New Jersey was the site of this study. A pair of hand clippers and a tape measure were used to cut the plants at 5, 10 and 20 cm above the soil surface. On each stem was hung a tag bearing that plant's individual treatment code number and cutting height. Clipping was done on four dates July 11, July 21, July 31 and August 11. On each of these dates a total of 30 ragweed plants were cut, 10 at 5 cm., 10 at 10 cm. and 10 at 20 cm.. As each plant was cut it's height was measured and the number of staminate inforescences (racemes) was noted. Also, after the initial treatment date, observations were made on the regrowth of previous treatments and the stage of development of control plants. Vegetation immediately surrounding the treatment area was cut to approximately the same height as the treatment plots to eliminate any shading and simulate the micro-climatic conditions which would prevail if the whole area had been cut.

On September 10, one month after the last treatment, final observations were made which consisted of measuring the height of the regrowth of each treated plant and counting the number of racemes formed on each. General observations were also made at this time of the stage of development of the controls and the treatments.

RESULTS AND DISCUSSION

Analysis of the data indicated that both the date and the height of cutting had significant effects on both the final height of the plants and the number of pollen producing racemes they were able to regenerate.

Table I shows a clearcut statistically significant reduction in final height with later and later cutting dates. Table II shows the same trend with regard to final number of recemes per plant.

TABLE I
REGROWTH IN RESPONSE TO VARIOUS CUTTING DATES

Cutting Date Treatment	Final Height (cm)
7-11-80	82.3 a
7-21-80	52.74 b
7-31-80	22.0 c
8-11-80	0.33 d

On July 21 the control plants were just initiating flower buds. On August 11 the control plants had mature flower buds but none had opened or shed pollen. Therefore the final treatment on August 11 would have been the most desireable one for preventing regrowth, pollen formation and seed dispersal. It should be mentioned that 29 out of 30 plants cut on August 11 had died by September 10.

TABLE II
FORMATION OF STAMINATE FLOWERS IN RESPONSE TO CUTTING DATE

Cutting Date Treatment	Final No. of Racemes/Plant
7-11-80	49.8 a
7-21-80	35.5 b
7-31-80	12.7 c
8-11-80	0.05 d

The effects of cutting height on regrowth and flower formation were decidedly less clear. Table III shows four different patterns of response to initial cutting height.

TABLE III
REGROWTH IN RESPONSE TO VARIOUS CUTTING HEIGHT AND DATES

Cutting Date Treatment	Cutting Height Treatment 5 cm	10 cm	20 cm
7-11-80	87.5 a	81.1 bc	78.3 bc
7-21-80	38.7 f	48.8 e	70.7 d
7-31-80	22.9 h	9.8 i	33.4 g
8-11-80	0 jkl	3.0 jkl	0 jkl

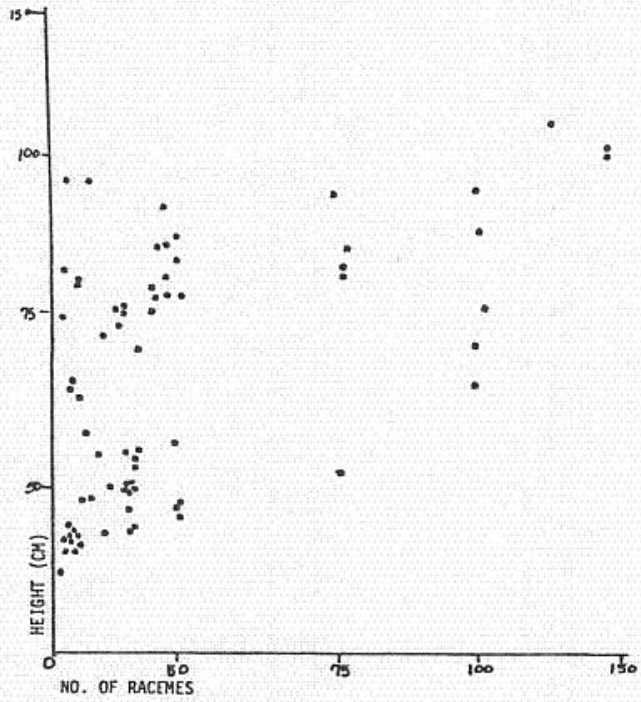
On 7-11-80 the greatest regrowth occurs at the lowest cutting height (5 cm). On 7-21-80 the exact opposite occurs. On 7-31-80 as 7-21-80 the greatest regrowth occurs on the tallest treatment (20 cm) but the second greatest regrowth occurs on the 5 cm treatment. On 8-11-80 there is no significant difference in any of the cutting height treatments. The same basic pattern is repeated in table IV which shows the number of racemes per plant finally formed in response to various cutting heights.

TABLE IV
FORMATION OF STAMINATE FLOWERS IN RESPONSE TO CUTTING HEIGHT

Cutting Date Treatment	Cutting Height Treatment (Racemes/Plant) 5 cm	10 cm	20 cm
7-11-80	77.1 a	37.3 b c	35.1 b c
7-21-80	20.2 d e	33.5 d e	52.8 f
7-31-80	11.6 ghi	3.5 ghi	23.0 ghi
8-11-80	0 jkl	.4 jkl	0 jkl

A test was made of the correlation between the final height of a plant in this experiment and the number of racemes it formed to see if one measure was a good indicator of the other. The resulting r=.98, which is a high positive correlation, indicates that height measurements are a good indicator of the ability of a plant to produce staminate inflorescences.

FIGURE I
DATA POINTS SHOWING CORRELATION OF HEIGHT AND NUMBER OF RACEMES, r=.98.



It should be mentioned that in 1980 mid-August marked the beginning of a month long period in New Jersey when virtually no rain fell. The marked death of the plants in the 7-31 and 8-11 treatments may be attributed to this. Further testing under conditions more favorable to regrowth should be done before it is concluded that ragweed plants lose the power to regenerate when cut just prior to anthesis.

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SUMMER AND FALL CONTROLS OF YELLOW NUTSEDGE (*Cyperus esculentus* L.)[1/]

A. S. McCue and R. D. Sweet[2/]

ABSTRACT

Yellow nutsedge (*Cyperus esculentus* L.) continues to be a problem weed in the Northeastern United States. One reinfestation source is nutsedge that escaped from early season controls. Even very small plants (less than 15 cm) form tubers during the shortening photoperiods of September. Approximately 50% of the previous season's viable tubers sprout the next year, the remainder are dormant. This creates a tuber reservoir which must be managed to decrease infestation. Most field experimentation has dealt with above ground control, however, there has been little investigation as to how treatments may be affecting new and past season's tubers.

The objectives of this three year study were two-fold: to determine the effectiveness of selected herbicide and tillage treatments implimented during various developmental stages of nutsedge and to evaluate their affects on tuber sprouting, dormancy, and kill. Treatments were applied during the 1978, 1979 and 1980 growing seasons. Chemical treatments included aminotriazol, bentazon, DPX-4129, glyphosate, linuron, and paraquat. Foliage control was rated each fall and the following season. Soil and tuber samples were taken from selected plots the spring following application. Treatment effects on tuber sprouting, dormancy and kill were evaluated in various laboratory and greenhouse tests.

Applications prior to tuber formation of DPX-4129, glyphosate, and paraquat reduced tuber numbers dramatically compared to later applications or to other chemical treatments. Paraquat quickly desiccated the foliage and immediately stopped tuber production. Glyphosate and DPX-4129 acted more slowly, thus were less effective. Early applications of bentazon, linuron, and aminotriazol reduced tuber numbers but not enough to give good control.

Time of cultivation affected tuber populations. Plots tilled prior to tuber initiation resulted in nutsedge reestablishment and tuber formation, which was not the case for plots tilled in mid-August and mid-September.

Generally, the early treatments decreased the percentage of sprouting tubers and increased the percentage of dead and dormant tubers. Tubers taken from glyphosate, aminotriazol, and DPX-4129 treated plots and replanted in treated soil had a lower percent sprout and a higher percent dormant and dead compared to the same tubers planted in untreated soil.

DPX-4129 plots remained nutsedge free unless plowed. Most tubers from these plots were viable but did not sprout or if sprouted produced small shoots when replanted in DPX-4129 soil. Tubers from untreated plots planted in DPX-4129 treated soil produced small shoots; and tubers from DPX-4129 plots planted in untreated soil showed some recovery, suggesting that DPX-4129 has residual activity.

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OVULE CULTURE FOR TESTING MATERNAL REGULATION OF WEED SEED DORMANCY

L. K. Thompson[1/], G. R. Leather[2/], and M. G. Hale[1/]

ABSTRACT

A knowledge of the factors which control weed seed dormancy is essential to successful weed control. Establishment of a weed species may stem from seed dormancy which allows seeds to remain viable over long and varied culture conditions. Most literature on seed dormancy deals with *in vivo* matured seed. However it has been shown that the nutritional and environmental factors which effect the parent plant also have an influence on seed dormancy. Thus the development of a system to culture seeds *in vitro* would help define the parameters determining seed dormancy.

Velvetleaf (*Abutilon theophrasti*) ovules are completely mature 21 days after anthesis. The mature ovule is non-endospermic, containing a well developed embryo and a thin layer of endosperm. The embryo remains green and continues to grow for 15 days after anthesis at which time maximum growth is attained. Velvetleaf was chosen for study because of its rapid rate of embryo development and maturity.

Five different nutrient media were selected: (1) Beasley and Ting (Amer. J. Bot. 60:130-139), (2) Linsmaier and Skoog (Physiol. Plant. 18:100-127), (3) Millerd et al. (Aust. J. Plant Physiol. 2:51-59), (4) Nitsch (Amer. J. Bot. 38:566-577), and (5) Thompson et al. (Ann. Bot. 41:29-39). These are basic media used in ovule, cotyledon and tissue culture. Ovules were cultured in multi-welled tissue culture plates with a working volume of 1 ml. This provided culturing space for the large number of ovules needed for germination tests. For each medium 386 ovules of velvetleaf collected five days after anthesis, were aseptically transferred from surface sterilized capsules to four multi-welled plates containing four ovules and 1 ml of medium. The plates were kept in a growth chamber at 27° C, 65% rh, and 14 hrs of light (60.5 mwatts/cm^2 through a green filter). The media was changed every five days.

On the day of transfer all ovules were white and had green embryos approximately 1 mm long. By day 14 embryos from ovules cultured in the Beasley and Ting medium had increased to only 2 mm in length, while embryos in the Thompson et al. had increased in length to 2.5 mm. Embryos from ovules cultured on Linsmaier and Skoog, Nitsch, and Millerd et al. media had increased to 3 mm in length. Embryos in the Nitsch medium, however, were deformed and chlorotic. By day 21 five ovules had germinated in the Linsmaier and Skoog media, possibly due to the presence of growth hormones in the medium which may have caused precocious germination. Unaltered media of Millerd et al. and Linsmaier and Skoog appeared to give the best embryo development.

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INCREASE IN REDUCING SUGARS AS THE CAUSE OF HYPERIMBIBITION OF SMARTWEED SEEDS INDUCED BY VOLATILE ALDEHYDES

G. R. Leather and R. C. French[1/]

ABSTRACT

Dormant Pennsylvania smartweed (*Polygonum pensylvanicum* L.) seed can be induced to hyperimbibe by exposure to vapors of several volatile aldehydes, including butyraldehyde and nonanal. The hyperimbibed seed is spherical, bound by an integument, and sheds the seed coat. The embryo appears firm, is white, and is approximately 3 mm long.

Aspiration and measurement of the liquid showed the volume of water imbibed averaged 1 µl per seed. Analysis of the aspirated liquid showed high levels of free reducing sugars. These sugars are apparently a product of amylase activity, found in low levels in the imbibed water and remaining endosperm, and not a result of glycolysis or anaerobic fermentation because alcohol dehydrogenase, ethanol and lactic acid were not detected. Although the embryo stained uniformly with tetrazolium, germination or growth did not proceed with incubation on moist filter paper or nutrient media.

We conclude that treatment with volatile aldehydes stimulates amylase activity, resulting in the hydrolysis of starch to free reducing sugars, thus increasing the osmotic gradient and subsequent water uptake. Further study is needed to determine the mechanism by which one portion of the germination sequence is stimulated while others remain inactive.

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PRESENCE OF A NATURAL PLANT GROWTH INHIBITOR IN 'EARLY BLACK' CRANBERRY LEAVES

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ABSTRACT

Acetone extracts of cranberry leaves contain a growth inhibiting compound(s) that strongly inhibits the germination and growth of wheat. The extract contains parasorbic acid, a well known growth inhibiting compound. However, parasorbic acid in cranberry leaves is not found in the free active form but as an inactive glucoside. It is the conclusion of this study that parasorbic acid has little effect on the growth inhibiting properties of cranberry leaf extracts.

INTRODUCTION

There have been a number of studies during the last decade describing the allelopathic effect of higher plants on neighboring competing vegetation (5,6,7,9). Allelopathy refers to the production of chemicals by one plant that inhibit the growth of other nearby plants. In the present study we found that acetone extraction of cranberry (*Vaccinium macrocarpon* L. 'Early Black') leaves yielded a substance that was inhibitory to wheat (*Triticum aestivum* L.) seed germination and growth.

Recently the unsaturated lactone, parasorbic acid, was discovered in cranberry leaves (10,11). Until this discovery parasorbic acid had only been found in the fruit of the mountain ash, *Sorbus aucuparia* L. Parasorbic acid has been shown to inhibit seed germination (1) and could possibly explain the germination-inhibiting effect of cranberry leaf extracts. However, parasorbic acid in cranberry leaves was not found in the free, active form but as the relatively inactive glucoside (10,11).

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MATERIALS AND METHODS

A 200 g sample of leaves was blended for 3 min at high speed with 1500 ml of 80% acetone. For this purpose a large stainless steel commercial Waring Blendor was used. The homogenate was stored for 48 hr at 4°C and during this period was stirred several times to facilitate extraction. The homogenate was then filtered twice through cheesecloth and Whatman No. 1 filter paper without suction. The acetone was evaporated off in a flash evaporator at 45°C and the remaining fraction (about 200 ml) filtered twice through cheesecloth and Whatman No. 1 filter paper. The extract was then distilled until 40 ml of distillate had been collected. Activity of the distillate was tested in a wheat seed bioassay.

Wheat seeds were placed in petri dishes containing 3 pads of filter paper (Whatman No. 1, 9 cm) and 5 ml of water or test solution (distillate or parasorbic acid). Each petri dish contained 50 seeds and one of the pads of filter paper was used to cover the seeds. The dishes were sealed in plastic bags to retard evaporation. Constant temperature (25 ± 1°C was maintained by allowing the seeds to germinate in an incubator (Precision, Model 806) in the dark. After 92 hr germination and coleoptile length were recorded.

For detection of parasorbic acid by gas chromatographic analysis, a 2 ml aliquot of distillate was extracted twice with a 2 ml of redistilled ether as described by Kuhn and Jerchel (3). The extracts were combined, dried over anhydrous sodium sulfate, and reduced in volume to 1 ml. For derivatization, 2 ml of diazomethane in ether was added. After 30 min the excess diazomethane was evaporated and the volume reduced to 2 ml. Volumes of 1 to 5 ul were injected into the gas chromatograph. At the operating parameters used in this analysis, 1 ug of derivatized parasorbic acid produced a 26% FSD.

Analysis was carried out using a Varian 3700 with a flame ionization detector. The instrument was equipped with a 3 mm O.D. X 180 cm nickel column packed with 1.5% OV-17 and 1.95% QF-1 on Anakrom Q 100/110 mesh. Injector port and detector were operated at 200 and 230°C, respectively. Samples were injected on the column at 160°C. After 2 min the column temperature was raised at the rate of 8°/min to 210°C. The electrometer setting was 16×10^{-10} amp/mv. Carrier gas was He at 30 ml/min. The air flow was set at 300 ml/min. Hydrogen flow was adjusted to obtain maximum response. Symmetrical peaks were also obtained with a 3 mm O.D. X 180 cm stainless steel column packed with 1.5% OV-101

on 100/120 mesh Chromasorb G HP.

RESULTS AND DISCUSSION

In a previous study Devlin (2) reported that extracts of 'Early Black' cranberry leaves strongly inhibited the germination and growth of wheat. In that study the inhibitor was present in a relatively crude extract that was prepared following a series of clean-up procedures. In the present study cumbersome clean-up procedures were circumvented by subjecting the acetone extract (after removal of the acetone) to distillation by heating to the boiling point. The resulting distillate strongly inhibited wheat seed germination and growth (Table 1).

Table 1. Effect of cranberry leaf distillate on wheat seed germination and coleoptile growth.

Distillate Strength	% Seed Germination	Coleoptile Length (mm)
0	95.0	23.2
¼	87.5	13.9
½	71.5	7.3
Full	0	0
LSD 1%	2.3	2.9
5%	1.7	2.1

When applied at full strength the distillate completely inhibited germination (Table 1). At one half strength there was a 28% inhibition of germination and 68% inhibition of coleoptile growth. Even at one fourth strength germination was inhibited 12.5% and coleoptile growth 40% (Table 1)

The growth inhibiting effect of parasorbic acid has been well-documented. For example, parasorbic acid has been shown to inhibit garden cress (Lepidium sativum) seed germination (1), cell enlargement in Avena coleoptile and etiolated stems (4,8), and bacterial growth (1). In the present study it was shown that parasorbic acid is inhibitory to wheat seed germination and coleoptile growth (Table 2). The highest concen-

tration (300 ppm) of parasorbic acid applied caused a 60% reduction in seed germination and a 90% reduction in coleoptile growth (Table 2).

Table 2. Effect of parasorbic acid on wheat seed germination and coleoptile growth.

Parasorbic Acid (ppm)	% Seed Germination	Coleoptile Length (mm)
0	96.6	24.6
100	93.0	21.0
200	84.0	10.5
300	39.6	2.3
LSD 1%	6.7	2.7
5%	4.7	1.9

Gas chromatographic analysis of the inhibitory cranberry distillate suggests the presence of parasorbic acid. A logical assumption would be that the inhibitory influence of the distillate is at least partially due to parasorbic acid. However, this assumption is doubtful since parasorbic acid is not present in cranberry leaves in the free form but as a glucoside (10,11). Distillation of the leaf extract would release parasorbic acid from the glucoside complex (3) but not in high enough concentration to be strongly inhibitory. For example, in this study we found the unphysiologically high concentration of 100 ppm parasorbic acid inactive in seed germination and only slightly inhibitory in coleoptile growth (Table 2). We feel that a compound (or compounds) other than parasorbic acid is responsible for the inhibitory action of cranberry leaf distillate.

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EFFECTS OF ROW-SPACING, WEED CONTROL TREATMENT AND CULTIVAR ON THE COMPETITIVE ABILITY OF SOYBEANS

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ABSTRACT

In this two-year study Miles, Elf, and Essex soybeans (Glycine max (L.)Merr.) were evaluated for their competitive ability under a regime of variable crop row-spacings and weed control treatments. The experiments were conducted at the College Farm in Newark, DE during 1979 and 1980 on a Metapeake silt loam soil with a known heavy infestation of ivyleaf morningglory (Ipomoea hederacea (L.)Jacq.) and tall morningglory (I. purpurea (L.)Roth). In June 1979, a mixture of common lambsquarters (Chenopodium album L.) and smooth pigweed (Amaranthus hybridus L.) seeds were broadcast over the test areas.

In 1979, soybeans were hand-planted in 2.3 m x 6.1 m plots on June 9 to 12 in 25,50, and 75-cm wide rows at a constant average density of 455,000 plants/ha after emergence and thinning. A factorial design was used and plots were replicated four times.

The four broadleaf weed control treatments were acifluorfen at 0.283 kg/ha ai with 0.125% Triton AG-98 surfactant (by volume) at three weeks after soybean emergence (July 5), aciflurofen at 0.283 kg/ha ai with ammonium sulfate at 3.39 kg/ha on July 20, hand-hoeing four times throughout the month of July, and no treatment.

Visual ratings were made on August 2. Above-ground crop and weed biomass samples were collected August 27 to 29 (0.5 m^2/plot) and oven-dried at 37°C for two weeks. The amount of incident solar radiation (watts/m^2) penetrating the canopy was measured August 22 to September 9 with a radiometer attached to a one meter long rod-type sensor. Grain yield was determined by hand-harvesting a 4 m^2 sample from each plot.

A factorial design with split-plots and four replications was also used in 1980. The soybeans were machine-drilled in 25,50 and 75-cm wide rows on June 13. Plot size was 2.1 by 9.1 meters. Final densities across all row-spacings were 437,500 plants/ha for Essex and Miles and 562,000 plants/ha for Elf.

Broadleaf weed treatments were similar to those used in 1979 except that the first acifluorfen treatment was applied two weeks following soybean emergence (July 1) when the weed seedlings were less than 1.5 cm tall. The second herbicide treatment called for the acifluorfen to be sprayed at 0.283 kg/ha ai at two and four weeks after emergence (July 1 and 16).

Weed control ratings were made on August 21 to include effects of the herbicide, row-spacings, and cultivars in the evaluations. Biomass was sampled August 25 to 28. Light penetration data were collected September 9

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to 11. Plots were hand-harvested October 22 to 24.

Soybeans planted in 75-cm rows resulted in a 43% decrease in total weed biomass (across both years) in plots receiving no broadleaf weed control treatment. Beans planted in 50 and 75-cm rows effected 54% and 60% reductions in weed biomass, respectively.

Highest values for above-ground crop biomass and grain yield were obtained when soybeans were planted in 25-cm rows and treated early with acifluorfen or hoeing. Across all varieties, replications and years, for any given weed control treatment, the grain yield decreased as row-spacing increased. Soybeans planted in 25-cm rows receiving no broadleaf weed control treatment yielded statistically as high as those planted in 75-cm rows and hoed throughout the month of July. These trends are supported by the visual ratings and light penetration data, which will be discussed at the meeting. Differences between cultivars were generally not significant.

Acifluorfen is most effective on common lambsquarters (Chenopodium album L.) and smooth pigweed (Amaranthus hybridus L.) when the weed seedlings are less than 1.5 cm tall. This herbicide at relatively low rates could be expected to provide excellent broadleaf weed control in narrow-row situations where cultivation may not be possible.

TABLE 1. The effects of row-spacing and weed control treatment on the competitive ability of soybeans*. Newark, DE: 1979 and 1980

		Row Spacings (cm)												
		(weeds only)			75			50			25			
		No Tmt	Herb**	Hoed	No Tmt	Herb**	Hoed	No Tmt	Herb**	Hoed	No Tmt	Herb**	Hoed	LSD***0.05
Total Weed Biomass (kg/ha)	1979	4520	1740	0	2427	903	0	2150	741	0	2133	341	0	815.9
	1980	2138	460	0	1625	144	163	1153	44	96	736	349	463	549.5
Total Crop Biomass (kg/ha)	1979	-	-	-	2088	2759	3220	2934	4184	4806	3146	3941	4717	859.7
	1980	-	-	-	4925	5803	5967	3868	4807	5030	5262	5625	5445	1098.5
Soybean Seed Yield (kg/ha)	1979	-	-	-	976	1328	1818	1054	1731	2184	1606	2138	2488	390.9
	1980	-	-	-	1002	1307	1359	952	1358	1202	1345	1366	1439	356.3

*Combined values for all three cultivars
**Combined values for following treatments (best treatment from each year):
1979 - acifluorofen @ 0.283 kg/ha 3 wks. postemergence
1980 - acifluorofen @ 0.283 kg/ha 2 wks. and 4 wks. postemergence
***Ivyleaf morningglory, tall morningglory, common lambsquarters, smooth pigweed

DICLOFOP MODIFICATION OF SOYBEAN/ANNUAL GRASS COMPETITION

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ABSTRACT

Diclofop {2-[4-(2, 4-dichlorophenoxy)phenoxy]propanoate} is a post-emergence annual grass herbicide which alters and weakens the root systems of susceptible species and has recently been registered for use in soybeans (Glycine max L. Merr.).

The objectives of this two year study are: (1) to examine the interaction(s) of cultivation, time of herbicide application and diclofop concentration in order to select the combination of cultural and chemical treatments which give the best annual grass control, and (2) to examine the effect of bentazon [3-isopropyl-1H-2, 1, 3-benzothiadiazin-4-(3H)-one 2, 2-dioxide] on diclofop grass control.

In 1979, diclofop concentrations from 0 to 1.12 kg/ha were applied as preemergence treatments or at either the 2 to 3 leaf stage or the 4 to 5 leaf stage of giant foxtail (Setaria faberi Herrm). Subplots were either with or without a single cultivation. The combination of diclofop at either 0.84 or 1.12 kg/ha, applied at the 4 to 5 leaf stage in conjunction with cultivation produced the best visual control, above ground weed biomass reduction, and soybean grain yield.

In 1980, giant foxtail control by diclofop at 1.12 kg/ha was compared to that of 1.12 kg/ha diclofop plus 1.12 kg/ha bentazon applied either as a tank mix or as sequential treatments applied 3 days apart. This year two giant foxtail leaf stages, the 4 to 5 leaf stage and early tillering, were investigated in conjunction with the following three cultivation practices, none, early (5 days after the sequncial bentazon treatment), or late (18 days after the sequencial bentazon treatment). Sequencial applications of diclofop followed by bentazon did not reduce the giant foxtail control observed when diclofop was used alone. Tank mixing the two herbicides, however did reduce grass control. The data further indicated that the timing of both cultivation and herbicide application was important. An herbicide application at the tillering leaf stage followed by an early cultivation was equivalent to an herbicide application at the 4 to 5 leaf stage followed by a late cultivation. Early cultivations plus 4 to 5 leaf stage herbicide applications or late cultivations plus tillering stage herbicide applications did not perform as well as the previous combinations.

In both years, while neither cultivation alone or diclofop alone provided economically adequate weed control, the two factors in combination gave excellent control. Further, the data of both years suggest that giant foxtail control is improved by delaying diclofop application until after the 2 to 3 leaf stage.

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DIFFERENTIAL RESPONSE OF NATURAL POPULATIONS OF WEEDY AMARANTHS TO POSTEMERGENCE HERBICIDES [1/]

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ABSTRACT

Field studies were conducted to examine possible differential response to postemergence herbicides by natural populations of weedy Ameranthus species (pigweed). Previous studies have shown extremely variable response by pigweed to bentazon, for example. These studies were conducted to examine some of the causes of this variability; in particular phenotypic variation which had been previously observed in the field.

In 1980 at the H. C. Thompson Vegetable Research Farm, Freeville, plots were set out in which a sample of the emerged pigweed population was tagged and measurements on growth stage and morphology were recorded prior to herbicide application. The survivors of the bentazon treatments, as well as the control plots were grown to maturity and harvested for further testing. Using this technique, three phenotypes were identified, which differed with respect to pubescence on the stem, leaf margin color, and shape of inflorescence. Tentatively these have been identified as Amaranthus retroflexus L. and two distinct races or ecotypes of A. hybridus L. The results indicate that while the two A. hybridus ecotypes were controlled to some degree by early timing and higher rates of bentazon, A. retroflexus was completely controlled at all timings and rates.

In another test in an adjacent field using similar methods, nitrofen and cyanazine as well as bentazon were applied postemergence. In this test there was a similar pattern of differential response to bentazon by the two species. In contrast, nitrofen and cyanazine controlled the weeds to a greater degree, and there was no clear pattern of differential response.

In another study conducted this summer at the same location, the natural population of pigweed was allowed to emerge. Treatments consisted of chemically removing all vegetation at 2, 4, and 6 weeks after which weeds were allowed to reemerge. At the end of the season, the reemerged pigweed was harvested and individuals were identified by phenotype. The results indicate that the proportional distribution of A. retroflexus and the two ecotypes of A. hybridus within a population is influenced by the period during the growing season in which they emerge.

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PROTEIN METABOLISM IN 2,4-D RESISTANT AND SUSCEPTIBLE BIRDSFOOT TREFOIL

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ABSTRACT

Protein metabolism was investigated in two varieties of birdsfoot trefoil. The resistant variety, T-68, was selected from the susceptible variety, Viking. When treated with 0.5-1.1 kg/ha 2,4-D, both varieties increased in protein content relative to controls on a dry weight basis. The protein content of T-68 increased earlier after treatment, while Viking protein content increased later and its total gain was greater.

^{14}C-leucine incorporation was studied to measure protein synthetic rates. T-68 mature roots and whole seedlings incorporated leucine more rapidly than Viking roots and seedlings. When both varieties were treated with 1.2 mM 2,4-D for twenty minutes before the six hour incubation, protein synthesis was inhibited 15% in both varieties.

The varieties did not differ in protein content in any plant part on a dry weight basis, but leaf protein content on a fresh weight basis was significantly greater in Viking. T-68 therefore has higher root and protein turnover rates and lower leaf protein content on a fresh weight basis. T-68 may metabolize hormonally active 2,4-D protein complexes more rapidly than does Viking, and may form them more slowly since its protein concentration is lower. Glutamic acid and aspartic acid are major components of legume protein and conjugate with 2,4-D to form poor auxins relative to other amino acid conjugates of 2,4-D, so the rapid protein turnover rate found in T-68 could free more aspartate and glutamate to bind and deactivate the herbicide, contributing to the 2,4-D resistance characteristic of T-68.

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STRUCTURAL REQUIREMENTS FOR THE AUXIN ACTIVITY OF MEFLUIDIDE

J.A. Jersey and S. Glenn[1/]

ABSTRACT

Mefluidide (N-(2,4-dimethyl-5-((trifluoromethyl)sulfonyl)amino phenyl)acetamide) is a plant growth regulator which is used as a growth retardant for various grass species. The mechanism of action of mefluidide has not been determined. Mefluidide has, however, been found to exhibit auxin-like activity by increasing protein, RNA and DNA synthesis as measured by incorporation of labelled precursors into the respective cellular constituents of corn coleoptile tissue and by the stimulation of corn coleoptile elongation. The effects of chemicals structurally related to mefluidide, including MBR-7200 (3-trifluoromethylsulfonomido-o-acetotoluidide), MBR 15733 (6-acetamine-4-amino-m-xylene), and MBR 4410 (4-trifluoromethylsulfonyl-amino-m-zylene) on ^{14}C-leucine incorporation into corn coleoptile protein was evaluated to examine possible structural requirements for the auxin-like activity of mefluidide.

Mefluidide at 10^{-6} M was found to stimulate the incorporation of ^{14}C-leucine into protein relative to the control (95% ethanol). Removal of the methyl from the 4-position of mefluidide (MBR 7200) did not alter the activity. When the acetamide chain of mefluidide was absent (MBR-4410) the effect on leucine incorporation was reduced. Removal of the trifluoromethylsulfonyl amino group of mefluidide (MBR-15733) eliminated the activity of mefluidide on leucine incorporation.

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SOME ECOLOGICAL OBSERVATIONS OF HEMPSTEAD PLAINS, LONG ISLAND NEW YORK

Richard Stalter [1/]

ABSTRACT

Herbaceous and shrubby vegetation of Hempstead Plains, in the vicinity of Mitchell Field, Long Island, New York, was sampled by the quadrat method during the summer and fall 1980 to determine species composition and dominance. Three fields at Mitchell Field were selected for study. Abundance classes for each species in each field were recorded. Rubus alleghenieensis, members of the gramineae and compositae are dominant. Soil texture, distribution of soil material, fire, grazing, mowing, drought, allelopathy, and the activity of small mammals are factors that might have produced the original vegetation. The fate of Hempstead Plains as a stable, treeless community cannot be predicted with certainty.

INTRODUCTION

Hempstead Plains, once encompassing approximately 60,000 acres, is located on Long Island. Originally, European settlers thought the land unsuitable for crops and used the land as pasture land (Hicks 1892). As more people settled the area, the land was gradually dissected into smaller and smaller parcels, and the original vegetation was replaced by houses, roads, and cultivated crops. In 1892 Hicks reported that several large tracts of land remained in their "original condition." Harper (1912) estimated that while 20% of the land was in its "natural condition," most of the original prairie vegetation was almost totally obliterated. Cain et. al. (1937) reported that much of Hempstead Plains had been converted into truck farms or building sites, although two years before Conrad (1935) reported that large tracts up to 100 acres remained in "primeval condition." In 1968 the "only remaining tracts of Hempstead Plains vegetation were located at Mitchell Field" (Seyfert 1972). Seyfert (1972) sampled vegetation in the vicinity of Mitchell Field and identified 233 taxa. He compared these taxa to species identified by thirteen different investigators, who identified 461 different species on the Hempstead Plains. Many of the 461 taxa were no longer a part of the flora at Mitchell Field when Seyfert (1972) conducted his study.

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MATERIALS AND METHODS

The quadrat method was used to sample vegetation in the vicinity of Mitchell Field. Fifty $1m^2$ quadrats were used to sample the vegetation in each of the three sites selected for study. Field one is located just east of the parking lot at Hofstra University. Field two is located at Mitchell Field and borders Rt. 24, Hempstead Turnpike. Field three is located east of Mitchell Field and study area #2.

RESULTS AND DISCUSSION

In Field #1, a field adjacent to the parking lot at Hofstra University, Agrostis alba, Plantago aristata, Solidago graminifolia, Solidago tenuifolia, Dactylis glomerata, Panicum spp. and Rubus allegheniensis were most abundant. In Field #2, a portion of Mitchell Field bordering Rt. 24 (Hempstead Turnpike), Carex scoparia, Rubus allegheniensis, Solidago tenuifolia, Solidago graminfolia, Andropogon virginicus, Solidago juncea, Daucus carrota and Linaria vulgaris were most abundant. Field #3, located east of Field #2 and bordering Mitchell Field, is a mosaic of plant communities. Dominant plants in each separate community within Field #3 are Rubus allegheniensis, Solidago juncea, Juncus Greenei, Andropogon virginicus, and Panicum virgatum.

It is important to note that the species observed in this study flower and fruit in the summer and fall. The dominant plants of spring and early summer, e.g. Viola fimbriatula, Rumex acetosella, Barbarea vulgaris, are conspicuously absent from the species list (Table 1). It is quite probable that no portion of the original Hempstead Plains could be defined as a virgin area today. Cultivation and development have altered the soils and destroyed the original vegetation. No record of precolonial vegetation exists. Early investigators reported that grasses dominated Hempstead Plains when the European colonists first settled this region. Several suggestions are offered to explain the origin and maintenance of "Plains" vegetation. Johnson (1972) and Seyfert (1972) cite evidence that the Indians of the region set fires to Hempstead Plains. Johnson (1972) believes that frequent burns killed the trees and shrubs to maintain a prairie in a 60,000-acre area. Most ecologists are in agreement that the Indians burned vast areas of the eastern forest. However, if fire alone removed the shrubs and trees from Hempstead Plains, then why did fire not remove trees from all areas burned by the Indians in the eastern United States. Moreover, pitch pine forests of southern New Jersey and nearby eastern Long Island burn readily, perpetuate themselves and are maintained by fire. Thus, fire alone is probably not responsible for the treeless state of Hempstead Plains. Harper (1918) suggests that a

combination of burning, mowing and grazing might have eliminated woody vegetation and kept the area in grassland. However, if the area were mowed by the colonists and grazed by their animals, other factors must have been responsible for maintaining the area as grassland before the arrival of the European colonists.

Soils have been thought to play a role in the development of the Plains' vegetation. The soils of the Plains are thin and overlay gravel deposits (Bonsteel 1904) or thick beds of sand and gravel (Bailey 1949). Water percolates rapidly through these soils. When water percolates rapidly through soil, little water is available for plant growth. Water availability, therefore, would be especially critical during times of drought. In addition, these soils provide a poor substrate for root development of arborescent species. Bonsteel (1904) and Bailey (1949) offer the above argument for the absence or paucity of woody vegetation present on the plains. Moreover, trees and shrubs need more water for growth and development than grasses. Thus, the soils of Hempstead Plains may contribute to perpetuation of grasses and forbs rather than trees.

Although no experimental work on the effect of allelopathic substances on plants has been conducted in the present study, it has been well-documented that allelopathy plays a role in influencing rates of plant succession (Rice 1974). Species found at Mitchell Field that produce phytotoxic substances are Andropogon virginicus, Digitaria sanguinalis, Euphorbia supina, Sorgum helapense, Rhus glabra, Melilotis alba, Helianthus annuus and Erigeron canadensis. Further investigation into the identification of all the species involved in producing allelopathic substances and the role allelopathy might play in plant succession and the distribution of plant species might well provide some basis for understanding the present assemblage of plant species at Mitchell Field.

Cain et. al. (1937) suggests that topography of the area favors grassland development and contends that the level character of the land favored grassland development over forest. However, many level areas on Long Island are forested. Although topography correlates well with vegetation development at Hempstead Plains, topography is not an important factor in producing prairie vegetation. Svenson (1936) believed that the presence of Andropogon scoparius, little blue stem, a thick sod producer, prevented shrubs and trees from invading the Plains. Moreover, a thick, dense root system of Andropogon spp. would inhibit growth and development of shrubs and trees, since this grass would compete with trees and shrubs for available minerals and water.

Johnson (1972) emphasizes the role of small rodents, e.g. Microtus pensylvanicus and rabbits, in excluding woody vegetation from the Plains. These animals feed on the buds and bark of

Table 1. Important species at Hempstead Plains, New York. Important species had an abundance class* of 2 or higher in one or more study areas. Field 1: Hofstra University; Field 2: Mitchell Field; Field 3: just east of Mitchell Field

Species	Study Area		
	Field 1	Field 2	Field 3
Agrostis alba	4	3	1
Dactylis glomerata	3	3	1
Plantago aristata	2	1	1
Solidago tenuifolia	2	4	1
Solidago graminifolia	2	4	1
Panicum spp.	2	1	1
Rubus allegheniensis	3	4	4
Carex scoparia	1	4	1
Andropogon virginicus	1	4	1
Solidago juncea	1	3	4
Daucus carrota	1	3	1
Linaria vulgaris	1	2	1
Juncus greenei	1	1	2
Panicum virgatum	0	0	2

*Abundance Class

0 not present or 0 percent
1 rare or from 1 to 20 percent
2 occasional or from 20 to 40 percent
3 frequent or from 40 to 60 percent
4 common or from 60 to 80 percent
5 abundant or from 80 to 100 percent

young trees and shrubs and might girdle and kill young, woody plants, especially during years when their populations were high. Small rodent populations also experience peaks and declines in other parts of Long Island where trees are dominant. Thus, the activity of small mammals along is probably not the primary factor in explaining the absence of arborescent and frutescent species at Hempstead Plains.

No single factor is responsible for the existence of the Hempstead Plains flora. Soil texture, distribution of soil material, fire, grazing, mowing, drought, allelopathy and the activity of small mammals probably acted in concert to produce the original assemblage of vegetation at Hempstead Plains. Each factor plays or played a role in the formation and perpetuation of the Plains flora. Not all factors exhibit the same degree of influence each year or each season. Some years are drier than others; some years small mammals are more abundant. During years of animal stress, fire, or drought, woody vegetation would be more adversely affected than grasses and forbs, and once killed, would take a longer time to regenerate than grasses or forbs. In addition, thick rootstocks of grasses would impede the invasion of woody species. Thus, all of the aforementioned factors could act alone, together, or synergistically to perpetuate the original flora of the Plains.

Once the Plains was settled by Europeans, the area was farmed and developed, and much of the original Plains' vegetation was destroyed (Seyfert 1972). Although grasses and forbs are dominant in portions of Mitchell Field today, other sections of Mitchell Field have been invaded by shrubs and trees. Thus, the fate of Hempstead Plains as a stable, treeless community cannot be predicted with certainty.

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EVALUATION OF SEVERAL HERBICIDES FOR PREEMERGENCE AND POSTEMERGENCE WEED CONTROL IN WHITE POTATOES

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ABSTRACT

Combination herbicide treatments of metribuzin preemergence followed by layby treatments or post emergence treatments with metolachlor, CGA-82725, or difenopenten provided full season control of barnyard grass, quackgrass, and lambsquarters. All treatments except dinoseb plus dalapon applied preemergence were weak on mustard control. None of the treatments had any significant effect on yield of Katahdin potatoes, nor was there any injury to the potato foliage.

INTRODUCTION

Comparisons were made among several herbicide combinations including metribuzin [4-amino-*tert*-butyl-3-(methylthio)-*as*-triazin-5(4*H*)-one], metolachlor [2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl) acetamide], experimental herbicide CGA-82725 (chemistry confidential) and difenopenten [4-[4-[4-(triflouromethyl)phenoxyl] phenoxy]-2-pentenoic] for weed control in the white potato *(Solanum tuberosum* L. 'Katahdin'*)*. Metolachlor was applied as both preemergence and layby treatments; metribuzin as a preemergence treatment; and CGA-82725 as post emergence treatments timed to coincide with growth stages of the grass species present which were annual barnyard grass *(Echinochloa crus-galli* (L.) Beauv.*)* and quackgrass *(Agropyron repens* L.*)*. Layby herbicides were applied directly over the potato foliage canopy. Weed populations of barnyard grass, quackgrass, mustard *(Brassica campestris* L.*)* and lambsquarters *(Chenopodium album* L.*)* are reported in Table 1.

MATERIALS AND METHODS

The test was conducted on a Caribou gravelly silt loam with a pH of 5.3 and organic matter content of 3.5 percent. Plot size was a single row, 20 feet long arranged in a randomized block design with six replicates of each treatment. Untreated buffer rows were used between treated rows. All herbicides were applied in 80 gallons of water per acre using 40 psi pressure. A compressed air sprayer was used, equipped with a two nozzle brush type boom. Nozzles were Delavan raindrop type with No. 3374-3 tips. Dates of treatment, soil, weather, and wind information are presented in the footnotes of Table 1. During July and after the last hilling of the potatoes, weed counts were made by species in the 'no treatment' plots as reported in Table 1.

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RESULTS AND DISCUSSION

None of the treatments in this test caused any crop injury. Although populations of barnyard grass was probably too low for a good evaluation, all treatments provided full season control of barnyard grass. Quackgrass control was satisfactory with combinations of metribuzin and metolachlor applied in combination as preemergence treatments or separately using metolachlor at layby. CGA-82725 applied post emergence gave slightly less quackgrass control than metolachlor. Diphenopenten provided better quackgrass control than either CGA-82725 or metolachlor. The standard used in Maine of dinoseb (2-*sec*-butyl-4,6-dinitrophenol) plus dalapon (2,2-dichloropropionic acid) provided the best control of mustard, although 0.5 pounds of metribuzin preemergence plus 2.0 pounds of metolachlor also provided good full season control of mustard. All of the treatments provided control of the small population of lambsquarters in this test.

Table 1. Effect of metolachlor in combination with dinoseb and metribuzin, and various comparisons of CGA-82725, and diphenopenten post emergence on yield, crop injury, and barnyard grass in Katahdin potatoes. Maine - 1980.

Treatments[a] Lbs. A.I. per Acre	Yield Cwt./A.	Percent Crop Injury and Weed Control[e]					
		Crop Injury			Barnyard grass		
		7-3	7-24	8-21	7-3	7-24	8-21
Check - no treatment	166	0	0	0	98	100	100
4.5 Dinoseb + 5.0 Dalapon, PE[b]	260	0	0	0	80	100	100
0.25 Metribuzin + 2.0 Metolachlor, PE	179	0	0	0	100	100	100
0.5 Metribuzin + 2.0 Metolachlor, PE	273	0	0	0	100	100	100
0.25 Metribuzin, PE	206	0	0	0	100	100	100
0.5 Metribuzin, PE	237	0	0	0	100	100	100
1.5 Metolachlor, LB	133	0	0	0	100	100	100
2.0 Metolachlor, PE	156	0	0	0	100	100	100
0.5 Metribuzin, PE + 1.5 Metolachlor, LB	233	0	0	0	100	100	100
0.25 Metribuzin, PE + 0.25 CGA82725, Post[c]	220	0	0	0	100	100	100
0.5 Metribuzin, PE + 0.25 CGA-82725, Post[c]	252	0	0	0	100	100	100
0.25 Metribuzin, PE + 0.25 CGA-82725, Post[d]	244	0	0	0	100	100	100
0.5 Metribuzin, PE + 0.25 CGA-82725, Post[d]	254	0	0	0	100	100	100
0.25 Metribuzin, PE + 1.0 Diphenopenten, Post[d]	208	0	0	0	98	100	100
Bayes L.S.D. (0.05)	59						

[a]Planted - June 5; killed - September 16; harvested - October 9, 1980.

[b]Preemergence treatments applied - June 10. Temperature - 55F., overcast; soil dry; west wind 10-12 mph.

Layby treatments applied - July 17. Temperature - 72F., clear; soil wet; south wind 0-2 mph.

[c]Post treatments at 2-5 leaf stage of grass applied - June 19. Temperature - 72F., partly cloudy; soil dry; north wind 3-5 mph.

[d]Post treatments at 5-8 leaf stage of grass applied - July 8. Temperature - 60F., overcast; soil wet; south wind 4-6 mph.

[e]Rating code: 100 percent = complete absence of weeds and all crop plants killed.

Number and species of weeds per square foot (average of 6 replicates):

Agropyron repens - 2.4
Brassica sp. -10.6
Chenopodium album - 0.2
Echinochloa crusgalli - 0.3

Table 2. Effect of metolachlor in combination with dinoseb and metribuzin, and various comparisons of CGA-82725, and diphenopenten post emergence in weed control of Katahdin potatoes. Maine-1980.

Treatments[a] Lbs. A.I. per Acre	Percent Weed Control[e]								
	Quackgrass			Mustard			Lambsquarters		
	7-3	7-24	8-21	7-3	7-24	8-21	7-3	7-24	8-21
Check - no treatment	80	95	90	44	19	38	87	100	100
4.5 Dinoseb + 5.0 Dalapon, PE[b]	100	92	86	100	100	100	100	100	100
0.25 Metribuzin + 2.0 Metolachlor, PE	80	90	84	75	59	64	100	100	99
2.0 Metolachlor, PE	82	94	92	97	95	96	100	100	100
0.25 Metribuzin, PE	83	96	90	70	51	50	96	100	100
0.5 Metribuzin, PE	81	92	93	96	87	91	100	100	100
1.5 Metolachlor, LB	86	96	94	34	12	36	94	100	100
2.0 Metolachlor, PE	77	91	87	57	30	33	97	100	99
0.5 Metribuzin, PE + 1.5 Metolachlor, LB	81	91	90	94	76	85	100	100	100
0.25 Metribuzin, PE + 0.25 CGA-82725, Post[c]	76	92	92	79	63	62	98	100	100
0.5 Metribuzin, PE + 0.25 CGA-82725, Post[c]	84	90	85	96	94	92	100	100	100
0.25 Metribuzin, PE + 0.25 CGA-82725, Post[d]	74	90	85	81	86	80	100	100	100
0.5 Metribuzin, PE + 0.25 CGA-82725, Post[d]	79	95	85	90	83	89	100	100	100
0.25 Metribuzin, PE + 1.0 Diphenopenten, Post[d]	78	98	98	76	45	55	99	100	100

[a]See footnotes on Table 1.

THE EFFICACY OF RO13-8895 FOR ANNUAL AND PERENNIAL GRASS CONTROL IN WHITE POTATOES

H. J. Murphy and L. S. Morrow[1]

ABSTRACT

Evaluation of RO13-8895 for grass control and crop tolerance was conducted at Aroostook Farm, Presque Isle, Maine. All of the RO13-8895 treatments controlled both annual and perennial grasses but no lambsquarters, the only broadleaved weed in the test area. Applications of RO13-8895 directly over the canopy did not injure potato foliage.

INTRODUCTION

RO13-8895, a new candidate grass herbicide with confidential chemistry, was tested for post emergence activity on annual barnyard grass *(Echinochloa crus-galli* (L.) Beauv.*)* and quackgrass *(Agropyron repens* (L.) Beauv.*)* growing in white potatoes *(Solanum tuberosum* L. 'Kennebec'*)*. Readings for crop injury and control of lambsquarters *(Chenopodium album* L.*)* were also made. RO13-8895 was applied at rates of 0.0625, 0.125, 0.25, and 0.5 pounds of active material per acre and also following preemergence applications of metribuzin [4-amino-6-*tert*-butyl-3-(methylthio)-*as*-triazin-5(4*H*)-one].

MATERIALS AND METHODS

The test was conducted on a Caribou gravelly silt loam with an organic matter of 3.5 percent. Plot size was a single row, 20 feet long, arranged in a randomized block design with six replicates of each treatment. All herbicides were applied in 80 gallons of water per acre using 40 pounds pressure. A compressed air sprayer was used, equipped with a two-nozzle brush type boom. Nozzles were Delavan raindrop type with No. 3374-3 tips. The post emergence treatments were applied over the canopy of potato plants. Treatment dates, weather, wind, and soil conditions at time of applications are presented in Table 1. During July, weed counts by species were made in 'no treatment' plots.

RESULTS AND DISCUSSION

None of the preemergence or post emergence herbicide treatments listed in Table 1 injured the potato crop. The low populations of barnyardgrass and quackgrass were completely controlled by all treatments. Preemergence and post emergence treatments with RO13-8895 did not control lambsquarters. Metribuzin applied alone at 0.25 pounds A.I. per acre controlled lambsquarters satisfactorily.

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Table 1. Effect of RO13-8895 applied preemergence, postemergence, alone, and with metribuzin on yield, crop injury, and weed control in Kennebec potatoes. Maine - 1980.

Treatments[a] Lbs. A.I. per Acre	Yield Cwt./A.	Percent Crop Injury and Weed Control[b]											
		Crop Injury			Barnyard grass			Quackgrass			Lambsquarters		
		7-1	7-25	8-21	7-1	7-25	8-21	7-1	7-25	8-21	7-1	7-25	8-21
Check - no treatment	282	0	0	0	95	100	100	95	100	100	52	88	84
4.5 Dinoseb + 3.0 Dalapon, PE	323	0	0	0	99	100	100	100	100	100	100	100	100
0.5 RO13-8895, PE	294	0	0	0	100	100	100	98	100	100	48	80	88
1.0 RO13-8895, PE	328	0	0	0	98	100	100	99	100	100	59	86	88
0.5 Metribuzin, PE	356	1	0	0	100	100	100	97	100	100	97	100	100
0.25 Metribuzin, PE	341	0	0	0	99	100	100	98	100	100	77	99	99
0.25 Metribuzin, PE + 0.0625 RO13-8895, Post	382	0	0	0	98	100	100	97	100	100	86	100	99
0.25 Metribuzin, PE + 0.125 RO13-8895, Post	330	0	0	0	99	100	100	98	100	100	82	96	99
0.25 Metribuzin, PE + 0.25 RO13-8895, Post	340	0	0	0	97	100	100	98	100	100	89	100	99
0.25 Metribuzin, PE + 0.5 RO13-8895, Post	387	0	0	0	98	100	100	98	100	100	88	99	98
0.0625 RO13-8895, Post	319	0	0	0	98	100	100	100	100	100	66	87	90
0.125 RO13-8895, Post	338	0	0	0	99	100	100	98	99	100	64	81	82
0.25 RO13-8895, Post	306	0	0	0	98	100	100	99	100	100	59	90	89
0.5 RO13-8895, Post	347	0	0	0	99	100	100	99	100	100	56	89	94
Bayes L.S.D. (0.05)	88												

[a]Planted - May 30; killed - September 10; harvested - October 10, 1980.

Preemergence treatments applied - June 4. Temperature - 59F., overcast; soil moist; north wind 5-7 mph.

Post emergence treatments applied - July 1. Temperature - 71F., partly cloudy; soil wet; southeast wind 4-6 mph.

[b]Rating code: 100 percent = complete absence of weeds and all crop plants killed.

Number and species of weeds per square foot (average of 6 replicates);

Agropyron repens - 0.4; *Echinochloa crus-galli* - 0.6; *Chenopodium album* - 3.7.

EFFECT OF METRIBUZIN COMBINED WITH ALACHLOR AND GLYPHOSATE ON WEED CONTROL IN POTATOES

L. S. Morrow and H. J. Murphy[1]

ABSTRACT

Metribuzin was evaluated in combinations with alachlor or glyphosate for weed control in white potatoes grown at Aroostook Farm, Presque Isle, Maine, in 1980. Most of the herbicide treatments were effective against the mustards but were not for quackgrass. Lambsquarters and barnyard grass populations were low enough so that evaluation of efficacy on those weed species was not possible. Yields in the check plots were greatly decreased due to the weed pressure of mustards. The standard of dinoseb plus dalapon was the most effective treatment against the mustard weeds. No crop injury was noted in any of the treatments.

INTRODUCTION

Preemergence treatments of metribuzin [4-amino-6-*tert*-butyl-3-(methylthio)-*as*-triazin-5(4*H*)-one] combined with preemergence or layby treatments of alachlor [2-chloro-2',6'-diethyl-*N*-(methoxymethyl) acetanilide] or pre-land preparation treatments of glyphosate [*N*-(phosphonomethyl) glycine] were evaluated for weed control in white potatoes *(Solanum tuberosum* L. 'Katahdin'*)*. Two formulations of alachlor were used, granular and liquid. The efficacy of these treatments was compared with the check plots and the standard of dinoseb [2-*sec*-butyl-4,6-dinitrophenol] plus dalapon [2,2-dichloropropionic acid]. The percentage of control of the following weeds was recorded: quackgrass *(Agropyron repens* L.*)*, mustard *(Brassica campestris* L.*)*, and lambsquarters *(Chenopodium album* (L.) Beauv.*)*.

MATERIALS AND METHODS

The test was conducted on a Caribou gravelly silt loam with an organic matter content of 3.5 percent. Since the land had been plowed the previous fall, the furrows were harrowed out in mid-May. The weed population was allowed to start again before the glyphosate plots were treated on June 3. On June 5, the land was prepared and planted. Preemergence and layby treatments were applied on June 11 and July 17, respectively.

Plot size was a single row, 20 feet long, arranged in a randomized block design with six replicates. Herbicide mixtures were applied in 80 gallons of water per acre using 40 psi pressure. A compressed air sprayer equipped with a two nozzle brush type boom was used. Nozzles were Delavan raindrop type with No. 3374-3 tips. Weed control and crop injury ratings were made on three dates as listed in Table 1 using the "Cornell" rating system reported in percentage values. Weed counts were made in early August and are also listed in Table 1. Harvest was on October 7.

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RESULTS AND DISCUSSION

Weed populations of barnyard grass and lambsquarters were not substantial enough to evaluate the treatments on these weed species. However, the weed pressure from quackgrass and mustard was considerable and untreated plots were virtually overgrown, resulting in a very low yield of potatoes.

The dinoseb and dalapon standard treatment was the best for controlling the mustard, while none of the treatments proved very effective against quackgrass. It is doubtful that layby treatments were of any value in this test due to the size of the weeds at the time of application. Meanwhile, the glyphosate/metribuzin combination deserves further study, since it appears effective when compared to the single metribuzin treatment.

Table 1. Effect of metribuzin preemergence followed by alachlor at layby and glyphosate as preplant followed by metribuzin on yield, crop injury, and weed control in Katahdin potatoes. Maine-1980.

Treatments[a] Lbs. A.I. per Acre	Yield Cwt./A.	Percent Crop Injury and Weed Control[b]											
		Crop Injury			Quackgrass			Mustard			Lambsquarters		
		7-3	7-24	8-21	7-3	7-24	8-21	7-3	7-24	8-21	7-3	7-24	8-21
Check - no treatment	122	0	0	0	79	94	90	28	12	34	92	100	100
4.5 Dinoseb + 5.0 Dalapon, PE	205	0	0	0	86	90	81	100	100	99	100	100	100
0.5 Metribuzin, PE	194	0	0	0	71	93	86	93	76	69	100	100	100
0.5 Metribuzin, PE + 1.0 Alachlor, LB	215	0	0	0	80	94	91	84	84	88	100	100	100
0.5 Metribuzin, PE + 2.0 Alachlor, LB	197	0	0	0	78	89	86	82	48	55	100	100	100
0.5 Metribuzin, PE + 2.0 Alachlor IIG, LB	201	0	0	0	84	92	86	86	60	44	100	100	100
0.5 Metribuzin + 2.0 Alachlor IIG, PE	214	0	0	0	89	97	81	95	94	93	100	100	100
0.5 Metribuzin + 2.0 Alachlor IIG, PE + 1.0 Alachlor IIG, LB	239	1	0	0	88	93	86	96	98	93	100	100	100
0.5 Metribuzin + 2.0 Alachlor, PE + 1.0 Alachlor IIG, LB	225	0	0	0	86	93	86	94	91	87	100	100	100
1.5 Glyphosate, PPI + 0.5 Metribuzin, PE	233	0	0	0	94	95	86	94	89	81	100	100	100
2.0 Glyphosate, PPI + 0.5 Metribuzin, PE	234	0	0	0	88	93	85	94	89	87	100	100	100
Bayes L.S.D. (0.05)	50												

[a]Planted - June 5; killed - September 16; harvested - October 7, 1980.

Glyphosate as a preplant treatment applied - June 3, but land not prepared until June 5. Temperature - 51F., overcast; soil dry; east wind 5-7 mph.

Preemergence treatments applied - June 11. Temperature - 48F., overcast; soil moist; west wind 12-15 mph.

Layby treatments applied - July 17. Temperature - 72F., clear; soil moist; southwest wind 0-2 mph.

[b]Rating code: 100 percent = complete absence of weeds and all crop plants killed.

Number and species of weeds per square foot (average of 6 replicates):

Agropyron repens - 2.4
Echinochloa crusgalli - 0.3
Brassica sp. - 10.6
Chenopodium album - 0.2

A COMPARISON OF THREE FORMULATIONS OF METRIBUZIN ALONE AND IN COMBINATIONS OF PENDIMETHALIN FOR WEED CONTROL IN POTATOES

L. S. Morrow and H. J. Murphy[1]

ABSTRACT

Several formulations of metribuzin alone and in combination with pendimethalin were compared for broad spectrum weed control in white potatoes grown at Aroostook Farm, Presque Isle, Maine, in 1980. Included in this experiment were two treatments of DPX 6573. Weed pressure from grasses was almost non-existent, but the lambsquarters population was high enough to depress yields in the check plots. None of the treatments caused any apparent crop injury. The majority of the treatments controlled the broadleaf weeds well, while the lower rate of metribuzin showed a slight decrease in efficacy.

INTRODUCTION

Pendimethalin [*N*-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine] and metribuzin [4-amino-6-*tert*-butyl-3-(methylthio)-*as*-triazin-5(4*H*)-one] were evaluated in combination treatments for use as broad spectrum weed control applications in potatoes *(Solanum tuberosum* L. 'Kennebec'*)*. Three formulations of metribuzin, DF, 50W, and 4L, were compared in this test. Also included was the experimental herbicide DPX 6573, a package mix of metribuzin and linuron [3-(3, 4-dichlorophenyl)-1-methoxy-1-methylurea]. DPX 6573 was applied at two rates. All treatments were measured against our standard of dinoseb [2-*sec*-butyl-4, 6-dinitrophenol] plus dalapon [2,2-dichloropropionic acid]. Various broadleaf weeds were present at the experiment location with lambsquarters *(Chenopodium album* L.*)* being the major weed problem. Annual grasses were absent, but there was a small amount of the perennial quackgrass *(Agropyron repens* L.*)*.

MATERIALS AND METHODS

The test field was a Caribou gravelly silt loam with an organic matter content of 3.5 percent. Land preparation followed recommended practices. Planting was on May 30, with all treatments applied preemergence on June 6. Plot size was a single row, 20 feet long, arranged in a randomized block design with six replicates. Herbicide mixtures were applied in 80 gallons of water per acre under 40 psi of pressure. A compressed air sprayer equipped with a two nozzle brush type boom was used. Nozzles were Delavan raindrop type with No. 3374-3 tips. Weed control and crop injury ratings were made on the two dates listed in Table 1, using the "Cornell" rating system reported in percentage values. Weed counts were made in the check plots in early August and are listed in Table 1. Tubers were harvested October 10, and the yields recorded.

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RESULTS AND DISCUSSION

In a similar study in 1979, there was no weed pressure from lambsquarters or other broadleaves, so it was good that we could evaluate the metribuzin and pendimethalin combinations in the present year for broadleaf control. As noted earlier, it appears that the tuber yields were less in the check plots due to the high broadleaf weed populations, mainly that of lambsquarters. Metribuzin and pendimethalin gave good control over lambsquarters and other broadleaf weeds regardless of the metribuzin rate or formulation. It should also be noted that rainfall was minimal with the soil remaining very dry from the third week in May until the third week in June. Where metribuzin was applied alone, the lower rate of 0.25 lb./A. may be losing control over the lambsquarters.

In reference to DPX 6573, the experimental package mix shows slightly better efficacy at the earlier reading than either of its two components applied separately which are linuron and metribuzin.

In summary, while the three formulations of metribuzin do not demonstrate any differences in efficacy and the most convenient should be used, perhaps the rate of metribuzin required for use with pendimethalin should be studied in more detail.

Table 1. Effect of DPX 6573 (linuron plus metribuzin) and combinations of metribuzin formulations with pendimethalin on yield, crop injury, and weed control in Kennebec potatoes. Maine - 1980.

Treatments[a] Lbs. A.I. per Acre	Yield Cwt./A.	Percent Crop Injury and Weed Control[b]							
		Crop Injury		Quackgrass		Lambs-quarters		Other	
		7-1	8-22	7-1	8-22	7-1	8-22	7-1	8-22
Check - no treatment	325	0	0	100	100	39	90	83	98
4.5 Dinoseb + 3.0 Dalapon, PE	393	0	0	100	100	100	100	99	100
1.25 DPX 6573, PE	362	0	0	100	100	100	99	99	100
2.0 DPX 6573, PE	363	1	0	100	100	100	99	100	100
0.83 Linuron 50W, PE	357	0	0	100	100	92	100	96	99
0.42 Metribuzin 50W, PE	355	0	0	100	100	98	100	100	100
0.5 Metribuzin 50W + 1.5 Pendimethalin, PE	372	0	0	100	100	98	100	98	100
0.5 Metribuzin 4L + 1.5 Pendimethalin, PE	392	0	0	100	100	98	100	99	100
0.5 Metribuzin DF + 1.5 Pendimethalin, PE	377	0	0	98	100	100	100	98	100
0.5 Metribuzin 50W, PE	371	0	0	100	100	100	100	100	100
0.5 Metribuzin 4L, PE	370	0	0	98	100	100	99	99	100
0.5 Metribuzin DF, PE	365	0	0	99	100	99	100	98	100
1.5 Pendimethalin, PE	389	0	0	98	99	95	100	97	100
0.25 Metribuzin 50W, PE	401	0	0	99	100	94	98	99	100
0.25 Metribuzin 4L, PE	378	0	0	100	100	91	99	99	100
0.25 Metribuzin DF, PE	376	0	0	100	100	88	97	99	100
0.25 Metribuzin 50W + 1.5 Pendimethalin, PE	354	0	0	99	100	99	100	98	100
0.25 Metribuzin 4L + 1.5 Pendimethalin, PE	372	0	0	99	100	95	100	98	100
0.25 Metribuzin DF + 1.5 Pendimethalin, PE	384	0	0	100	100	100	100	98	99
Bayes L.S.D. (0.05)	43								

[a]Planted - May 30; killed - September 10; harvested - October 10, 1980.

Preemergence treatments applied - June 6. Temperature - 60F., clear sky; soil moist; north wind 2-4 mph.

[b]Rating code: 100 percent = complete absence of weeds and all crop plants killed.

Number and species of weeds per square foot (average of 6 replicates):

Agropyron repens - 0.1
Chenopodium album - 4.1

INCORPORATED EPTC, METRIBUZIN, NAPROPAMIDE AND UBI-S734 IN POTATOES

D. Vitolo, R. D. Ilnicki, and S. Crane[1/]

ABSTRACT

EPTC, napropamide, UBI-S734, and metribuzin, alone and in combination, were evaluated for their effects on weed control and yields in white potatoes. None of the herbicides applied caused injury to the crop. Excellent weed control was obtained by preplant incorporated applications of EPTC at 4 lb/A, EPTC + napropamide at 3.0 + 1.0 lb/A, metribuzin at 0.5 and 1.0 lb/A, and UBI-S734 + metribuzin at all rates (Table 1). Weed control was improved when preplant incorporated UBI-S734 was followed by preemergence metribuzin. Poor weed control was obtained by use of UBI-S734 and napropamide alone. Significant yield increases were recorded for EPTC at 4.0 lb/A, EPTC + napropamide at 3.0 + 1.0 lb/A, metribuzin at 1.0 lb/A, UBI-S734 + metribuzin at 0.75 + 0.5 and 1.00 + 0.50 lb/A, and preplant incorporated UBI-S734 + preemergence metribuzin at 0.75 + 0.50, 1.0 + 0.50 and 1.50 + 0.50 lb/A.

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Table 1. Weed control ratings and potato yields for preplant incorporated and preemergence herbicide treatments in potatoes, Adelphia, N.J. 1980.

Herbicide	Rate, lb.a.i./A	Weed Control Ratings[a] Lambs-quarters	Pigweed	Barnyard-grass	Fall Panicum	%[b] Control	Yields[c] CWT/A #1	Duncan's[c] Grouping
EPTC	3.0	6.3	6.2	8.8	9.0	72.7	139.7	AB
7EC	4.0	8.7	8.3	9.2	10.0	88.0	154.7	AB
EPTC +	2.0	6.7	7.7	7.5	10.0	72.7	121.3	ABC
R-33865 (6:1)	3.0	4.8	6.0	6.5	8.0	78.3	115.9	ABC
6 lb./gal	4.0	8.7	8.8	9.0	9.5	90.0	177.3	A
napropamide	0.5	8.1	3.8	4.0	5.5	40.0	122.6	ABC
50WP	1.0	7.5	4.5	4.7	7.5	58.3	122.0	ABC
EPTC (7E) +	2.0 + 1.0	9.2	7.3	7.5	7.8	83.3	160.1	AB
napropamide	3.0 + 1.0	9.3	7.5	8.8	8.4	91.0	171.3	A
	4.0 + 1.0	8.8	7.0	8.8	2.8	86.7	146.1	AB
UBI-S734	0.75	2.0	0.3	9.1	9.5	38.3	100.6	ABC
75WP	1.00	1.7	6.8	8.8	10.0	61.7	120.6	ABC
	1.50	4.0	3.7	7.0	9.5	53.0	99.0	BC
metribuzin	0.5	9.5	8.6	8.7	9.3	88.0	158.8	AB
50WP	1.0	9.0	9.5	8.6	9.1	89.0	183.4	A
UBI-S734 +	0.75 + 0.5	9.2	6.2	8.7	9.0	90.0	176.4	A
metribuzin	1.00 + 0.5	9.6	9.2	9.2	9.0	91.0	177.3	A
	1.50 + 0.5	9.3	7.6	9.2	10.0	78.7	150.3	AB
	1.0 + 1.0	9.3	9.0	8.8	9.0	90.0	157.6	AB
UBI-S734 (ppi)	(0.75) + 0.5							
metribuzin (pre)	(1.00) + 0.5	9.6	9.7	9.7	10.0	96.0	170.0	A
	(1.50) + 0.5	9.9	9.9	9.8	9.9	99.0	181.8	A
		3.3	9.2	9.8	4.8	98.0	169.7	A
	(1.0) + 1.0	10.0	9.9	9.9	10.0	99.0	161.4	AB
Check		0.0	0.0	0.0	0.0	0.0	61.4	C

a. Weed Control Ratings (0.0 = No Control, 10.0 = Complete Control) Made June 6, 1980.
b. Average of Plot Area Weed Free.
c. Yields With Same Letters Are Not Significantly Different.

LONG ISLAND POTATO WEED CONTROL RESULTS, 1980[1/]

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ABSTRACT

Four experiments were conducted to evaluate the effectiveness of 41 herbicide treatments on annual weed control and one experiment was established to determine the effect of 15 treatments on yellow nutsedge (Cyperus esculentus L.). Good control of annual grasses, primarily barnyardgrass (Echinochloa crus-galli (L.) Beauv), was achieved by preemergence applications of DPX6573; metolachlor, alone or in combination with dinoseb or metribuzin; metribuzin in combination with alachlor, pendamethalin or Uniroyal S734; and post-emergence applications of difenopenten and BASF 9052. None of the herbicide treatments in the nutsedge experiment produced results which were significantly different from the control.

INTRODUCTION

A major production problem in growing potatoes (Solanum tuberosum L.) on Long Island is the control of yellow nutsedge and annual grasses, mostly barnyardgrass, crabgrass (Digitaria sanguinalis (L.) Scop.) and fall panicum (Panicum dichotomiflorum, Michx). Attempts to deal with the problem have included applications of pre-emergence and post-emergence herbicides alone and in combinations. Commercial treatments in the 1980 growing season on the varieties 'Katahdin' and 'Superior' were not effective in controlling barnyardgrass resulting in yield reduction and decreased harvest efficiency.

MATERIALS AND METHODS

Herbicide treatments were applied to the potato cultivar 'Katahdin' with a tractor mounted boom sprayer applying 374 ℓ/ha at 2 kg/cm^2. Plot size was 2 rows by 7.6 meters. Soil incorporated treatments were made with a finger weeder, cultivator or hillers, depending on time of treatment. Pertinent data for each of the experiments are as follows:

Experiment	Planting Date	Dates of Application			Harvest Date
		Pre	Post	Layby	
I	5/14	5/14	5/23	7/7	9/23-24
II	5/14	5/23	6/5, 6/26	-	9/24
III	4/25	5/14	6/11	7/2	9/25
IV	5/7	5/12	6/13	6/27	9/25
Nutsedge	4/14	5/28	-	7/11	-

Sprinkler irrigation was used to help supplement rainfall but because of the unusually hot, dry conditions in July and August and the limited amount of irrigation equipment adequate soil moisture was not maintained in the plots throughout the growing season.

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Ratings on weed control and phytotoxicity were made on a one to nine scale. Weed control ratings of one are equivalent to complete ground cover with weeds, seven is considered commercial control and nine is the complete absence of weeds. One on the phytotoxicity scale is equivalent to all crop plants killed, seven refers to moderately long lasting symptoms but no yield or quality reduction, and a rating of nine indicates no crop damage.

RESULTS AND DISCUSSION

None of the treatments in any of the experiments had phytotoxic effects. Yields were not significantly affected by herbicide treatment but generally yields were lowest in the weedy treatments. Weed control and phytotoxicity ratings, and yield data for Experiments I, II, III and the Nutsedge Control Experiment are included in Tables 1, 2, 3, and 4, respectively. The annual grass pressure in Experiment IV, where metribuzin at 0.2 kg/ha was used as an overspray, was low. Therefore the effectiveness of post-emergence or layby treatments of EPTC (S-ethyl dipropylthiocarbamate), napropamide (2-(α-naphthoxy)-N,N-diethylpropionamide), and trifluralin (α,α,α-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine) could not be determined (data not shown).

Delayed preemergence treatments containing metolachlor (2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide) gave season long commercial control of barnyardgrass. However, the layby application of metolachlor at 1.7 kg/ha preceeded by a preemergence application of metribuzin at 0.6 kg/ha did not result in acceptable control. In fact all the layby treatments used in Experiment I were not effective. Weather conditions were hot and dry after the layby treatments were made and undoubtedly had an effect on herbicide activity. Post emergence treatments of difenopenten and BASF 9052 in Experiments II and III killed barnyardgrass seedlings up to six inches in height. BASF 9052 provided longer lasting control at 0.6 and 0.8 kg/ha when treatment was delayed until the grass seedlings were about six inches tall. Smartweed (*Polygonum pensylvanicum*) was more prevalent in the BASF 9052 plots than in the controls. Presumably this is because of the decreased grass pressure and the lack of activity against broadleaves by this compound. Pendimethalin (N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine) at 2.2 kg/ha alone and in combination with dinoseb and metribuzin provided relatively good control. Similar control was achieved with cyanazine (2-((4-chloro-6-(ethylamino)-s-triazin-2-yl)amino)-2-methylpropionitrile) combinations with alachlor (2-chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide) and with the high rate (2.2 kg/ha) of linuron (3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea). The Uniroyal compound S734 in combination with metribuzin provided comparable control to the combinations of metribuzin and alachlor. Diclofop (2-(4-(2,4-dichlorophenoxy)phenoxy)propanoic acid) treatments reduced the grass problem but did not provide commercial control.

Table 1. Long Island Potato Herbicide Experiment I, 1980

Treatment				Ratings						
				Overall	Broadleaves		Grasses		Phyto.	Total
	Material	Rate (kg/ha)	Timing	6/27	8/1	9/9	8/1	9/9	6/27	Yield (cwt/A)
1	pendimethalin	2.2	D Pre	7.5	9.0	8.5	7.3	6.5	8.8	250
2	pendimethalin + dinoseb	2.2 3.4	D Pre	7.3	9.0	9.0	7.5	6.0	8.8	216
3	pendimethalin + metribuzin	2.2 0.6	D Pre	8.8	9.0	9.0	8.0	7.3	8.8	233
4	metolachlor	2.2	D Pre	8.0	8.8	8.5	8.3	7.5	8.8	234
5	metolachlor + dinoseb	1.7 3.4	D Pre	7.8	9.0	9.0	8.5	7.0	9.0	227
6	metolachlor + dinoseb	2.2 3.4	D Pre	9.0	9.0	8.5	9.0	7.5	8.8	211
7	metolachlor + metribuzin	2.2 0.6	D Pre	9.0	9.0	8.8	9.0	7.3	8.8	213
8	diclofop	1.1	D Pre	5.8	8.8	8.8	6.3	5.0	9.0	183
9	diclofop + dinoseb	1.1 3.4	D Pre	6.3	9.0	9.0	6.8	5.8	9.0	249
10	diclofop + metribuzin	1.1 0.6	D Pre	7.5	9.0	9.0	7.5	6.8	9.0	232
11	metribuzin	0.6	D Pre	5.0	8.8	8.0	4.8	4.5	8.8	175
12	A. metribuzin B. diclofop	0.6 1.1	D Pre Layby	5.5	9.0	9.0	6.3	5.5	8.3	209
13	A. dinoseb B. metribuzin + diclofop	3.4 0.3 1.1	D Pre Layby	4.3	8.5	8.3	6.0	5.3	9.0	168
14	A. metribuzin B. metolachlor	0.6 1.7	D Pre Layby	5.3	8.8	9.0	5.5	4.8	8.5	157
15	A. metribuzin B. alachlor	0.6 2.2	D Pre Layby	6.5	9.0	8.5	5.8	5.0	8.8	214
16	A. metribuzin B. alachlor(gran)	0.6 2.2	D Pre Layby	5.0	8.8	8.3	5.3	4.3	8.8	172
17	Control			3.5	8.8	8.3	4.0	3.3	9.0	169
	$D_{(.05)}$ Waller-Duncan			(1.1)	(ns)	(ns)	(1.4)	(1.2)	(ns)	(ns)

Table 2. Long Island Potato Herbicide Experiment II, 1980

Treatment			Ratings						Total Yield (cwt/A)
			Overall	Broadleaves		Grasses		Phyto	
Material[a/]	Rate (kg/ha)	Timing	6/27	8/1	9/8	8/1	9/8	6/27	
cyanazine + alachlor	0.9 2.2	D Pre	8.3	8.8	8.0	8.0	6.3	9.0	209
cyanazine + alachlor	1.8 4.5	D Pre	9.0	9.0	8.5	8.5	6.5	9.0	217
cyanazine + linuron	0.9 1.1	D Pre	7.0	9.0	9.0	7.3	5.3	8.5	175
cyanazine + linuron	1.8 2.2	D Pre	8.5	8.8	9.0	8.5	6.3	9.0	174
linuron	1.1	D Pre	6.0	9.0	8.5	8.0	6.3	9.0	166
DPX 6573	1.7	D Pre	8.3	9.0	8.8	7.3	6.3	9.0	221
DPX 6573	3.4	D Pre	9.0	9.0	8.5	8.8	7.0	9.0	207
metribuzin + alachlor	0.6 2.2	D Pre	9.0	9.0	8.5	8.3	6.8	9.0	203
BASF 9052	0.6	Grass 1-4"	6.3	8.0	5.5	8.5	6.5	9.0	172
BASF 9052	0.6	Grass 6"	3.8	6.3	4.5	9.0	7.5	9.0	175
BASF 9052	0.8	Grass 1-4"	6.8	7.3	5.8	8.3	6.3	9.0	184
BASF 9052	0.8	Grass 6"	4.0	8.5	6.5	9.0	7.0	8.8	187
Control			3.0	8.0	6.3	5.0	3.3	9.0	135
Weeded Control			7.0	8.3	6.8	8.0	5.0	9.0	200
$D_{(.05)}$ Waller-Duncan			(1.2)	(1.2)	(1.1)	(1.0)	(1.1)	(ns)	(ns)

a/ Booster plus E was added to the BASF 9052 treatments at a rate of 2.3 l/ha.

Table 3. Long Island Potato Herbicide Experiment III, 1980

Treatment[a/]			Ratings						
			Overall	Broadleaves		Grasses		Phyto.	Total Yield
Material	Rate (kg/ha)	Timing	6/27	8/2	9/5	8/2	9/5	6/27	(cwt/A)
1 metribuzin + alachlor	0.6 2.2	D Pre	9.0	9.0	9.0	8.0	6.3	9.0	242
2 metribuzin + S734	0.6 0.8	D Pre	8.0	9.0	9.0	7.3	6.3	8.7	226
3 metribuzin + S734	0.6 1.1	D Pre	8.3	9.0	9.0	7.3	6.3	9.0	224
4 metribuzin + S734	0.6 1.9	D Pre	9.0	9.0	8.7	8.3	7.0	8.7	224
5 A-dinoseb B-difenopenten	3.4 0.6	D Pre Post	6.3	6.7	6.7	8.3	7.0	9.0	229
6 A-dinoseb B-difenopenten	3.4 1.1	D Pre Layby	3.3	9.0	9.0	8.0	6.7	9.0	218
7 A-dinoseb B-difenopenten C-difenopenten	3.4 0.6 0.6	D Pre Post Layby	8.7	9.0	9.0	8.7	8.0	8.7	235
8 Control			4.3	9.0	9.0	4.0	3.7	9.0	182
$D_{(.05)}$ Waller-Duncan			(1.2)	(1.4)	(1.4)	(2.4)	(1.6)	(ns)	(ns)

a/ Ortho experimental surfactant added to difenopenten treatments at 0.25%.

Table 4. Results of Nutsedge Control Experiment in Potatoes, 1980

	Treatment			Ratings						
	Material	Rate (kg/ha)	Timing	Nutsedge 7/1	Nutsedge 8/17	Nutsedge 9/19	Annuals 7/1	Broadleaves 8/17	Broadleaves 9/19	Grasses 8/17
1	Control			4.5	5.5	5.8	4.3	2.8	3.8	6.0
2	EPTC	4.5	D Pre Inc	4.8	5.8	6.3	5.3	3.3	4.5	8.3
3	metolachlor	2.2	D Pre	5.5	6.3	6.8	6.3	4.8	5.8	8.5
4	metolachlor + metribuzin	2.2 0.6	D Pre	4.3	6.0	5.3	9.0	8.3	7.5	9.0
5	metribuzin + alachlor	0.6 2.2	D Pre	4.8	5.0	5.8	9.0	8.8	8.3	8.3
6	metribuzin + alachlor (gran)	0.6 2.2	D Pre	4.5	6.3	6.8	9.0	9.0	7.8	7.8
7	metribuzin	0.6	D Pre	4.3	5.3	5.0	9.0	8.5	7.8	8.3
8	metribuzin + EPTC	0.6 4.5	D Pre Inc	5.3	6.5	6.0	9.0	8.8	8.8	8.3
9	A-metribuzin B-metolachlor	0.6 2.2	D Pre Layby	4.3	5.0	5.3	9.0	9.0	7.5	8.0
10	A-metribuzin B-alachlor	0.6 2.2	D Pre Layby	4.5	5.8	5.8	9.0	8.5	8.3	7.8
11	A-metribuzin B-alachlor (gran)	0.6 2.2	D Pre Layby	4.3	6.5	6.3	9.0	8.8	8.3	8.3
12	metribuzin + Ortho 28269	0.6 0.8	D Pre	4.3	5.3	5.0	8.8	9.0	8.3	8.8
13	metribuzin + Ortho 28269	0.6 1.7	D Pre	6.5	6.0	6.5	9.0	9.0	8.0	8.3
14	metribuzin + Ortho 28269	0.6 0.8	D Pre Inc	6.8	6.3	7.0	8.3	8.0	7.8	7.3
15	metribuzin + Ortho 28269	0.6 1.7	D Pre Inc	5.5	6.5	6.8	8.8	8.8	7.3	8.8
	$D_{(.05)}$ Waller-Duncan			(ns)	(ns)	(ns)	(1.7)	(1.8)	(1.3)	(2.3)

LONGEVITY OF CONTROL WITH METOLACHLOR AND ALACHLOR

C. Buchholz, E. R. Higgins, M. G. Schnappinger, and S. W. Pruss[1]

ABSTRACT

Field experiments in Pennsylvania, New York, and Maryland were conducted to compare the length of control with metolachlor and alachlor. At use rates on sandy loam soils, metolachlor provided 8 weeks of commercial control compared to 2 to 4 weeks for alachlor. On a silt loam soil, metolachlor provided 8 to 10 weeks of commercial control compared to less than 4 weeks for alachlor.

INTRODUCTION

Late season control is an important phase of a successful weed control program since it will result in reduced weed seed production and improved harvest conditions. Also, in crops that are not very competitive with weeds or do not form a complete canopy, longer control is important for improving yields and reducing weed removal costs.

Differences in the length of control with metolachlor [2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)acetamide] and alachlor [2-chloro-2',6'-diethyl-*N*-(methoxymethyl)acetanilide] have been observed both in experimental plots and in commercial fields. Dixon, Stoller, and McGlamery (1) reported that metolachlor provided longer grass control than alachlor and several other acetanilide herbicides. They also emphasized the importance of late season control of yellow nutsedge (Cyperus esculentus) to prevent the production of tubers.

A preliminary experiment conducted in 1979 in Pennsylvania was so distinct and striking that six more experiments were conducted in 1980. However, data presented in this paper will be limited to the three experiments conducted in the Northeastern states.

MATERIALS AND METHODS

Japanese millet [Echinochloa crus-galli(L.) var. frumentacea (Roxb.)] was selected as the bioassay species primarily because of its botanical similarities to barnyardgrass [Echinochloa crus-galli(L.) Beauv.] (R. D. Sweet, personal communication). In addition, Japanese millet has good germination qualities, is readily available, and is commonly used by weed scientists as an indicator crop.

Treatments were applied with a CO_2 sprayer. A single row of Japanese millet was then planted across each plot periodically during the season. The

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experimental design was a randomized complete block in all experiments with four replications used in Pennsylvania and three in New York and Maryland. Paraquat (1,1'-dimethyl-4,4'-bipyridinium ion) was applied to the unplanted areas of the 1980 experiments to eliminate existing vegetation. Visual ratings of control were made 30 to 60 days after each planting using a scale of 0 to 10 where 0=no effect, 7=satisfactory or commercially acceptable control, and 10=complete kill. All untreated check plots were rated 0, thus, are not listed in the data tables. Procedures unique to each test are presented below.

Pennsylvania, 1979

The preliminary experiment was initiated on June 22 near Lancaster, Pennsylvania, on a Hagerstown silt loam soil with 2.6% organic matter. Plot dimensions were 1.8 by 7.9 m. All treatments were applied preemergence. Japanese millet was planted with a Planet Jr. planter equipped with a double disk opener at 0, 7, 8, 9, 10, and 11 weeks after treating. Equal rates of each herbicide were located adjacent to each other which were then randomized in blocks.

Pennsylvania, 1980

The second Pennsylvania experiment, initiated on May 29, was at the same location as the 1979 experiment discussed above. Plot size was 2.7 by 4.6 m. Treatments and planting procedures were the same as those in 1979 except that the Japanese millet was seeded at 0 weeks followed by a weekly planting schedule at 4 through 14 weeks after treating. In addition to visual ratings, weights of top growth were also taken.

New York, 1980

This experiment was conducted near Waterloo, New York, on an Arkport fine sandy loam with 1.7% organic matter. The plot size was 3.7 by 6.1 m. Both preplant incorporated and preemergence treatments of metolachlor and alachlor were applied on May 29. Incorporation was done with a tandem disk to a depth of approximately 7.5 cm. No further tillage operations were performed after applying the preemergence herbicides.

Maryland, 1980

The fourth experiment was conducted near Lakeshore, Maryland, on a Norfolk sandy loam with 1.5% organic matter. Herbicides were applied preemergence on April 22 to 3.7 by 6.1 m plots. Preceding each planting, a hand cultivator was used to break up the soil crust but soil was not disturbed below a depth of 2.5 cm. Fresh weights, as well as visual ratings, of the Japanese millet were recorded from this experiment.

RESULTS AND DISCUSSION

Weed control data at the lowest rate tested and twice that rate are illustrated in Figures 1 through 4. Other rates are included in Tables 1 and 2 and in Figure 5. In all experiments, metolachlor and alachlor applied

preplant incorporated or preemergence gave complete control of Japanese millet seeded immediately after treating. There were substantial differences in the longevity of control between metolachlor and alachlor at subsequent seedings; however, variation in control levels obtained at different rates of the same herbicide were surprisingly small with the exception of the New York experiment which is further discussed below. After several plantings, Japanese millet emerged while metolachlor and alachlor were still biologically active. However, these plants were severely twisted, stunted, and, in most cases, they eventually died. This delayed herbicidal action was most apparent when the Japanese millet was planted in soil with sufficient moisture for germination followed by limited rainfall after emergence.

Figure 1 shows the longevity of control for 1.7 and 3.4 kg/ha obtained in the experiment conducted in Pennsylvania for 1979. Metolachlor at 1.7 kg/ha provided 8 weeks of commercial control while the 3.4 kg/ha rate was still providing commercial control when the experiment was terminated at 11 weeks. Even at the highest rate tested (4.5 kg/ha), alachlor did not provide commercial control at the second planting (7 weeks after application). Results from this experiment suggest that if more specific differences in longevity of control are to be obtained, plantings would have to be made sooner after the herbicide application and beyond 11 weeks.

Results from the 1980 Pennsylvania experiment for the 1.7 and 3.4 kg/ha rates of metolachlor and alachlor are shown in Figure 2. Soil moisture was adequate for germination at each planting. The longevity of commercial control of Japanese millet with either rate of metolachlor was approximately ten weeks. After the tenth week, control decreased rapidly. Commercial levels of control with 1.7 and 3.4 kg/ha of alachlor lasted less than four weeks. Only 4.5 kg/ha (not shown) provided commercial control at 4 weeks, but by the fifth week, this treatment was unacceptable.

Fresh weights taken from the 1980 Pennsylvania experiment on October 9 (Table 1) confirm the visual ratings. The relatively lower weights obtained at the early planting dates were caused by competition from a heavy common ragweed (*Ambrosia artemisifolia*) infestation. Ragweed pressure was reduced in later plantings by applying paraquat before seeding the Japanese millet.

Results from New York are presented in Figure 3. A rate response to metolachlor was more apparent in this experiment than in the Pennsylvania or Maryland experiments. Metolachlor at 1.7 kg/ha applied preplant incorporated and preemergence, provided acceptable control for 8 and 9 weeks, respectively. At 3.4 kg/ha metolachlor effectively controlled Japanese millet for the duration of the experiment (12 weeks) regardless of application method while alachlor gave acceptable levels of Japanese millet control for 4 weeks at both rates and methods of application. In all instances, a preemergence application of either acetanilide was slightly more active than the corresponding incorporated treatments.

Results from label rates of metolachlor (1.4 kg/ha) and alachlor (1.7 kg/ha) and twice the label rates from Maryland are presented in Figure 4. Metolachlor at 1.4 kg/ha provided commercial control for eight weeks. A decrease in control at six weeks after application was attributed to dry

weather conditions encountered after seeding. Again, it can be seen that control with alachlor decreased rapidly. Alachlor at 3.4 kg/ha (highest rate tested) provided commercial control for only two weeks after treatment. Fresh weights (Table 2) from this experiment confirm the visual ratings.

Figure 5 summarizes the longevity of commercial control for all rates tested in Pennsylvania, New York, and Maryland. The length of control was greatest in Pennsylvania and New York where finer soil textures were present at the test sites. When comparing the length of control of all rates tested (1.4 to 4.5 kg/ha), it can be seen that metolachlor provided 8 to 12 weeks of commercial control while alachlor provided 2 to 4 weeks. Similar results have been reported in Indiana, Michigan, and Ohio by Ross, Porpiglia, and Pruss (2).

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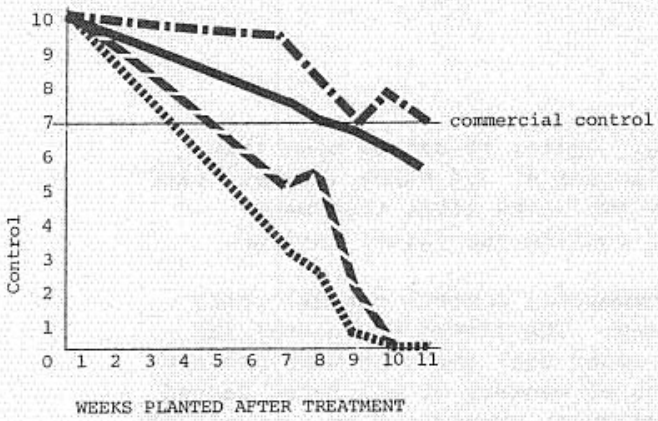

Figure 1. Longevity of control of Japanese millet in the 1979 Pennsylvania experiment with metolachlor at 1.7 kg/ha (▬▬▬) and 3.4 kg/ha (▬▪▬▪▬) and alachlor at 1.7 kg/ha (▪▪▪▪▪▪▪▪▪▪) and 3.4 kg/ha (▰▰▰▲).

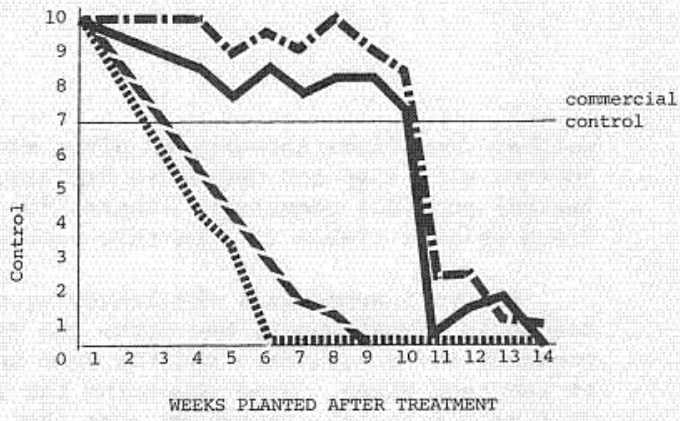

Figure 2. Longevity of control of Japanese millet in the 1980 Pennsylvania experiment with metolachlor at 1.7 kg/ha (▬▬▬) and 3.4 kg/ha (▪▬▪▬▪) and alachlor at 1.7 kg/ha (▪▪▪▪▪▪▪▪▪▪) and 3.4 kg/ha (▰▰▰▲).

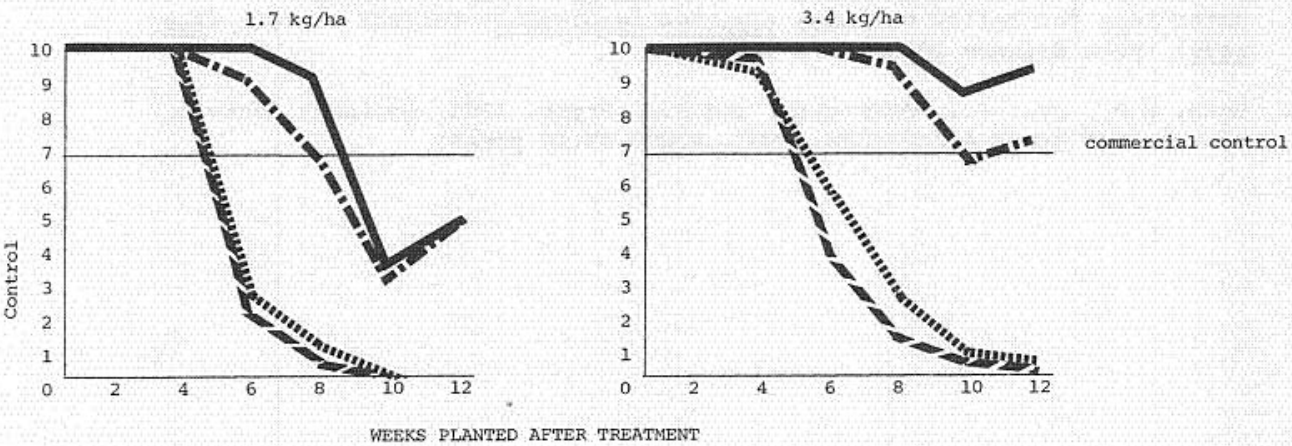

Figure 3. Longevity of control of Japanese millet in New York with metolachlor applied preemergence (▬▬▬) and preplant incorporated (▪▬▪▬▪) and alachlor applied preemergence (▪▪▪▪▪▪▪▪▪▪) and preplant incorporated (▰▰▰▲).

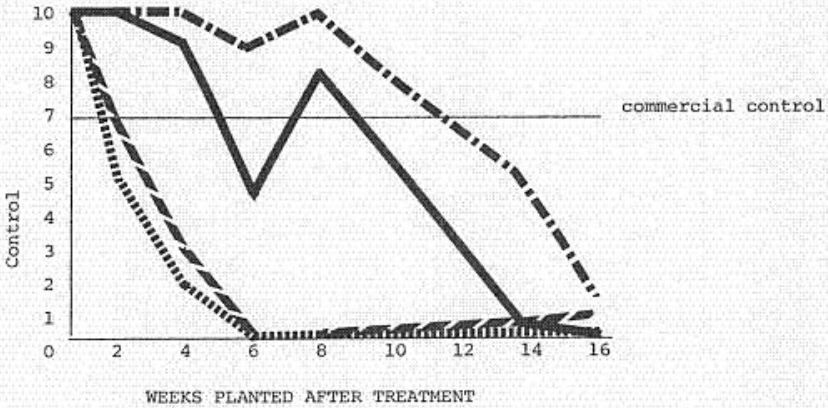

Figure 4. Longevity of control of Japanese millet in Maryland with metolachlor at 1.4 kg/ha (▬▬▬) and 2.8 kg/ha (▪▬▪▬▪) and alachlor at 1.7 kg/ha (▪▪▪▪▪▪▪▪▪▪) and 3.4 kg/ha (▰▰▰).

Table 1 Mean fresh weights (g/64.8 cm of row) of Japanese millet in Pennsylvania (1980).

HERBICIDE	kg/ha	WEEKS PLANTED AFTER TREATMENT 0	4	5	6	7	8	9	10	11	12	13	14
metolachlor	4.5	0	0	0	0	0	1	1	3	8	2	1	2
alachlor	4.5	0	5	26	17	19	30	30	41	21	7	7	4
metolachlor	3.4	0	0	0	0	0	3	7	16	26	11	6	3
alachlor	3.4	0	10	15	27	21	37	56	50	25	10	10	3
metolachlor	2.8	0	0	0	0	0	0	0	1	4	1	1	2
alachlor	2.8	0	16	25	40	34	48	49	58	35	10	9	3
metolachlor	2.2	0	0	3	1	1	47	32	65	36	18	12	4
alachlor	2.2	0	13	13	22	58	32	70	62	33	10	13	2
metolachlor	1.7	0	0	2	1	2	4	8	20	14	10	5	5
alachlor	1.7	0	11	27	55	42	25	44	52	33	13	8	2

Table 2 Mean fresh weights (g/30.5 cm of row) Japanese millet in Maryland.

HERBICIDE	kg/ha	WEEKS PLANTED AFTER TREATMENT 0	2	4	6	14	16
alachlor	3.4	0	32	217	419	76	22
metolachlor	2.8	0	0	0	54	39	14
metolachlor	2.2	0	0	0	25	20	30
alachlor	2.2	0	85	203	293	62	40
metolachlor	1.7	0	0	0	155	19	47
alachlor	1.7	0	61	288	384	95	40
metolachlor	1.4	0	0	39	148	76	62
alachlor	1.4	0	64	285	392	112	65
Control		55	73	145	318	86	32

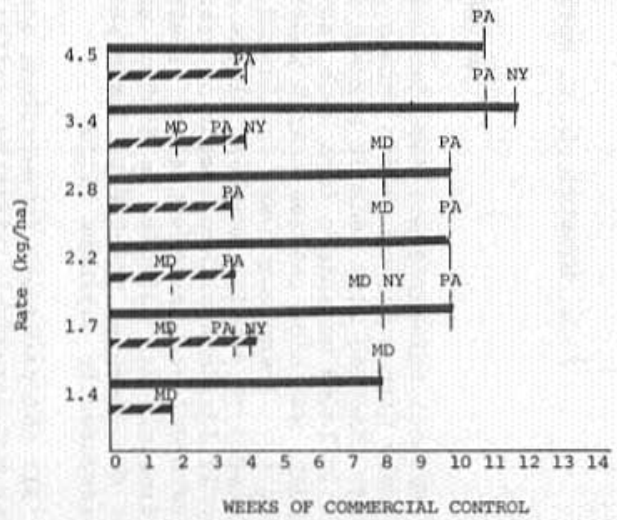

Figure 5. Longevity of commercial control of Japanese millet control at all locations with preemergence treatments of metolachlor (▬▬) and alachlor (▰▰). The longevity at each location is indicated by a vertical bar.

EVIDENCE FOR EFFECTIVE EXTENSION OF [1/] THIOCARBAMATE ACTIVITY IN THE FIELD

P. L. Minotti, D. T. Warholic, and R. D. Sweet [2/]

ABSTRACT

Several thiocarbamate formulations at 3.0 lbs/A ai were incorporated shallowly with a finger weeder into a gravelly loam soil (PH 5.6, OM 2.6%) heavily infested with redroot pigweed and seeded to Japanese millet. Treatments included extenders from both Stauffer and PPG , dinoseb as an extender, and slow release starch xanthate granular formulations from Agway (Table 1). Treatments were replicated four times and the experiment was duplicated on similar adjacent blocks of land one of which received three heavy irrigations within a week of treatment. Initial weed control data was recorded and one month after treatment one-half the area in each plot was treated with paraquat to destroy and existing vegetation. Three days later the paraquat treated portions were reworked with the finger weeder and reseeded to Japanese millet.

All thiocarbamate formulations gave complete initial control of millet and reasonably effective initial control of pigweed (Table 1). The initial broadleaf control was slightly weakened in the excessively irrigated plots. Differences in performance due to formulation were not evident at this point. The pigweed took over by six weeks and no formulation tested proved superior in holding them in check. On the other hand, in those plots reworked and reseeded to millet one month after treatment, Stauffer's EPTC+R25788 with extender stood out. It was the only treatment which provided acceptable control of the reseeded millet while all other thiocarbamate formulations tested appeared little better than untreated control plots. This was the case in both unirrigated and excessively irrigated blocks.

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Table 1. Performance of several formulations of thiocarbamates incorporated in Howard gravelly loam.

	Herbicide	Source	Form	Rate lb/A a.i.	Initial Weed Control a/ Rrpw 7/14	Rrpw 7/31	J. millet 7/14	J. millet 7/31	Weed Control for Reseeded Plots J. millet 8/4	J. millet 8/15
	Non-irrigated									
1.	untreated	--	--	--	3.0	1.0	3.5	1.5	3.0	1.0
2.	EPTC+	Stauffer	6.7E	3.0	7.8	4.0	9.0	9.0	3.0	1.0
3.	EPTC+ with extender	Stauffer	6.1E	3.0	7.8	4.8	9.0	9.0	8.0	7.3
4.	EPTC+ with dinoseb	Stauffer, Dow	6.7E, 3WS	3.0, 1.0	8.0	4.8	9.0	9.0	4.0	1.0
5.	dinoseb	Dow	3WS	1.0	3.0	1.0	4.0	1.5	3.0	1.0
6.	EPTC	PPG	7E	3.0	8.0	5.8	8.8	9.0	3.0	1.0
7.	EPTC with extender	PPG	6E	3.0	7.8	5.0	9.0	9.0	3.0	1.5
8.	EPTC with dinoseb	PPG, Dow	7E, 3WS	3.0, 1.0	8.3	5.3	9.0	9.0	4.0	1.0
9.	EPTC-SX (technical)	Agway	5%G	3.0	7.0	3.3	9.0	9.0	3.0	1.0
10.	EPTC+ SX (formulated)	Agway	5%G	3.0	6.8	3.3	9.0	9.0	3.0	1.0
	Irrigated excessively									
1-I	untreated	--	--	--	3.3	1.0	4.5	1.0	3.0	1.0
2-I	EPTC+	Stauffer	6.7E	3.0	6.3	3.3	9.0	9.0	3.8	2.0
3-I	EPTC+ with extender	Stauffer	6.1E	3.0	6.3	2.5	9.0	9.0	8.0	7.0
4-I	EPTC+ with dinoseb	Stauffer, Dow	6.7E, 3WS	3.0, 1.0	6.0	2.5	9.0	9.0	3.0	1.0
5-I	dinoseb	Dow	3WS	1.0	3.5	2.3	5.0	1.0	3.0	1.0
6-I	EPTC	PPG	7E	3.0	6.8	3.0	9.0	9.0	3.0	1.0
7-I	EPTC with extender	PPG	6E	3.0	6.0	2.3	9.0	9.0	2.5	2.8
8-I	EPTC with dinoseb	PPG, Dow	7E, 3WS	3.0, 1.0	6.8	4.5	9.0	9.0	1.8	1.8
9-I	EPTC-SX (technical)	Agway	5%G	3.0	6.8	4.0	9.0	9.0	3.0	1.0
10-I	EPTC+-SX (formulated)	Agway	5%G	3.0	6.0	2.8	8.3	9.0	3.0	1.0

a/ mean of 4 replications 1 = no control, 9 = perfect control, 7 = commercially acceptable

SQUASH SPACING FOR WEED CONTROL [1/]

R. C. Pedersen, R. D. Sweet, and P. L. Minotti [2/]

ABSTRACT

Weed control in squash for processing (Cucurbita maxima Duchesne 'NK 530, Golden Delicious') is generally inadequate and maximum yields are seldom obtained. There is no herbicide which is safe on squash and which gives satisfactory control of annual broadleaved weeds. Frequently crop spacing is 6' by 1½' or 8' by 1½', a preemergence herbicide such as dinoseb is used, and several cultivations are given. In some investigations equidistant plant arrangements of 3' by 3' and 3' by 4' were reported to have out yielded rectangular arrangements but their effects on weed control were not investigated.

In these experiments several plant spacings with and without cultivation, herbicides, or "mulch crops" were tested for ability to control broadleaved weeds primarily redroot pigweed (Amaranthus retroflexus L.) and common lambsquarters (Chenopodium album L.). Data on crop vigor, leaf number, size, and orientation, and fruit size and weight were obtained. Weed population dynamics, position and size were recorded. In 1979 no chemical weed control was used. In 1980 a delayed preemergent application of dinoseb at 1.5 lb ai was used on unmulched plots and 0.75 lb ai on those with mulch. In all treatments squash produced yields equal to or above the commercially accepted minimums. Three foot row spacing with one cultivation was as effective in suppressing weeds as six foot row spacing with two cultivations. Higher plant densities per unit area decreased weed competition. Higher plant densities within the row (3/4', 1½') allowed greater numbers of weed seedlings to survive but suppressed their growth to an extent that they were less competitive than those in wider intra-row spacings. Vines covered the between row area in three foot rows faster than in the six foot rows and resulted in fewer large weeds at harvest. Although the closer in-row spacings had an advantage in weed control, they decreased yields primarily because of reduced fruit size. Available moisture was reduced in the 2½' by 1½' spacing compared to the 2½' by 3' spacing and explains at least some of the yield reduction. The 3' by 3' and 2½' by 3' spacings gave the highest yields, had acceptable sized fruits, and were more successful in suppressing weeds than the six foot row spacings. The ryegrass "living mulch" was not as effective in controlling weeds as cultivation and significantly reduced plant size and yields. Moisture levels were greatly reduced in the ryegrass plots.

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Table 1. Effect of crop spacing, ryegrass living mulch, and cultivation on squash and weeds.

Treatment		Weeds						
		Midseason		At harvest				
		Weeds per $2m^2$		Weeds above	Leaf area	Weight	No. fruit	Yield
Spacing	Tillage	Total	>30"	crop canopy	index [a]	per fruit (kg)	per plot	kg/ha
				1980[b]				
2½' x 3'	cult. once	28	6	36	909	4.1	14.3	49533
2½' x 1½'	cult. once	16	1	8	1468	2.9	19.0	45313
2½' x 3'	not cult.	54	16	38	746	3.5	12.7	37140
2½' x 1½'	not cult.	72	6	31	1246	2.5	15.3	30965
2½' x 3'	ryegrass mulch	25	12	28	396	3.2	10.0	27597
2½' x 1½'	ryegrass mulch	29	9	31	834	2.5	14.0	29528
				1979[b]				
3' x 3'	cult. once	132	-	12	-	8.9	29.1	69272
3' x 1½'	cult. once	172	-	11	-	7.8	29.3	62087
6' x 1½'	cult. twice	152	-	28	-	9.1	20.9	50298
6' x 3/4'	cult. twice	163	-	10	-	7.0	27.2	50972

[a] Product of leaf diameter by leaf width by number of leaves/plant by plant density (1X or 2X).

[b] Applied 1.5 lb ai delayed preemergent dinoseb over unmulched plots and 0.75 lb ai D-Pre over mulched plots in 1980. No chemical weed control used in 1979.

EARLY POSTEMERGENCE APPLICATIONS OF 1/ HERBICIDES FOR SWEET CORN

P. L. Minotti, D. T. Warholic, R. D. Sweet, and T. E. Vrabel 2/

ABSTRACT

Treatments were applied in quadruplicate to spike stage Gold Cup Sweet Corn growing in a Howard gravelly loam soil with a PH of 5.6 and organic matter content of 2.8%. Redroot, pigweed, smooth pigweed, common lambsquarter, and common purslane were the predominant broadleaves while Japanese millet was seeded to similate grass pressure. Under these conditions corn yield was reduced 72% in weedy control plots as compared to handweeded control plots. Nevertheless, plots treated once at the spike stage with 0.56 kg/ha of atrazine plus oil and 0.84 kg/ha of alachlor were clean at harvest time nearly ten weeks later (Table 1). Metolachlor could be effectively substituted for alachlor and both acetanilides proved safe at a higher rate of 2.24 kg/ha on spike corn. Atrazine plus oil by itself was effective leaving only some crabgrass at harvest which did not affect yield.

Substituting 2,4-D at 0.42 kg/ha for atrazine in a series of treatments (Table 1) provided a reasonable measure of weed control but was less effective than atrazine. Note that yields in treatments 8-12 where 2,4-D was used were all somewhat lower than those in treatments 3-7 where atrazine was used. This may be due to less effective broadleaf control although a small percentage of plants treated with 2,4-D in the spike stage showed "onion-leaf" symptoms. Thus, although 2,4-D at spike is a reasonable alternative to atrazine, it is still less effective and more risky. Carryover problems with 0.56 kg of atrazine would not be expected. Moreover atrazine still proved effective at a later timing on 20 cm corn, whereas 2,4-D caused injury and yield reduction at this later stage and bentazon was ineffective on pigweed at this stage.

In an adjacent test (results not shown) acetochlor (Monsanto CP 55097) proved safe on spike stage corn at rates up to 3.36 kg/ha. Thus, several possibilities exist for using acetanilides with atrazine on spike stage corn.

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Table 1. Corn yields and weed control as affected by post emergence herbicide application.

	Herbicide	Rate Kg/ha a.i.	Stage of Corn	Weed Control and Crop Ratings b/ Rrpw 7/14	Rrpw 8/1	Copu 7/14	Copu 8/1	Colq 7/14	Colq 8/1	J. millet 7/14	J. millet 8/1	Lacg 8/1	S. Corn 7/14	S. Corn 8/1	Mean Ear Yields Kg/plot	Kg/ear
1.	weedy control	--	--	4.5	2.8	4.8	5.0	6.0	5.0	5.0	3.0	6.0	9.0	6.0	1.88	0.14
2.	hand weeded control	--	--	--	--	--	--	--	--	--	--	--	9.0	9.0	6.88	0.34
3.	atra+oil a/	0.56	spike	9.0	9.0	9.0	8.8	9.0	9.0	9.0	8.8	7.0	9.0	9.0	6.25	0.32
4.	atra+ala+oil	0.56+0.84	spike	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.8	9.0	9.0	6.85	0.34
5.	atra+ala+oil	0.56+2.24	spike	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.58	0.31
6.	atra+meto+oil	0.56+0.84	spike	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.43	0.32
7.	atra+meto+oil	0.56+2.24	spike	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.23	0.32
8.	2,4-D+oil	0.42	spike	6.8	4.3	7.0	6.0	9.0	9.0	7.0	5.8	6.3	7.0	8.5	5.23	0.29
9.	2,4-D+ala+oil	0.42+0.84	spike	8.5	6.5	7.5	6.0	9.0	9.0	9.0	8.8	9.0	7.0	7.0	5.43	0.28
10.	2.4-D+ala+oil	0.42+2.24	spike	9.0	9.0	8.8	7.8	9.0	9.0	9.0	9.0	9.0	7.0	7.0	5.95	0.29
11.	2,4-D+meto+oil	0.42+0.84	spike	7.5	4.8	7.0	5.8	9.0	9.0	9.0	9.0	9.0	7.0	7.0	5.50	0.32
12.	2,4-D+meto+oil	0.42+2.24	spike	8.8	6.0	7.0	6.3	9.0	9.0	9.0	9.0	9.0	7.0	7.3	5.58	0.31
13.	atra+oil	0.56	20 cm	9.0	9.0	9.0	9.0	9.0	9.0	8.5	8.5	7.3	9.0	9.0	6.48	0.33
14.	bentazon+oil	0.56	20 cm	5.3	2.8	9.0	9.0	8.8	9.0	5.3	3.5	7.3	9.0	6.0	2.83	0.18
15.	atra+bentazon+oil	0.56+0.56	20 cm	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.8	7.0	9.0	9.0	6.20	0.29
16.	atra+2,4-D+oil	0.56+0.42	20 cm	9.0	9.0	9.0	9.0	9.0	9.0	8.5	9.0	7.0	6.3	5.0	4.50	0.21
	$LSD_{.05}$														1.44	0.04

a/ Booster+E (Agway)

b/ mean of 4 replications; 1 = no control, 9 = perfect control, 7 = commercially acceptable

HERBICIDE EVALUATION IN SWEET CORN ON LONG ISLAND

J.B. Sieczka, J.F. Creighton and W.J. Sanok[1/,2/]

ABSTRACT

Several herbicide treatments provided good to excellent control when applied at the spike stage of the sweet corn variety 'Harmony.' Herbicides used included atrazine at 0.56 kg/ha; cyanazine at 1.12 kg/ha; metolachlor at 1.12 kg/ha; and combinations of atrazine plus cyanazine, metolachlor, alachlor, pendimethalin, and alachlor. The wettable powder formulation of atrazine was compared with the Attrex Nine-O. Alachlor and pendimethalin at 1.12 kg/ha did not provide as good control as the other materials. There were only two principal weed species which included barnyardgrass (Echinochloa crus-galli (L.) Beauv.) and smartweed (Polygonum pensylvanicum L.).

INTRODUCTION

Sweet corn is produced on approximately 1,000 acres on Long Island. This crop is generally sold by vegetable growers at roadside stands and often the rotation includes other vegetables. Residues of herbicides become important when rotations include sweet corn with cabbage and many other sensitive crops. It is desirable under these circumstances to use low rates of atrazine (2-chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine) alone or in combination with other herbicides to give broad spectrum weed control.

MATERIALS AND METHODS

The sweet corn variety "Harmony" was planted on June 17 on a sandy loam soil at the Long Island Horticulture Research Laboratory. Herbicide applications were made on June 28 when the sweet corn was in the spike stage. Applications were made with a tractor-mounted sprayer delivering 374 l/ha at 2 kb/cm^2. The treatments were applied to two-row plots, eight meters long, with four replications.

Applications included atrazine at 0.56 kg/ha; cyanazine (2-(4-chloro-6-(ethylamino)-s-triazin-2-yl)-2-methyl propionitrile) at 1.12 kg/ha; metolachlor (2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl) acetamide) at 1.12 kg/ha; alachlor (2-chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide) at 1.12 kg/ha; pendimethalin (N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobezemamin) at 1.12 kg/ha and combinations of tank mix atrazine at 0.28 plus cyanazine at 0.84 kg/ha; atrazine at 0.56 and metolachlor at 1.12 kg/ha; atrazine at 0.56 and alachlor at 1.12 kg/ha; atrazine at 0.56 and pendimethalin at

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1.12 kg/ha; cyanazine at 1.12 and alachlor at 1.12 kg/ha. One treatment included the 80W formulation of atrazine but the other treatments, including all of the tank mixes, included the Attrex Nine-O formulation. All applications were made with the equivalent rate of 0.6 percent Booster plus E adjuvant. Ratings for phytotoxicity and weed control were made on July 28, August 2 and September 12.

RESULTS AND DISCUSSION

Ratings for weed control are given in Table 1. All of the treatments provided excellent overall ratings except for the single applications of alachlor and pendimethalin. Both of these materials, when used alone, provided fair to adequate broadleaf weed control but were weak on barnyardgrass. Atrazine, cyanazine, metholachlor and combinations of atrazine with cyanazine, metolachlor, alachlor, and pendamethalin resulted in excellent control of smartweed and barnyardgrass. The wettable powder and Nine-O formulations of atrazine resulted in comparable control.

Table 1. Long Island Sweet Corn Weed Control Results, 1980

			Weed Control Ratings[a/]					
			Broadleaves[b/]			Grasses[c/]		
Treatment	Rate (kg/ha)	Overall 7/9	7/28	8/2	9/12	7/28	8/2	9/12
atrazine	0.56	8.8	8.8	9.0	9.0	7.3	6.3	6.3
cyanazine	1.12	9.0	9.0	9.0	9.0	7.5	6.7	6.7
metolachlor	1.12	8.5	8.5	9.0	8.5	8.5	8.8	8.5
alachlor	1.12	7.3	7.0	7.5	7.3	6.8	6.3	5.8
pendimethalin	1.12	6.3	6.5	6.8	7.0	6.5	5.3	5.5
atrazine + cyanazine	0.28 0.84	9.0	9.0	9.0	9.0	8.0	7.3	7.3
atrazine + metolachlor	0.56 1.12	9.0	9.0	9.0	9.0	9.0	9.0	8.8
atrazine + alachlor	0.56 1.12	9.0	9.0	9.0	8.8	9.0	9.0	8.3
atrazine + pendimethalin	0.56 1.12	8.8	8.8	9.0	8.8	8.0	7.0	7.5
cyanazine + alachlor	1.12 1.12	9.0	9.0	9.0	9.0	9.0	9.0	8.3
atrazine (Attres Nine-O)	0.56	8.0	9.0	9.0	9.0	6.5	6.3	5.5
control		2.8	6.5	6.5	6.5	1.0	1.0	3.3
$D_{(.05)}$ Waller-Duncan		(0.6)	(0.8)	(0.7)	(1.3)	(0.8)	(0.6)	(0.6)

a/ Ratings: Weeds = 1 = no control, 7 = commercial control, 9 = complete control.
Crop = 1 = crop killed, 7 = moderate symptoms, no yield or quality reduction, 9 = no damage.
b/ Primarily smartweed.
c/ Primarily barnyardgrass.

ORYZALIN ALONE AND IN COMBINATION FOR CULTURE OF FRUIT TREES[1/]

R. S. Young and W. V. Welker[2/]

ABSTRACT

Diuron [3-(3 4-dichlorophenyl)-1, 1-dimethylurea], oryzalin (3, 5-dinitro-N^4, N^4-dipropylsulfanilamide) and simazine [2-chloro-4, 6 bis(ethylamino)-s-triazine] were applied in 1979 and 1980 alone and in combination with varying rates of oryzalin to young peach [Prunus persica (L.) Batsch] trees at two widely separated locations, (Cream Ridge, NJ and Kearneysville, WV) and in 1980 to young apple (Malus domestica Borkh.) trees at Kearneysville WV. Weed control was increased when combinations of the herbicides were applied as compared to the individual herbicide used alone. Tree vigor and fruiting was influenced by treatments.

INTRODUCTION

Herbicide mixtures many times are more effective than a single herbicide for the control of either a larger number of weed species or an individual species. Herbicide mixtures may also offer the possibility of reducing the total amount applied to the soil as well as lowering the cost.

The use of tank mixtures of diuron and simazine or diuron and terbacil (3-tert-butyl-5-chloro-6-methyluracil) as a method to control more weed species and to help reduce the potential for injury from the individual herbicide is becoming more widely used by orchardists (2). Of the dinitroanaline type herbicides, oryzalin is one of the least influenced by ultra violet light and also is one of the most persistent of these herbicides (1). Selleck (4) found that the efficacy of oryzalin in potatoes was weak on barnyardgrass (Echinochloa crus-galli (L.) Beauv.) and Pennsylvania smartweed (Polygonum pensylvanicum L.) but when combined with metribuzin [4-amino-6-tert-butyl-3-(methylthio)-as-triazin-5(4H)-one] the performance was greatly improved Weed control was greater when oryzalin was combined with linuron [3-(3, 4-dichlorophenyl)-1-methoxy-1-methylurea] or dinoseb (2-sec-butyl-4, 6-dinitrophenol). The combination of oryzalin plus linuron was more effective when applied with glyphosate [N-(phosphonomethyl)glycine] than with paraquat (1, 1'-dimethyl-4, 4'-bipyridinium ion) in a no-till soybean double-crop system (3). Previous

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work has shown an increase in efficacy when oryzalin was combined with simazine (5).

MATERIALS AND METHODS

At the Kearneysville, WV location, the peach trees were planted May 1978 and the apple trees in May 1977. The trees were planted in a Hagerstown-Frederick silt and cherty silt loam soil. A randomized complete block design with three replications was used. Each plot consisted of three trees for the peach experiment and a single tree for the apple experiment. Herbicide applications were made April 12, 1979 and April 21, 1980 for the peach trials and May 8, 1980 for the apple experiment. The 1980 weed control ratings were made August 6 and October 6, 1980. Trunk circumference and size of tree canopy measurements were made on September 29.

At the Cream Ridge, NJ site, the peach trees were planted in April 1979 on a Freehold sandy loam soil. A randomized complete block design with three replications was used. Each plot consisted of two trees. The herbicide treatments were applied May 15 both 1979 and 1980. Weed control and vigor ratings were made July 31, 1979. Trunk diameter measurements, weed control and vigor ratings were made August 20, 1980.

RESULTS AND DISCUSSION

Even though the soils at Cream Ridge and Kearneysville are contrasting in physical and chemical properties, some of the major weed species of the two soils and locations were similar. Crabgrass (*Digitaria spp.*), ragweed (*Ambrosia artemisiifolia* L.), dock (*Rumex spp.*), foxtail (*Setaria spp.*), dandelion (*Taraxacum spp.*), horseweed (*Conyza canadensis* (L.) Cronq.) were major weeds at both locations, chickweed (*Cerastium spp.* and *Stellaria media* (L.) Cyrillo), fall panicum (*Panicum dichotomiflorum* Michx.), barnyardgrass, horsenettle (*Solanum carolinense* L.), knotweed (*Polygonum spp.*), Pennsylvania smartweed, witchgrass (*Panicum capillare* L.), redroot pigweed (*Amaranthus retroflexus* L.), lambsquarters (*Chenopodium album* L.), hedge bindweed (*Convolvulus sepium* L.) and downy brome (*Bromus tectorum* L.) were additional major weeds present at Kearneysville.

Regardless of location, weed control with oryzalin at 2, 4 or 8 pounds per acre was improved with the addition of 2 to 4 pounds per acre of either diuron or simazine (Tables 1, 2, 3). Under most conditions where the individual herbicide was applied, the lower rate of diuron or simazine resulted in better weed control than the lower rate of oryzalin. On occasion diuron or simazine applied by itself had a higher weed control rating than did the 4 pound per acre rate of oryzalin. When oryzalin was combined with either diuron or simazine, weed control was better than that which occurred with either herbicide when applied by itself.

Tree vigor whether it be based upon visual observations, trunk growth, tree canopy size or harvested fruit (Tables 1 & 2), reveals that all herbicide treatments produced more vigorous trees than the clean weeded or untreated plots. Greater tree vigor occurred when oryzalin was combined with either diuron or simazine than when used by itself. Similarly tree vigor of diuron or simazine treated trees was greater when either herbicide was combined with oryzalin.

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Table 1. Effect of oryzalin and simazine alone and in combination upon peach tree vigor and weed control. Treated April 12, 1979 and April 21, 1980. Evaluated September 29 and October 6, 1980. Kearneysville, WV.[a/]

Treatment[b/]	% Weed Control[c/]	Tree Canopy Volume (cu m)	Number of Fruits Harvested	Trunk Circumference Increase (cm) 1978-1980	1979-1980
Oryzalin 2	30	14.5 d	176 c	13.9 d	8.0 c
Oryzalin 4	40	16.6 cd	288 a	16.9 bc	9.3 b
Oryzalin 8	68	26.6 a	248 b	17.8 abc	10.4 ab
Simazine 2	45	23.2 ab	204 c	18.0 abc	10.5 ab
Ory. 2 + sim. 2	85	24.6 ab	259 ab	20.1 a	10.5 ab
Ory. 4 + sim. 2	85	20.7 bc	184 c	16.1 cd	10.5 ab
Ory. 8 + sim. 2	90	23.3 ab	199 c	19.1 ab	11.1 a
Untreated	0	7.2 e	60 d	10.8 e	5.8 d

a/ Mean separation in columns by Duncan's multiple range test, 5% level.
b/ Herbicide rates expressed as pounds active ingredient per acre.
c/ Weed control rating 0 to 100 where 0 = no control and 100 = complete weed kill. Major weeds (a) oryzalin plots: chickweed 45%, ragweed 35%, horsenettle 15%; (b) simazine plots: redroot pigweed 40%, fall panicum 15%, witchgrass 10%, barnyardgrass 15%, crabgrass, chickweed: (c) oryzalin + simazine plots: horsenettle 40%, chickweed 50%, broadleaf dock 5%; (d) untreated plots: ragweed 40%, downy brome 20%, chickweed 10%, foxtail, dandelion, dock.orchardgrass, knotweed.

Table 2. Effect of various herbicide treatments upon growth and vigor of young peach trees and the control of weeds. Treated May 15, 1979 and 1980. Evaluated August 20, 1980. Cream Ridge, NJ.[a/]

Treatment[b/]	Trunk Diameter in cm	Vigor Rating[c/]	% Weed Control
Oryzalin 2	1.20 e	87 bc	85 b
Oryzalin 4	1.40 cde	90 abc	85 b
Oryzalin 8	1.43 bcd	95 ab	90 b
Oryzalin 2 + diuron 2	1.50 abcd	100 a	100 a
Oryzalin 4 + diuron 2	1.55 abc	100 a	100 a
Oryzalin 8 + diuron 4	1.63 ab	100 a	100 a
Oryzalin 2 + simazine 2	1.67 a	100 a	100 a
Oryzalin 4 + simazine 2	1.58 abc	100 a	100 a
Oryzalin 8 + simazine 4	1.58 abc	100 a	100 a
Diuron 2	1.57 abc	90 abc	90 b
Simazine 2	1.32 de	82 c	67 c
Untreated 1979 & 1980	.68 f	33 d	0 d
Clean Weeded 1979 Untreated 1980	.83 f	40 d	0 d

a/ Means followed by the same letter within each column were not significantly different at the 5% level as determined by Duncan's multiple range test.
b/ Herbicide rates expressed as pounds active ingredient per acre.
c/ Vigor ratings based on 0 to 100% scale. 0 = complete kill; 100 = most vigorous.

Table 3. Effect of various herbicide treatments on the control of weeds. Herbicides applied April 21, 1980 to peach and May 8, 1980 to apple trees. Evaluated August 6 and October 6, 1980. Kearneysville, WV.

Treatment[a]	Percent Weed Control[b] Peach[c] 10/6/80	Apple[d] 8/6/80	Apple[d] 10/6/80
Oryzalin 2	23	69	28
Oryzalin 4	54	82	72
Oryzalin 8	82	95	91
Oryzalin 2 + diuron 2	57	-	-
Oryzalin 4 + diuron 2	78	-	-
Oryzalin 8 + diuron 2	93	-	-
Oryzalin 2 + simazine 2	-	98	86
Oryzalin 4 + simazine 2	-	91	89
Oryzalin 8 + simazine 2	-	99	99
Oryzalin 2 + diuron 3.2	-	94	83
Oryzalin 4 + diuron 3.2	-	98	98
Oryzalin 8 + diuron 6.4	-	100	99
Diuron 2	33	-	-
Diuron 3.2	-	86	67
Simazine 2	-	53	37
Untreated	0	3	0

a/ Herbicide rates expressed as pounds active ingredient per acre.

b/ Weed control rating 0 to 100 where 0 = no control and 100 = complete weed kill.

c/ Major weeds (a) oryzalin plots: crabgrass 30%, foxtail 20%, knotweed 15%, broadleaf dock 10%, redroot pigweed 5%, horsenettle 5%, fall panicum 5%; (b) diuron plots: crabgrass 65%, redroot pigweed 20%, foxtail 5%, hedge bindweed; (c) oryzalin + diuron plots: crabgrass 55%, barnyardgrass 10%, foxtail 20%, fall panicum 5%, hedge bindweed 2%; (d) untreated plots: crabgrass 65%, foxtail 10%, Pa. smartweed 10%, chickweed 5%.

d/ Major weeds (a) diuron plots: fall panicum 50%, crabgrass 40%, knotweed, dandelion, foxtail, redroot pigweed; (b) oryzalin plots: dandelion 50%, horsenettle 20%, crabgrass 10%, foxtail 5%, fall panicum 5%; (c) simazine plots: crabgrass 70%, fall panicum 20%, barnyardgrass, dandelion: (d) oryzalin + diuron plots: dandelion 50%, fall panicum 80%, crabgrass, knotweed, dandelion, broadleaf dock; (f) untreated plots: fall panicum 40%, foxtail 30%, horseweed 10%, lambsquarters 10%, crabgrass, barnyardgrass, redroot pigweed, horsenettle, knotweed, Pa. smartweed, dandelion.

THE EFFECT OF GLYPHOSATE APPLICATION TO APPLE SUCKERS ON TREE GROWTH

G. K. Stamm and R. A. Ashley[1/]

ABSTRACT

Applications of glyphosate [N-(phosphonomethyl)glycine] were made during the first week of June, July, August, September and October 1979 at 2.26 and 4.52 kg ae/ha. An application of 1.68 kg ae/ha was also made in July, August and October 1979. Treatment areas of each tree included a plot 2.5 by 3.6 m, the trunk and all sucker tissue and foliage. In all cases, the sucker leaf area treated in each plot was 10% or less of the total leaf area of the tree. Trees were evaluated in May and September, 1980 to determine the effect of glyphosate application on the number and size of suckers. Data was expressed as a percent of control. Additional observations were made in November, 1979 and April, June and August, 1980 to determine the extent of tree injury.

Treatment of suckers at any time or rate had no effect on tree growth in terms of terminal elongation or increase in tree circumference; however, differences were noted in terms of injury and percent change in sucker height and population. Sucker populations were readily reduced by all treatments when compared to a control treatment and/or a control treatment in which all suckers had been removed by clipping early in the first season. By the end of the second season some plots still showed reductions in percent population change but these changes were not significant due to the variability that existed. Sucker height was readily reduced in all treatments except the June treatments at the 2.26 and 4.52 kg ae/ha which were comparable to the unclipped control for the first season. Changes in sucker height the second season were not significant.

Treatment of trees in October at 4.25 kg ae/ha produced significant injury the following season which was characterized by dwarfed, chlorotic leaves in water sprouts and bark injury on the main trunk. Treatment of trees in June and October at a 4.25 kg ae/ha rate produced necrotic flakes of bark in some trees but such injury was not serious.

Another experiment indicated that when 25% of the total leaf area of an apple tree exists as suckers and are treated with glyphosate at 2.26 or 4.52 kg ae/ha significant injury and reductions in terminal elongation and increase in tree circumference occured the following season. Treatment of sucker leaf area which constituted 15% of the total tree leaf area at 4.25 kg ae/ha produced less injury and had no effect on terminal elongation or increase in tree circumference.

In general, both experiments indicated that sucker treatments with glyphosate at standard herbicidal rates are safe when the treatment area is confined to sucker foliage which constitutes less than 25% of the total tree leaf area. Glyphosate appears to show a potential as a sucker control agent.

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THE EFFECT OF TIME OF GLYPHOSATE APPLICATION ON THE CONTROL OF BLACKBERRIES

G. K. Stamm and R. A. Ashley

ABSTRACT

Blackberry plants (Rubus allegheniensis Porter) from a wild clone were treated with glyphosate at 1.26 and 1.71 kg ae/ha at bi-weekly intervals during the growing season. At either rate, treatments in late summer to early fall provided adequate control of the blackberry plants the season after treatment. Treatment of canes on May 29, 1979 was equally effective and provided adequate control for the season of treatment and the season after. Treatments at other times of the year reduced the blackberry stand but did not provide adequate control.

INTRODUCTION

Rubus spp. are a common weed problem in many long term crops where herbicides are routinely applied to control weed problems. Skroch et al reported that the repeated use of triazine and substituted urea herbicides caused an increase in the population of brambles (Rubus spp.) in an apple orchard over a five year period (2). Hence, brambles are a potential weed problem in many crops when these herbicides are used on a regular, long term basis. Glyphosate has been used to control brambles, but successful control has been obtained only by late summer or fall applications (1,3). While treatment at this time is very effective, this is an inconvenient time for growers of certain crops to apply herbicides due to harvest obligations. The purpose of this experiment was to evaluate the effect of a glyphosate application to blackberries at various times of the year in order to determine whether blackberries are sensitive to glyphosate at other times during the growing season.

MATERIALS AND METHODS

Experiments were conducted during 1979-80 at the University of Connecticut Agronomy Research Farm in Storrs, CT. Plots of 9.29 m^2 each were established in a wild clone of blackberries which existed on site. Treatments were arranged in a completely randomized design and were repeated three times. All herbicide treatments were made with an 11.4 L compressed air, knapsack sprayer using a Spraying Systems 8004E nozzle at a volume of 467.5 L/ha and at a pressure of 2.8 kg/cm^2.

Glyphosate [N-(phosophoneomethyl)glycine] treatments were applied at bi-weekly intervals, as determined by weather conditions, at 1.26 and 1.71 kg ae/ha. Evaluation of the plots prior to treatment indicated a mean cane height of 147.5 cm and 18 canes and 17 crowns per 9.29 m^2.

On January 5, 1980 and September 2, 1980 cane height and counts of live canes and crowns were recorded. Observations for the first season after treatment were delayed until January 5, 1980 to make the counting of the number of live canes and crowns easier.

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RESULTS AND DISCUSSION

The results of this experiment are summarized in Table 1. Observations on January 5, 1980 indicated that the canes and crowns which existed in the plots were viable and healthy. In March 1980 it was noted that all top growth in the control and treated plots had been killed by winter injury. However, new growth was noted in both the control and some treatment plots by July 1980.

The results confirm that late summer to early fall is an effective time to control blackberries. Treatments on August 15, September 1, or September 15 at either rate, or September 29 treatment at 1.26 ae/ha, readily reduced the blackberry stand in terms of cane height and number of live canes per plot the season after treatment. Canes produced from these plants after treatment were either from the existing crowns or from adventitious buds which developed on the crown or roots. In general, such regrowth was spindly and did little to contribute to a potential weed problem. The only evidence of herbicidal activity in these plots during the year of treatment was in plots treated on August 15 and September 1. Plots treated at this time tended to display leaf drop and senescence earlier than control plants. This was less evident on later treatments due to natural senescence which was occuring by that time.

The only treatment which was effective during the season of application and comparable to the fall treatments was glyphosate at 1.71 kg ae/ha applied on May 29. Such treatment caused the greatest reduction in both the number of canes and crowns and cane height. Plants treated at this time readily exhibited chlorotic new growth which was later followed by necrotic canes and lack of new growth. Canes outside the treatment area also exhibited similar symptoms at the same time. Such an observation readily indicates the active translocation of glyphosate between canes and was not indicated to such an extent in later treatments. Plants treated on this date at the 1.26 rate also exhibited similar symptoms and kill. The effects of treatment at this date were also carried over into the second season with plots treated at either rate still having satisfactory levels of control.

All treatments made between June 14 and July 30 at both rates tended to show a reduction in the number of crowns and cane height the season after treatment. The number of live canes per plot also followed a similar trend except in the treatments made on June 1 and July 14 at the 1.26 rate which were comparable to the control. Treatments during this time-span did little to reduce the blackberries to a level and density which would constitute satisfactory weed control.

Treatments to plants on September 29 and October 14 were made when the plants were exhibiting signs of leaf drop—25 to 50% and 75% of the total foliage, respectively—and leaf coloration. Plots treated at this time showed a significant reduction in the number of canes and crowns on September 2, 1980, but visually these plots were similar to plots which had been treated in mid-season.

In conclusion, blackberries were effectively controlled by a glyphosate application at 1.26 or 1.71 kg ae/ha in late summer to early fall. Such control,

however, is not evident until the season after treatment. The use of glyphosate at 1.71 kg ae/ha gave control during the season of application and the effect persisted into the year after treatment.

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Table 1. Effect of time of glyphosate application in the control of blackberries.

Treatment	Rate Kg/ha	Live Canes 1-80 1/	Live Canes 9-80 2/	Live Crowns 1-80 1/	Live Crowns 9-80 2/	Cane Height 1-80 1/	Cane Height 9-80 2/
		per plot				cm	
Control	0.00	26.6	23.8	19.3	16.0	159.0	123.0
5-29	1.26	13.6	6.0	8.0	3.7	64.3	70.0
	1.71	7.3	1.0	5.0	1.0	43.3	26.7
6-14	1.26	15.0	18.0	11.0	8.0	76.6	70.0
	1.71	26.3	7.0	17.7	3.7	102.6	38.7
7- 5	1.26	22.0	5.0	21.3	3.0	83.6	48.3
	1.71	17.0	3.0	16.7	3.0	108.6	26.7
7-15	1.26	33.3	15.0	22.0	9.7	138.0	69.7
	1.71	21.7	3.0	20.7	3.3	107.6	53.0
7-30	1.26	37.3	7.0	29.3	6.0	127.6	53.0
	1.71	25.7	5.0	22.0	2.3	134.3	60.0
8-15	1.26	22.0	1.0	17.0	0.7	108.3	10.0
	1.71	23.3	0.3	16.3	0.3	123.3	12.7
9- 1	1.26	51.3	1.0	15.0	1.0	117.3	23.3
	1.71	21.3	0.3	19.0	0.3	144.3	5.0
9-15	1.26	25.6	1.7	16.3	1.7	116.6	42.7
	1.71	23.3	0.0	15.0	0.0	132.6	0.0
9-29	1.26	26.3	0.6	22.3	0.7	136.0	1.7
	1.71	31.3	7.0	19.0	3.3	126.0	62.3
10-14	1.26	23.3	2.7	15.7	2.0	139.3	48.0
	1.71	22.0	8.0	14.0	5.0	148.6	60.3
LSD 5%	—	18.3	8.3	10.6	5.4	41.7	46.2

1/ Data taken: January 5, 1980

2/ Data taken: September 2, 1980

WEED CONTROL IN LOWBUSH BLUEBERRIES WITH HEXAZINONE

K. Jensen, D. Doohan and J. Thomson[1/]

ABSTRACT

Hexazinone has been evaluated for weed control in lowbush blueberries in eastern Canada since 1975. In 1979, a series of cooperative trials were established in the 4 provinces comparing the efficacy of hexazinone against other promising herbicides. In addition, a number of related trials were conducted testing rates and timing of application of hexazinone in relation to crop safety and level and spectrum of weeds controlled.

Mid-summer application of 1.5 to 3.0 kg/ha resulted in severe foliar injury to the crop. When applied to dormant shoots, some injury was observed at 4.0 kg/ha, but this did generally not affect yields. At several sites, crop injury from these treatments was related, in part, to gravelly and rocky soil types, or to wet soils with a high water table. There was an acceptable margin of crop tolerance to 1.0 to 4.0 kg/ha hexazinone when application was made between the pruning burn and the emergence of the blueberry shoots. These rates gave excellent control of most herbaceous and woody weed species and resulted in significant yield increases.

Hexazinone at 1.5 to 3.0 kg/ha gave superior weed control to atrazine or simazine at 2.5 to 5.0 kg/ha; and to terbacil or diuron at 1.5 to 3.0 kg/ha. Spring treatments of hexazinone were always more effective than fall treatments; 2.0 kg/ha hexazinone applied in the spring was as effective as 4.0 kg/ha applied in the fall. When spring applied, hexazinone at 1.0 to 2.0 kg/ha gave excellent control of all associated native grasses, all herbaceous Compositae species including the goldenrods (*Solidago* spp.), the hawkweeds (Hieraceum spp.), the asters (*Aster* spp.), pearly everlasting [*Anaphalis margaritacea* (L.) C. B. Clarke], and yarrow (*Achillea millefolium* L.); all herbaceous Rosaceae species including the cinquefoils (*Potentilla* spp.) and wild strawberry (*Fragaria virginiana* Dcne.); and others including sheep sorrel (*Rumex acetocella* L.) and fireweed (*Epilobium angustifolium* L.). Woody species controlled by 2.0 to 4.0 kg/ha hexazinone included wild rose (*Rosa virginiana* Mill.), trailing blackberry (*Rubus hispidus* L.), sheep laurel (*Kalmia angustifolia* L.), and meadowsweet [*Spirea latifolia* (Ait.) Borkh.)]. In general, hexazinone controls the majority of species growing in association with lowbush blueberries. However, poor or variable control was obtained with the following weedy species: Canadian rhododendron [*Rhododendron canadense* (L.) Torr.], bunchberry (*Cornus canadensis* L.), black chokeberry [*Pyrus melanocarpa* (Michz.) Willd.], willows (*Salix* spp.), and ferns ([*Pteridium aquilinum* (L.) Kuhn.] and [*Dennstaedtia punctilobula* (Michx.) Moore]). Studies to date indicate hexazinone can be used selectively in lowbush blueberries against a wide range of weedy species and merits further work.

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HEXAZINONE PELLETS FOR SPOT TREATMENT OF WOODY WEEDS IN LOWBUSH BLUEBERRY FIELDS

D. E. Yarborough and A. A. Ismail[1]

ABSTRACT

Two hexazinone pellets[2] placed at the base of cherry (Prunus sp.), willow (Salix sp.), and birch (Betula sp.) stems significantly reduced the number of stems one year after application. A linear decline in the number of willow stems from 0 to 100% was obtained by increasing the rate from 0 to 4 pellets. This material could provide an efficient method for spot treatment of woody weeds which grow in clumps sporadically throughout lowbush blueberry (Vaccinium angustifolium Ait.) fields.

INTRODUCTION

Commercial lowbush blueberry (Vaccinium angustifolium Ait.) fields in Maine have been developed from natural or "wild" stands (2). Their occurance is governed by natural factors such as a temporate climate and acid, sandy soils with moderate to low fertility. Management consists of delaying succession of woody weeds through burning the fields every two years and employing cultural practices such as fertilizer application to promote blueberry growth. Many woody weeds, which are naturally occurring, often respond well to the fertilizer and increase to become serious weed problems.

A weed wiper may be employed to selectively control woody weeds taller than lowbush blueberries and will efficiently control weeds which possess a rhizome system such as black chokeberry {Pyrus melanocarpa (Michx.) Willd.}, (8), sweet fern {Comptonia peregrina (L). Coult.} and quaking aspen (Populus tremuloides Michx.) (7). However, many weeds such as willow (Salix sp.), cherry (Prunus sp.), and birch (Betula sp.) are not always widely dispersed over blueberry fields. Before the FIFRA Act of 1972 (1), these weeds were controlled by spot or stump sprays (6). Currently there is no provision on the 2,4-D state label for spot treatment of woody weeds in lowbush blueberry fields.

The use of 10% hexazinone {3-cyclohexyl-6-(dimethylamino)- 1 methyl-1,3,5-triazine-2,4(1H,3H-dione)} pellets provides an easy method of herbicide placement to control susceptable woody weeds which grow in discreet clumps. Canadian researchers have reported that spray applications of hexazinone at rates up to 4 kg/ha did not injure blueberries (3) or reduce yields (4). However, when the pellets were used in a forest for sprout control only marginal success was obtained at 4 lb/A but soils were high in organic matter (OM) and clay (5). This should not present a problem in most blueberry fields

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[2]Velpar gridball

which are predominantly sandy and have less OM due to the periodic burning. The objective of this experiment is to ascertain the efficacy of hexazinone pellets on several species of woody weeds in lowbush blueberry fields.

MATERIALS AND METHODS

Two experiments were initiated on lowbush blueberry fields in Washington County, Maine in late July, 1979. At the first location, two hexazinone pellets were placed at the base of clumps of three year old cherry, willow or birch stems. The number of live stems were recorded before and one year later as well as any resprouting the second year. A T-test was used to determine significance.

At the second location, either 0, 1, 2, or 4 pellets were placed at the base of three year old willow clumps. The number of stems before treatment and the number of stems and sprouts one year later were recorded. A visual estimate of foliar injury was also made one month after treatment. The experimental design was a completely randomized block with five replications. Data were analyzed by regression analysis with an F-test at a single degree of freedom used to determine significance.

RESULTS AND DISCUSSION

One year after treatment two hexazinone pellets reduced the average number of live cherry stems from 1.6 to 0, the number of willow stems from 7.1 to 0 and the number of birch from 4.3 to 0.6. Analysis with a T-test indicates that the difference in the number of stems before and after treatment was highly significant. No stem sprouting occurred with the cherry but the willow had an average of 0.5 sprouts and the birch 1.4 (Table 1). The birch stems originated from large, well developed root stocks which were less susceptable to the treatment and had more resprouting than the cherry or willow.

In the second experiment, the number of willow stems before treatment ranged from 26 to 17 with no significant variation (Table 2). One to four hexazinone pellets resulted in a significant linear decline in the number of stems from 26 to 0, one year after treatment. This represents a percent reduction in stems from 0 to 100% (Table 2).

Visual observations of the foliage, made one month after treatment showed leaf and stem necrosis or chlorosis of 78% at 1, 97% and 2 and 100% at 4 pellets. Defoliation of the blueberries in the immediate area of treatment was noted but not considered severe. Some willow sprouting did occur, with a greater number of sprouts associated with the least number of pellets (Table 2). However, there was no significant trend detected relative to the number of sprouts.

Since hexazinone can effectively control willow, cherry, and birch stems with two pellets, this material could provide an efficient method of spot treatment of woody weeds in lowbush blueberry fields. A more detailed study involving more woody species, and a rating of blueberry injury and yield is needed.

Table 1. Effect of Two Hexazinone Pellets on Three Year Old Cherry, Willow and Birch Stems

Species	Mean No. Stems before treatment	Mean No. Stems after treatment		stem sprouts	
Cherry	1.6	0	**[a]	0	**[b]
Willow	7.1	0	**	0.5	**
Birch	4.3	0.6	**	1.4	**

[a] T-Test between number of stems before and after treatment significant at 1% level.

[b] T-Test significant at the 1% level between number of stems and number of sprouts after treatment.

Table 2. Effect of Number of Hexazinone Pellets On Three Year Old Willow Survival and Sprouting

No. Hexazinone Pellets	Mean No. Willow Stems Pretreatment 1979	Mean No. Willow Stems Posttreatment 1980	Visual Percent Reduction 1979	Actual percent Reduction 1980	Mean Number of Sprouts 1980
0	26	26	0	0	0
1	21	2	-33	-78	6
2	21	<1	-62	-97	2
4	17	0	-100	-100	<1
F Test	NS[a]	L**	L**	L**	NS

[a] F Test was non-significant (NS), significant at the 1% level (**), (L) indicates linear trend from regression analysis.

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EFFECT OF SELECTIVE WIPER APPLICATION OF 2,4-D OR GLYPHOSATE ON BLUEBERRY AND BLACK CHOKEBERRY YIELDS

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ABSTRACT

Yields from a mixed blueberry (Vaccinium angustifolium Ait.) black chokeberry {Pyrus melanocarpa (Michx.) Willd.} stand were obtained two years after selective treatment with 2,4-D or glyphosate. Blueberry and black chokeberry fruit were separated, weighed and counted. Glyphosate or 2,4-D treatments did not influence yield of mixed berries. Increasing the rate of glyphosate produced a significant linear decrease in the number, weight and percentage of black chokeberry in the fruit mixture. This provided better U.S.D.A. frozen and canned grade standards. Increasing rates of 2,4-D resulted in a linear increase in the number and weight of blueberry fruit and a quadratic trend for the number, weight and frozen or canned blueberry grade standards. Increasing the rate of 2,4-D from 4.8 to 9.6 g/L resulted in a larger number of black chokeberries.

INTRODUCTION

The black chokeberry {Pyrus melanocarpa (Michx.) Willd.} is a serious problem in the 20,000 ha of commercially harvested native lowbush blueberry (Vaccinium angustifolium Ait.) stands in Maine (3). Since black chokeberry plants are usually interspersed throughout the blueberry stands, it is difficult to harvest blueberries without including some black chokeberry fruit. Separation of the mixed berries at the processing plants is difficult due to the similarity of berry size, shape and specific gravity. The United States Department of Agriculture Standards for frozen (5) and canned (6) blueberries limit the number of foreign edible berries allowed in the processed pack. Taste panel tests also have indicated that the presence of black chokeberry adversely influences the flavor and texture of blueberry muffins, tarts and pies (2).

Research efforts to identify a selective herbicide to control black chokeberry without harming lowbush blueberry have not been successful (3). Trevett and Durgin (4) indicated that an application of endothall {7-oxabicyclo (2.2.1) heptane-2,3-dicarboxylic acid} would selectively defoliate blueberry leaves in a mixed blueberry-black chokeberry stand. A herbicide could then be applied to thin out black chokeberry without reducing blueberry plant stand. Using this procedure, Yarborough and Ismail (8) reduced black chokeberry stand and the number, weight and percent of black chokeberry fruit (9) by treatment with endothall followed by glyphosate {N-(phosphonomethyl)glycine}. However, the reamining black chokeberry fruit still exceeded minimum U.S.D.A. grade requirements before separation at the processing plant.

The development of a segmented herbicide applicator at the University of Maine (1) enables selective application of herbicides on weeds which are taller

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than lowbush blueberry stems. Using this device, Yarborough and Ismail (7) successfully reduced black chokeberry plant stand with 2,4-D {(2,4-dichlorophenoxy)acetic acid} or glyphosate without affecting blueberry plant stand. This report presents a follow-up of the effect of selective applications of 2,4-D or glyphosate on blueberry and black chokeberry yield and relates the quality of the treated berries to U.S.D.A. grade standards.

MATERIALS AND METHODS

Herbicides were applied to black chokeberry stems taller than blueberry plants using a weed wiper as described by Yarborough and Ismail (7). The device consists of two offset mounted tractor drawn drums each 61 by 23 cm diameter adjusted to a height above the blueberry plants. Drums were covered with an absorbant material are saturated with herbicide and rotated at 42 rpm counterclockwise to the direction of travel at 0.62 km/hr on the test areas.

The experimental design was a randomized complete block with eight treatments and six replications. After harvest in August, 1976, either glyphosate at 0, 1.2, 2.4 or 4.8 g/L ai or the low volatile iso-octyl ester of 2,4-D at 0, 2.4, 4.8 or 9.6 g/L ai with 0.1% X-77 surfactant were applied to the 1.2 by 30.5 m plots.

Experimental plots were pruned by fire in the spring of 1977. Yields were obtained in the summer of 1978 by hand raking the treated areas. Samples of mixed berries (0.9L) were randomly taken and blueberry and black chokeberry fruit in each sample were separated, counted and weighed. Regression analysis with an F-test at a single degree of freedom was used to determine the significance of the data.

RESULTS AND DISCUSSION

Selective wiper application of 2,4-D or glyphosate did not influence the mixed blueberry-black chokeberry yield taken two years after treatment (Table 1). However, when the 0.9L samples of mixed berries were separated into blueberries and black chokeberries, and fruit counted and weighed, the effect of the herbicide application became evident.

The number of black chokeberry fruit showed a significant linear decline from 23 for the control to 4 for the 4.8 g/L glyphosate treatment without influencing the number of blueberries. The 2,4-D treatments produced a significant quadratic trend for the black chokeberry with 27 for the control and 7 to 15 for the respective 4.8 to 9.6 g/L rates while the number of blueberry fruit showed a significant linear increase (Table 1).

The glyphosate treatments resulted in a linear decrease in black chokeberry fruit weight and a significant quadratic trend for the blueberry fruit weight. Although the trend for the weight of the blueberry fruit is significant, the amount of change is very small. The black chokeberry weight did not show a significant trend associated with the 2,4-D treatments, but the blueberry fruit weight increased with increasing rates of 2,4-D (Table 1).

The percent of black chokeberry fruit by number and weight revealed a significant linear decline due to the selective application of glyphosate but not

Table 1. Effect of Selective Wiper Application of Glyphosate and 2,4-D on Yield and Proportion of Berries From a Mixed Blueberry-Black Chokeberry Stand.

Rate (g/L)	Yield (Kg/ha) Mixed Berries	Fruit No./0.9 L Blueberry	Fruit No./0.9 L Black Chokeberry	Fruit wt.(g)/0.9 L Blueberry	Fruit wt.(g)/0.9 L Black Chokeberry
Glyphosate					
0.0	1570	1965	23	586.4	5
1.2	1960	2021	14	566.6	2
2.4	1608	2081	6	553.5	1
4.8	1258	2193	4	582.5	1
F Test	ns[a]	ns	L*	Q*	L*
2,4-D					
0.0	1642	1910	27	565.1	4
2.4	1868	2014	11	580.7	2
4.8	1860	2120	7	571.8	2
9.6	1759	2760	15	601.1	3
F Test	NS	L*	Q*	L*	NS

[a] F Test was significant at 5% level (*), non-significant (NS); (L) indicates linear trend, (Q) indicates quadratic trend, from regression analysis.

for the 2,4-D (Table 2). When the data were transformed to the basis of frozen and canned grades, trends due to the herbicide treatments become evident. The number of black chokeberry on a canned or frozen grade basis showed a significant linear decrease. The 22 chokeberries for the control decreased to 5 for the 4.8/L glyphosate rate. This represents an improvement on canned grade basis from U.S. substandard to U.S. Fancy. An identical trend was seen for the frozen grade basis (Table 2).

The 2,4-D treatments produced a quadratic trend on a frozen and canned grade basis. The number of black chokeberries was reduced from 27 for the control to 7 for the 4.8 g/L rate but increased to 15 with the 9.6 g/L rate. This represents a change in canned grade from U.S. substandard to U.S. choice and U.S. substandard respectively (Table 2). The frozen grade was changed from 21 (U.S. substandard) black chokeberries to 6 (U.S. Fancy) to 12 (U.S. choice) for the control, 4.8 g/L and 9.6 g/L 2,4-D g/L rates respectively. The 9.6 g/L 2,4-D treatment may have damaged the black chokeberry foliage so that less material was translocated, making the higher rate less effective than the lower rate at 4.8 g/L thus producing a quadratic trend.

Although there were some discrepencies between the number, weight and percentage of black chokeberries, the grade basis is the criteria used to classify the berries at the processing point. Using the weed wiper selective application of both 2,4-D or glyphosate resulted in significant increases in the frozen and canned blueberry grades at 4.8 g/L. This method will enable growers to reduce the amount of black chokeberry before processing without reducing the blueberry yield. It will also allow for a higher blueberry grade with less labor needed to separate the berries at the processing point.

Table 2. Effect of Selective Application of Glyphosate and 2,4-D on Percentage of Barrenberry Fruit and Potential Blueberry Grade a From a Mixed Blueberry-Black Chokeberry Stand.

Rate (g/L)	Black Chokeberry (%) No.	Black Chokeberry (%) Wt.	Canned Grade No. Black Chokeberry/567	Frozen Grade No. Black Chokeberry/545
Glyphosate				
0.0	1.2[a]	0.8	22	17
1.2	0.7	0.4	13	11
2.4	0.3	0.2	6	5
4.8	0.2	0.2	5	4
F Test	L*[b]	L*	L*	L*
2,4-D				
0.0	1.4	0.7	27	21
2.4	0.6	0.4	11	8
4.8	0.4	0.3	7	6
9.6	0.7	0.4	15	12
F Test	NS	NS	Q*	Q*

[a] U.S.D.A. standards: 10 = U.S. Grade A or U.S. Fancy, 16 = U.S. Grade B or U.S. Choice, 20 = U.S. Grade C or U.S. Standard, >20 U.S. Grade D or U.S. Substandard, foreign edible berries per 454g for four frozen grade classes and 5 = U.S. Grade A or U.S. Fancy, 8 = U.S. Grade B or U.S. Choice, 10 = U.S. Grade C or U.S. Standard, >10 = U.S. Grade D or U.S. Substandard, foreign edible berries per 567g for four canned grade classes.

[b] F Test was significant at 5% level (*), non-significant (NS); (L) indicates linear trend, (Q) indicates quadratic trend from regression analysis.

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LEGUME SODS AS LIVING MULCHES IN SWEET CORN [1/]

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ABSTRACT

Atrazine, glyphosate, and mowing were evaluated as treatments for the regulation of white clover, ladino clover, red clover, and alfalfa when used as living mulch crops in sweet corn. All legume stands were established in the summer of 1979, and were dense and vigorous in the spring of 1980. At this time, a broadcast spray of atrazine or glyphosate was applied to some of the legume sods two weeks prior to corn planting. Other legume sods were mowed to a height of 7.5 cm immediately after corn planting. Strips .34 m wide were rototilled out of the sods into which the sweet corn was planted. Corn row spacing was .91 m with a plant population of approximately 48,000 plants/ha. At time of planting 125 kg/ha of 15-60-60 fertilizer was banded. For weed control an application of .61 kg/ha atrazine, plus 1.22 kg/ha alachlor and Booster plus E (1.6%) surfactant oil was applied to the corn at spike stage. This spray was applied either in 30 cm bands over the corn rows in the living mulch plots or broadcast over the clean cultivated no cover plots.

With one exception sweet corn yields in the regulated mulch plots were comparable to or greater than yields in conventional no-cover treatments (Table 1). White and ladino clover sods treated with a broadcast spray of .91 kg/ha atrazine produced marketable ear yields 75% higher and leaf tissue nitrogen contents 50% higher than corn not planted in a living mulch crop. Untreated mulch crops were too competitive and corn yields were reduced. White and ladino clover sods were much more successful in controlling weeds than red clover or alfalfa sods. While soil moisture levels were lower in the legume sod plots, corn yields were not affected.

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Table 1. Effect of mulch/crop treatments on sweet corn yields, leaf tissue nitrogen content, and weed control. [a]

Treatment	Total yield/plant (kg fresh weight)	Marketable ear yield/ plant (g dry weight)	Nitrogen content [c]	Weed control rating
Clean cultivation - no cover [b]	0.71 bcd	45.5 bcde	1.70 cdef	9
Clean cultivation - no cover [b]	0.68 bcde	43.7 bcde	1.64 def	9
White clover - untreated	0.66 cde	33.5 cde	1.91 cde	8.3
White clover - mowed	0.74 bcd	46.8 bcde	1.95 cde	8
White clover - atrazine .91 kg/ha	0.98 a	79.3 a	3.01 a	8
White clover - glyphosate 1.22 kg/ha	0.84 abc	57.9 abc	2.42 abc	7.4
Ladino clover - untreated	0.68 bcde	43.5 bcde	1.90 cde	8
Ladino clover - mowed	0.76 bcd	52.4 bcd	2.05 bcde	8
Ladino clover - atrazine .91 kg/ha	0.92 ab	78.3 a	2.66 ab	7.5
Ladino clover - glyphosate 1.22 kg/ha	0.67 cde	42.8 bcde	1.90 cde	6
Red clover - untreated	0.54 de	27.9 de	1.56 def	8
Red clover - mowed	0.55 de	25.1 e	1.48 def	8
Red clover - atrazine .46 kg/ha	0.65 cde	39.3 bcde	1.42 ef	8
Red clover - glyphosate .61 kg/ha	0.83 abc	63.9 ab	2.19 bcd	6.3
Alfalfa - untreated	0.72 bcd	22.4 e	1.09 f	7.8
Alfalfa - mowed	0.80 abc	41.7 bcde	1.96 cde	7.7
Alfalfa - atrazine .91 kg/ha	0.72 bcd	52.9 bcd	1.71 cdef	7.5
Alfalfa - glyphosate 1.22 kg/ha	0.64 cde	43.8 bcde	1.52 def	5.8

[a] Harvested September 3-4 1980

[b] Treatments are identical

[c] Total N as % dry weight primary ear leaf.

HERBICIDE EVALUATION IN TOMATOES

W.J. Sanok, J.B. Sieczka and J.F. Creighton[1/,2/]

ABSTRACT

Metribuzin is one of the most promising herbicides for use in transplanted tomatoes (Lycopersicon esculentum Mill.). Over the past several years this material has been used at the Long Island Horticultural Research Laboratory and has resulted in excellent weed control of weeds present which generally are barnyardgrass (Echinochloa crus-galli (L.) Beauv.), crabgrass (Digitaria sanguinalis (L.) Scop.), purslane (Portulaca oleracea L.), and galinsoga (Galinsoga ciliata (Raf.) Blake).

Single applications of metribuzin applied at 0.28, and 0.56 pre-plant incorporated and postemergence provided good to excellent weed control of the weeds present. The combination of pre-plant and postemergence metribuzin gave season-long control. Napropamide at 1.12 kg/ha provided excellent control of crabgrass and galinsoga but was not as effective on barnyardgrass and purslane. Diphenamid at 2.24 kg/ha was not effective on either purslane or barnyardgrass. The combination of metribuzin plus trifluralin applied pre-plant incorporated provided good control of purslane, galinsoga, and crabgrass, and fair control of barnyardgrass.

Several of the treatments were phytotoxic to the tomato plants. The 0.56 kg/ha rate, applied pre-plant incorporated followed by a postemergence application at the same rate resulted in severe damage to all three varieties. This treatment reduced stand by 50 percent whereas a single postemergence application at the 0.56 kg/ha rate reduced plant stand by eight percent. Plants that did survive eventually recovered from the effects of the spray.

INTRODUCTION

The herbicide metribuzin (4-amino-6-tert-butyl-3-(methylthio)-as-triazine-5(4H)-one) is proving to be one of the most effective postemergence treatments for weed control in transplant tomatoes. This chemical has proven to be very effective in controlling a broad spectrum of weeds for most of the growing season.

In experiments conducted on Long Island during the past three years as in other areas, some phytotoxic effects have been noticed resulting in severe damage or event death of tomato plants. If area farmers are to use this effective herbicide, they must be aware of its phytotoxic effects and its relationship to varieties and/or environmental conditions.

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MATERIALS AND METHODS

In 1980 three varieties of tomatoes, 'Early Girl,' 'Springset' and 'Manapal,' were seeded in a greenhouse on April 23 and transplanted to the field on May 28, Prior to transplanting the pre-plant incorporated and pre-plant treatments of herbicides were applied. The soil is a Haven loam soil with less than 2 percent organic matter. Four plants of each variety were spaced 1.2 meters apart in each plot. Experimental design was a split plot with tomato varieties as the main plots and herbicide treatments as subplots. An untreated area was adjacent to each of the treatments. All applications of herbicides were made with a tractor-mounted sprayer delivering 374 l/ha at 2 kg/cm^2. Ratings for phytotoxicity and weed control were made on July 1 and July 30. Weeds present were barnyardgrass, crabgrass, purslane, and galinsoga.

Pre-plant incorporated treatments included metribuzin at 0.28 and 0.56 kg/ha and a tank mix of metribuzin at 0.28 with trifluralin (a,a,a-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine) at 0.56 kg/ha. Metribuzin at 0.28 and 0.56 kg/ha was also applied as a postemergence treatment on June 5. Two combinations of pre-plant incorporated and postemergence metribuzin were included. Napropamide (2-(a-naphthoxy)-N,N-diethylpropionamide) at 1.12 and diphenamid (N,N-dimethyl-2,2-diphenylacetamide) at 2.24 kg/ha treatments were applied pre-plant.

RESULTS AND DISCUSSION

Table 1 is a compilation of results of the phytotoxicity and weed control ratings made on July 1 and July 30 for the three varieties tested. Metribuzin applied postemergence resulted in phytotoxicity to each of the varieties in the trial with a severe damage resulting from the higher rate of application. The multiple application of metribuzin at 0.56 kg/ha resulted in approximately 50 percent reduction in plant stand. In all cases surviving plants did recover from the early damage.

Metribuzin was effective in the control of the weeds present. The combination of the pre-plant incorporated followed by the post-transplant treatment at 0.28 kg/ha provided excellent control of the broadleaf weeds and substantial control of barnyardgrass. Napropamide and diphenamid did not give commercial control of barnyardgrass and purslane. The combination of metribuzin at 0.28 and trifluralin at 0.56 kg/ha pre-plant incorporated gave good control of those weeds present. The differences between chemical treatments for weed control and phytotoxicity ratings on both dates of observation were significant at the one percent level. The main effect of variety and the interaction between variety and chemical treatment were not statistically significant.

For several years now we have observed damage using metribuzin post-transplant on several different varieties. Applications for 1980 were made after several days of cloudy weather and under these conditions the metribuzin, particularly at the 0.56 kg/ha rate, resulted in significant phytotoxicity in tomatoes. Apparently this damage is most severe under these conditions. This material is an excellent tool in a herbicide program but caution must be used to prevent unacceptable damage to the tomato crop.

Table 1. Long Island Tomato Weed Control Results, 1980

Treatment	Rate (kg/ha)	Timing	Ratings[a/] Weed Control 7/1	Weed Control 7/30	Phytotoxicity Early Girl 7/1	Early Girl 7/30[b/]	Spring Set 7/1	Spring Set 7/30[b/]	Manapal 7/1	Manapal 7/30[b/]	% Plant Stand Early Girl	Spring Set	Manapal
napropamide	1.12	pre	7.2	5.1	8.7	8.0	8.3	8.3	8.7	8.3	100	100	100
metribuzin	0.28	ppi	8.4	6.0	9.0	8.7	8.3	8.3	7.3	8.3	100	100	92
metribuzin	0.56	ppi	8.7	6.8	9.0	7.7	7.0	8.0	6.7	8.3	100	100	100
metribuzin	0.28	post	8.8	5.7	9.0	8.7	9.0	8.0	8.7	8.3	100	100	100
metribuzin	0.56	post	9.0	7.6	8.3	8.7	9.0	8.7	8.0	9.0	92	92	92
diphenamid	2.24	pre	6.1	3.6	8.0	8.7	8.7	8.3	8.7	9.0	100	100	100
metribuzin metribuzin	0.28 0.28	ppi post	9.0	7.3	8.0	8.0	7.7	7.7	8.3	8.3	92	100	100
metribuzin metribuzin	0.56 0.56	ppi post	9.0	8.9	5.0	8.7	4.3	8.3	5.7	8.7	42	58	67
metribuzin + trifluralin	0.28 0.56	ppi ppi	8.4	6.6	9.0	8.0	8.7	7.7	9.0	8.7	100	100	100
control			2.6	1.0	9.0	6.7	8.7	6.7	9.0	7.7	100	100	100
0.5 Tukey													

a/ Ratings: Weeds = 1 = no control, 7 = commercial control, 9 = complete control.
Crop = 1 = plant killed, 7 = moderate symptoms, no yield or quality reduction, 9 = no damage.
b/ Ratings made on remaining plants.

EFFECT OF TRIFLURALIN, MH, AND AMINOZIDE ON TOMATO TOLERANCE TO METRIBUZIN

B. B. Messier and R. A. Ashley[1/]

ABSTRACT

In recent studies, trifluralin, preplant incorporated, has been shown to increase soybean tolerance to preplant incorporated applications of metribuzin. Growth chamber experiments were conducted to see if applications of trifluralin to tomato roots or foliage would increase tolerance to foliar applications of metribuzin. Trifluralin acts by inhibiting growth via mitotic inhibition. The effect of two other growth inhibitors, MH and aminozide, on tomato tolerance to metribuzin was examined. MH is a mitotic inhibitor and aminozide is thought to inhibit gibberellin synthesis and has been used in the bedding plant industry to produce stockiness in tomato transplants.

A three day pretreatment with trifluralin 5ppm in the nutrient solution increased tomato 'Heinz 1350' tolerance to foliar applications of metribuzin 0.56 kg ai/ha. Prior to metribuzin application, trifluralin was observed to cause clubbing of root tips, (gH_2O/gfw) to 64 percent of control, and decrease in fresh weight gain to 61 percent of control. Fresh weight loss due to metribuzin was 3 percent with trifluralin pretreatment compared to 50 percent in controls.

Foliar pretreatment with both MH 0.2% w/v and aminozide 0.5% w/v caused significant reduction in fresh weight gain compared to untreated plants but no differences in water uptake (gH_2O/gfw) after three days. MH treatments caused clubbing of root tips. MH increased tomato tolerance to metribuzin. Three days after metribuzin treatment, fresh weight gain of plants receiving no pretreatment was reduced 83 percent compared to 27 percent with MH pretreatment.

Aminozide did not significantly increase tomato tolerance to metribuzin and in one test appeared to have an additive effect.

When trifluralin 1.1 kg ai/ha was applied to the foliage, a three day pretreatment caused root clubbing (gH_2O/gfw) but had no effect in increasing tomato tolerance to metribuzin. Percent reduction in fresh weight gain due to metribuzin was 75 percent in control plants and 72 percent in the foliar trifluralin pretreatments.

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EVALUATION OF HERBICIDES IN ONIONS ON LONG ISLAND

J.B. Sieczka, J.F. Creighton, and W.J. Sanok[1/,2/]

ABSTRACT

Several pre- and postemergence herbicides were used alone and in combinations to attempt to attain season-long weed control in onions (Allium cepa L.). Both preemergence and postemergence applications of herbicides are necessary for the long season of growth and for broad spectrum weed control in this crop.

The most effective treatment was DCPA applied preemergence followed by two postemergence applications of diclofop and nitrofen. Preemergence applications of DCPA, pendimethalin and propachlor all required postemergence applications of nitrofen to obtain good to excellent weed control. Propachlor alone at 4.4 kg/ha pre- and postemergence did not provide adequate weed control through the season. Pendimethalin applied preemergence resulted in phytotoxicity to the crops.

INTRODUCTION

Onions are raised on a very limited acreage on sandy loam soils on Long Island. Although it is a minor crop, it is still an important crop for a number of farmers and weed control is one of the most essential practices to produce a crop economically. Unfortunately, in 1980 nitrofen (2,4-dichlorophenyl-p-nitrophenyl ether) was withdrawn from the market. This material used at low rates controls newly emerging problem weeds, particularly the grasses, galinsoga, and pineapple weed. Efforts need to be continued to try and find a good substitute for this material.

MATERIALS AND METHODS

In 1980 a trial was conducted on a Haven loam soil at the Long Island Horticultural Research Laboratory at Riverhead. The onion variety Rocket was direct seeded on April 15 using a Stan Hay planter with four rows per bed with the seed being distributed five centimeters apart. The treatments were approximately eight meters long with a one-meter check area adjacent to each of the treatments. Preemergence applications were applied on May 2 and postemergence applications applied June 11 and July 14. Prior to any of the postemergence treatments all onions were cultivated and weeds hand pulled, so essentially treatments were postemergence to the crop but preemergence to weeds. All applications of chemicals were made with a tractor-mounted sprayer delivering 374 l/ha at 2 kg/cm^2 with four replications.

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The preemergence applications included DCPA (dimethyl tetrachloroterephthalate) at 6.72 kg/ha; propachlor (2-chloro-N-isopropylacetanilide) at 4.48 and 6.72 kg/ha; pendimethalin (N-(1-ethylpropyl)-3,4-dimethyl-2, 6-dinitrobezenamin) at 1.12, and 1.68 kg/ha. Tank mix combinations applied preemergence were nitrofen at 3.36 kg/ha with pendimethalin at 1.12 or 1.68, and DCPA at 6.72 plus diclofop (2-(2,4-dichlorophenoxy)phenoxy)propanoic acid) at 1.12 or 2.24 kg/ha. Postemergence applications included DCPA at 6.72 kg/ha; propachlor at 4.48 kg/ha; diclofop at 1.12, 2.24 kg/ha; and nitrofen at 3.36 kg/ha. In two treatments diclofop and nitrofen were used as tank mixes for postemergence applications. Many of the treatments were followed by postemergence applications of nitrofen at 3.36 kg/ha.

All treatments were hand hoed and existing weeds pulled prior to the postemergence applications of June 11 and July 14. Principal weeds present in experimental area were crabgrass (*Digitaria sanguinalis* (L.) Scop.), barnyardgrass (*Echinochloa crus-galli* (L.) Beauv.), purslane (*Portulaca oleracea* L.), galinsoga (*Galinsoga ciliata* (Raf.) Blake), and pineappleweed (*Matricaria matricarioides* (Less.) Porter). Other weeds present were groundsel (*Senecio valgaris* L.), wild radish (*Raphanus raphanistrum* L.) lambsquarter (*Chenopodium album* L.), smartweed (*Polygonum pensylvanicum* L.), prostrate pigweed (*Amaranthus blitoides* S. Wats), chickweed (*Cerastium vulgatum* L.), fall panicum (*Panicum dichotomiflorum* Michx.)

RESULTS AND DISCUSSION

Weed control and phytotoxicity ratings are listed in Table 1. The most effective treatments included the use of DCPA applied preemergence, followed by two postemergence applications of diclofop and nitrofen. Premergence applications of DCPA, pendimethalin and propachlor all required postemergence applications of nitrofen to obtain good to excellent weed control. Propachlor alone at 4.48 kg/ha, applied pre- and postemergence, did not provide adequate weed control for the season and required additional application of nitrofen July 14.

Pendimethalin applied preemergence at 1.68 kg/ha and combinations of pendimethalin and nitrofen resulted in phytotoxicity to the onions. The combinations resulted in the most severe phytotoxicity to the crop.

Onion yield was lowest in the untreated area which was hand weeded at the same times as the chemical plots (see Table 1). As a crop, onions do not compete well with weeds and severe stunting and crop loss results if weeds are not adequately controlled, either through the use of herbicides or hand weeding. The loss of an effective material such as nitrofen makes it essential that we look for alternatives in controlling weeds in this crop.

Table 1. Long Island Onion Weed Control Results, 1980

Treatment			Weed Control Ratings[a/]					Phytotoxicity Rating[a/]			Yield
Material	Rate (kg/ha)	Date	5/19	6/5	7/1	7/31	8/29	5/19	6/5	7/1	(kg/plot)
DCPA[a/]	6.72	5/2	7.5	7.3	7.8	8.0	6.5	9.0	8.8	8.8	22.0
DCPA DCPA[b/]	6.72 6.72	5/2 6/11	7.8	8.0	7.5	8.3	7.5	9.0	9.0	9.0	27.1
pendimethalin[a/]	1.12	5/2	8.3	8.5	7.8	7.5	6.3	8.3	8.8	8.8	26.3
pendimethalin[a/]	1.68	5/2	8.3	8.3	8.3	8.5	7.8	7.8	6.5	6.5	21.8
pendimethalin + nitrofen(TM)[b/]	1.12 3.36	5/2	9.0	9.0	8.0	7.8	5.8	4.3	6.8	7.5	19.9
pendimethalin + nitrofen(TM)[b/]	1.68 3.36	5/2	8.8	8.0	7.8	7.5	5.8	4.8	6.8	6.3	23.0
propachlor[a/]	4.48	5/2	8.5	8.0	7.3	7.0	6.0	9.0	8.0	7.0	21.6
propachlor[a/]	6.72	5/2	8.8	8.0	7.8	6.8	5.3	9.0	8.8	9.0	24.5
propachlor propachlor[b/]	4.48 4.48	5/2 6/11	9.0	8.5	6.3	7.5	6.0	9.0	9.0	8.5	24.8
propachlor propachlor propachlor	4.48 4.48 4.48	5/2 6/11 7/14	9.0	7.8	5.8	6.0	3.0	9.0	8.8	8.0	22.0
propachlor + DCPA(TM)[b/]	4.48 6.72	5/2	8.8	8.8	8.0	8.0	7.0	8.5	8.8	8.3	24.8
DCPA + diclofop(TM)[b/]	6.72 1.12	5/2	7.8	7.5	8.5	8.5	7.8	8.5	8.8	9.0	26.5
DCPA + diclofop(TM)[b/]	6.72 2.24	5/2	7.5	8.0	8.3	8.8	7.8	7.8	7.8	7.0	25.1
DCPA diclofop + nitrofen(TM)	6.72 1.12 3.36	5/2 6/11,7/14	8.0	7.5	8.0	8.5	7.5	9.0	8.8	8.0	24.1
DCPA diclofop + nitrofen(TM)	6.72 2.24 3.36	5/2 6/11,7/14	8.3	8.0	8.0	9.0	7.8	9.0	9.0	8.3	26.1
Control			6.0	3.5	2.5	5.5	1.0	9.0	8.8	8.3	18.1
$D_{(.05)}$ Waller Duncan			0.8	0.8	1.2	0.8	1.0	0.6	0.8	2.0	(n.s.)

a/ Ratings: Weeds = 1 = no control, 7 = commercial control, 9 = complete control.
Crop = 1 = crops killed, 7 = moderate symptoms, no yield or quality reduction, 9 = no damage.
b/ Nitrofen 3 lbs AIA applied 6/11 and 7/14.

WEED CONTROL FOR EGGPLANTS GROWN ON CLEAR PLASTIC MULCH

S.F. Gorske [1/]

ABSTRACT

Several herbicides were evaluated for weed control and eggplant phytotoxicity when used under a clear plastic mulch. Only the high rates of alachlor and DCPA provided satisfactory weed control 30 days after treatment (Table 1).

Although not statistically significant, metolachlor was somewhat phytotoxic to eggplants. Yield data revealed that metolachlor significantly reduced the total number and weight of fruit harvested.

Alachlor caused little or no apparent phytotoxicity to the eggplants and did not significantly reduce total yields. Eggplants treated with DCPA, Napropamide and R23758 were some of the highest yielding treatments. No significantly differences existed between the two formulations (WP and 4F) of napropamide.

There was no significant difference as to earliness of first harvest when comparisons were made between treatments.

Most treatments provided unacceptable weed control in 1980. However the presence of weeds was not enough to significantly reduce yields when compared to the weed free black plastic treatment.

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Table 1. Weed Control and Yield Data for Eggplants Grown on Clear Plastic Mulches.

TREATMENT	METHOD[2]	Kg/HA	CROP PHYTO-TOXICITY[1]	WEED RATING[1]	TOTAL FRUIT NO.	TOTAL FRUIT WT. (Kg)
Vorlex W/ Clear Plastic	-	280 (L/HA)	8.7	1.0	26.5	26.2
Clear Plastic	-	-	9.7	2.3	18.7	25.3
Black Plastic	-	-	10.0	10.0	52.0	81.2
Trifluralin	PPI	1.12	10.0	1.7	58.0	87.9
Metolachlor	PPI	2.24	9.0	4.3	42.7	56.2
Metolachlor	PPI	1.12	7.5	4.0	34.0	25.0
Alachlor	PPI	1.12	10.0	6.7	61.7	71.5
Alachlor	PPI	2.24	9.0	8.3	63.7	109.9
DCPA	PRE	8.40	10.0	8.0	72.0	106.7
DCPA	PRE	11.20	10.0	9.0	60.7	71.7
Oryzalin	PRE	.84	8.3	3.0	30.3	48.7
Oryzalin	PRE	1.12	9.3	2.0	36.7	47.8
Napropamide WP	PPI	2.24	10.0	7.5	70.7	91.9
Napropamide 4F	PPI	2.24	10.0	3.7	66.7	117.6
R23758	PPI	2.24	10.0	7.0	76.7	116.0
LSD 5%			NSD	1.57	15.14	61.06

1/ A visual rating scale was used with
1 = no weed control, complete crop kill,
10 = total weed control, no phytotoxicity

2/ PPI = preplant incorporated
PRE = preplant but not incorporated

3/ Statistical significance is according to Duncan's Multiple Range Test.

GLYPHOSATE FOR BERMUDAGRASS CONTROL IN ASPARAGUS

C. E. Beste and W.F. Jeffers[1/]

Asparagus in the Mid-Atlantic area has bermudagrass (Cynodon dactylon (L.) Pers.) that is not adequately controlled by the preemergence and post-harvest herbicides diuron, simazine, metribuzin, and 2,4-D. Dalapon is registered for bermudagrass control in asparagus; however, glyphosate was selected for this study because it received a registration for asparagus in 1978. Bermudagrass occurs in asparagus on the Delmarva Peninsula occasionally because this is the most southern area of asparagus production in the United States while it is the northern boundary of the area where bermudagrass can be a weed problem. The objective of this study was to determine if bermudagrass could be controlled in asparagus with glyphosate.

The study was conducted in Wicomico Co., Maryland on a 12 year old established asparagus field (5 ft row width) of three acre size on a Fallsington sandy loam of 1.0% organic matter. Treatments were applied with a tractor-mounted sprayer with a roller pump and a 15 ft. boom with flat fan spray tips of 8003 size. The spray volume was 25 gal/A at 32 psi and 3 mph. The asparagus rows had a 12 inch high ridge of soil which was formed by cultivation during the spring of 1978. The spray boom operated 19 inches above the top of the ridged rows and a nozzle was directly over each row. The sprayer provided 95% coverage of the 8 to 10 inch tall bermudagrass foliage with the glyphosate treatment on June 10, 1978 and the spray coverage was 100% in 1979. In June of 1978 and 1979, the asparagus was cut immediately prior to glyphosate treatments and asparagus spears that remained were less than 3 inches tall. Glyphosate treatments were made when the wind was less than 3 mph, and rainfall occurred more than 2 days after treatment each year. One cultivation and fertilizer sidedress was made after the glyphosate treatment in 1978 and the cultivation was omitted in 1979 and 1980 with a topdress application of fertilizer. Prior to the harvesting season, the field was disced in 1978, however, the field was not disced in 1979 or 1980. Table 1 contains the growth response of asparagus and bermudagrass to sequential treatments during 1978, 1979 and 1980.

In 1978, poor bermudagrass control was obtained because rhizome pieces were buried which were not treated and they sprouted after the treated foliage died. The cultivation after treatment also cut rhizomes into segments which sprouted. Some broadleaf weeds such as lambsquarters interfered with the glyphosate spray in 1978. Apparently, most of the rhizomes sprouted during the summer, 1978 and spring, 1979 because the glyphosate treatment in June, 1979 provided 99% control of bermudagrass. The omission of all tillage in 1979 and 1980, which prevented formation of rhizome segments, appeared to improve bermudagrass control. The application of diuron in 1978 and 1979 may have also improved the bermudagrass control in 1980 and the rhizomes may have been more susceptible to winter injury following the herbicidal treatments. Diuron appeared to control seedling bermudagrass.

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Table 1. Chronology of herbicide treatments in established asparagus and bermudagrass control and crop injury evaluations in a Fallsington sandy loam.

Date	Treatment Herbicide	Lb/A	% Control Bermudagrass 1/	% Injury Asparagus 2/
1978				
June 10	glyphosate (3E)	3.75	0	0
July 20	--- --	----	85	3%
Aug. 23	--- --	----	55	1%
1979				
June 12	glyphosate (3E) + diuron (80W)	3.75 + 2.4 3/	40	0
Aug. 16 4/	---	----	99	1%
1980				
April 7	diuron	2.4	----	-
June 10	diuron	2.4	99.5	0
Aug. 20	---	---	99.5	0

1/ Based on the solid mat of bermudagrass which was 4 to 12 inches tall and covered 70% of the soil surface in the 3 A field. Ratings were made by a visual survey while walking over the entire field

2/ Based on malformed fern growth with chlorotic leaves or distorted growth.

3/ Applied as separate sprays.

4/ On July 25, spot spraying of about 20 escaped bermudagrass stems was made with a 1 1/2% solution of glyphosate.

This study has shown that modification of cultural practices improved the effectiveness of glyphosate for bermudagrass control in asparagus. Two applications of glyphosate effectively erradicated bermudagrass from established asparagus. The grower had considered destroying the asparagus bed prior to the treatments; however, yields have now resumed to normal levels. The summer of 1980 was the hottest and driest on record, yet the asparagus ferns were the largest and most lush that the grower has every observed. The asparagus fern canopy density increased 3-fold from 1977 to 1980 with the elimination of bermudagrass competition.

In 1977, the weed population was 90% bermudagrass with 7% common lambsquarters (*Chenopodium album* L.) and 3% trumpetcreeper (*Campsis radicans* (L.)Seem.). In 1980, the lambsquarters control was 100% and trumpetcreeper control was 50%.

TRIFLURALIN AND BENSULIDE IN COMBINATION WITH ALACHLOR, DCPA, AND NITROFEN IN CABBAGE

D. Vitolo, R. D. Ilnicki, and P. Chitapong[1]/

ABSTRACT

Trifluralin and bensulide alone, and in various combinations with DCPA, alachlor, and nitrofen, were evaluated in 1978 and 1979 for their effects on weed control and yield in cabbage. In 1978 excellent broad spectrum weed control was provided by preplant incorporated trifluralin followed sequentially by post transplanting alachlor at rates of 0.5 to 0.75 plus 1.5 to 3.0 lb/A, respectively, for trifluralin and alachlor, and preplant incorporated bensulide followed sequentially by post transplanting alachlor at rates of 4.0 to 5.0 + 1.5 to 2.0 lb/A, respectively. No other treatments provided adequate control of common ragweed, which was a severe problem in 1978. Significant yield increases were obtained with alachlor at rates of 0.75 + 2.0 lb/A and 0.75 + 3.0 lb/A, and with bensulide followed by alachlor at a rate of 5.0 + 1.5 lb/A.

In 1979, velvetleaf was the primary problem weed. Excellent weed control was obtained with trifluralin followed by alachlor at all rates evaluated, with trifluralin followed sequentially by nitrofen at all rates evaluated, and with bensulide followed by nitrofen at the rate of 5.0 + 4.5 lb/A.

Crop injury was sustained at all rates of trifluralin followed by alachlor.

Significant yield increases were obtained at all rates of trifluralin followed by nitrofen.

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HERBICIDE EVALUATION IN CABBAGE ON LONG ISLAND

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ABSTRACT

Transplanted cabbage (Brassica oleracea cv. Capitata (L.)) was treated with various herbicides pre-plant incorporated, preemergence and early post-emergence for evaluation for control of crabgrass (Digitaria sanguinalis) (L.) Scop.), barnyardgrass (Echinochloa crus-galli (L.) Beauv.), lambsquarter (Chenopodium album L.), and purslane (Portulaca oleracea L.). Cabbage variety A & C #5 Plus was transplanted on August 1. Pre-plant incorporated and preemergence treatments were applied one day prior to the transplanting and the early postemergence treatments applied August 6.

The best treatment for control of broadleaf weeds, purslane and lambs-quarter, was the combination of trifluralin, pre-plant incorporated at 0.84 kg/ha followed by early postemergence application of nitrofen at 3.36 kg/ha. Alachlor at 0.56 and 1.12 kg/ha and pendimethalin at 1.68 kg/ha provided fair control of these weeds. Good to excellent barnyardgrass control was achieved by using pre-plant incorporated treatments of pendimethalin at 1.68 kg/ha, napropamide at 1.12 and 2.24 kg/ha, metolachlor at 0.56, 1.12 and 1.68 kg/ha. The postemergence application of KK80 gave excellent control of barnyardgrass. Postemergence treatments of metolachlor and alachlor provided good control of this weed. Crabgrass control was good to excellent with most of the materials used.

The early postemergence application of pendimethalin at 1.68 kg/ha resulted in phytotoxicity to the cabbage. The damage was not evident right after application but was noticeable three weeks later. By mid-September the cabbage plants were recovering but the plants still appeared stunted.

INTRODUCTION

Transplanted crucifers are produced on approximately 3,000 acres on eastern Long Island. Much of the cabbage and cauliflower is raised on fields following potatoes and weeds, particularly barnyardgrass, can be a problem. This trial was conducted to evaluate some of the standard herbicide treatments with some of the new chemicals that are being developed for use on crucifers. With the withdrawal of nitrofen (2,4dichlorophenyl-o-nitrophenyl ether) from use on these crops it is important to continually look for new materials, particularly herbicides that can be used postemergence to control problem weeds.

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MATERIALS AND METHODS

The cabbage variety A & C #5 Plus was seeded on July 2 and transplanted on August 1 on a Haven loam soil at the Long Island Horticultural Research Laboratory. The soil contains less than 2% organic matter. Prior to transplanting, the field was laid out for the herbicide experiment and pre-plant incorporated treatments were applied and disced in on July 31. The pre-plant incorporated treatments included DCPA (dimethyl tetrachloroterephthalate) at 6.72 kg/ha; trifluralin (a,a,a-trifluoro-2,6-dinitro-N,N-dipropyl-o-toluidine) at 0.84 kg/ha; napropamide (2-(α-naphthoxy)-N,N,-diethylpropionamide) at 1.12 and 2.24 kg/ha; metolachlor (2-chloro-N-(2- ethyl-6-methylphenyl)-N-(methoxy-1-methyl)-a,a,a-trifluoro-2,6-dinitro-Npropyl-p-toluidine) at 0.56, 1.12, and 1.68 kg/ha; and pendimethalin (N(1-ethylpropyl)-3,4-dimethyl-2, 6-dinitrobezenamin) at 1.68 kg/ha. Postemergence applications applied on August 6 included metolachlor at 0.56, 1.12, and 1.68 kg/ha; pendamethalin at 1.68 kg/ha; alachlor (2-chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide) at 0.56 and 1.12 kg/ha; and KK80 at 1.12 kg/ha.

All applications were made with a tractor-mounted sprayer delivering 374 l/ha at 2 kg/cm^2. Treatments were two rows wide by eight meters long, with four replications. Ratings for phytotoxicity and weed control were made on August 14, August 29, and September 18.

RESULTS AND DISCUSSION

The only treatments that resulted in good long-term control of purslane and lambsquarter were the postemergence application of pendimethalin at 1.68 kg/ha and the combination of trifluralin at 0.84 kg/ha pre-plant incorporated followed by nitrofen postemergence at 3.36 kg/ha. Alachlor at 0.56 and 1.12 kg/ha provided fair early weed control but did not result in long-term control. Crabgrass control was good to excellent with most of the herbicides used. However, barnyardgrass was not adequately controlled with the pre-plant incorporated treatment of DCPA at 6.78 kg/ha. DCPA, followed by KK80 postemergence and KK80 alone at 1.12 kg/ha resulted in excellent control of barnyardgrass. Good to excellent control of this species resulted from the use of pendimethalin, trifluralin, napropamide, metolachlor, and the high rate of alachlor. These treatments continued to provide control for more than six weeks.

Early postemergence applications of pendimethalin at 1.68 kg/ha resulted in the most severe phytotoxicity ratings. Damage was not apparent on August 14 but was readily seen three weeks later. The plants were stunted, had brittle leaves and prominent veins. By September 18, the cabbage plants were recovering but rate of growth was slow and damage was still evident.

Season-long control of a broad spectrum of weeds on a commercial basis has been achieved by a postemergence application of nitrofen. The loss of this material in 1981 will have an effect on good weed control in cabbage fields.

Table 1. Long Island Cabbage Weed Control Ratings[a/], 1980

Treatment	Rate (kg/ha)	Timing	Weed Control: Broadleaves 8/14	Broadleaves 8/29	Broadleaves 9/18	Grasses 8/14	Grasses 8/29	Grasses 9/18	Phytotoxicity 8/14	Phytotoxicity 8/29	Phytotoxicity 9/18
control			4.8	1.5	1.3	6.8	5.5	3.0	9.0	8.5	8.5
DCPA	6.72	ppi	4.8	2.0	1.3	6.8	6.0	5.5	8.5	7.5	8.0
DCPA KK80[b/]	6.72 1.12	ppi post	5.5	2.5	2.0	9.0	9.0	9.0	9.0	8.5	8.8
pendimethalin	1.68	ppi	6.5	5.0	3.0	8.3	8.3	7.8	9.0	8.0	8.8
trifluralin nitrofen	0.84 3.36	ppi post	9.0	8.3	7.8	8.5	8.3	7.5	8.8	8.3	9.0
napropamide	1.12	ppi	6.0	4.3	3.5	8.0	7.0	7.3	8.5	7.8	8.5
napropamide	2.24	ppi	6.5	5.0	3.5	8.0	7.5	7.3	8.8	8.0	9.0
metolachlor	0.56	ppi	5.0	2.8	1.0	9.0	8.3	8.5	9.0	8.0	8.3
metolachlor	1.12	ppi	6.0	4.3	2.8	8.8	8.5	8.0	9.0	7.8	8.5
metolachlor	1.68	ppi	6.5	4.0	1.5	9.0	9.0	8.8	8.3	6.8	8.5
metolachlor	0.56	post	6.0	3.3	1.0	7.8	7.8	7.0	9.0	8.3	8.3
metolachlor	1.12	post	6.5	4.5	1.3	8.0	8.3	7.8	8.3	7.3	8.3
metolachlor	1.68	post	6.5	4.0	3.0	8.5	9.0	8.5	9.0	8.3	9.0
pendimethalin	1.68	post	7.3	8.0	7.3	8.0	8.0	7.8	9.0	3.8	5.8
alachlor	0.56	post	7.8	5.0	2.8	7.8	7.8	6.8	9.0	8.8	8.8
alachlor	1.12	post	8.0	6.8	5.5	8.0	7.8	7.5	8.3	7.8	8.5
KK80 [b/]	1.12	post	6.3	2.0	1.5	9.0	9.0	9.0	9.0	8.5	8.3
$D_{(.05)}$ Waller-Duncan			(1.3)	(1.6)	(2.0)	(0.9)	(1.2)	(1.7)	(ns)	(1.0)	(1.0)
pendimethalin[c/]	1.68	pre	8.0	7.0	6.5	7.5	7.0	6.8	8.0	8.0	8.0

a/ Ratings: Weeds = 1 = no control, 7 = commercial control, 9 = complete control.
Crop = 1 = crop killed, 7 = moderate symptoms, no yield or quality reduction, 9 = no damage.
b/ Applied in combination with Ortho experimental surfactant at 0.25%.
c/ Only 2 replications, not included in analysis of variance.

WEED CONTROL FOR CABBAGE, CAULIFLOWER, AND BROCCOLI USING ALACHLOR AND NAPROPAMIDE

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ABSTRACT

Few herbicides are registered for use on cole crops, and especially now that Nitrofen has been removed from the market. Additional materials are needed which will provide effective season-long weed control without causing crop injury. Therefore, a fall crop field experiment was conducted in 1980 at the Rock Springs Horticulture Research Farm to obtain efficacy, yield, and residue data when two promising preemergence herbicides were applied to cabbage, cauliflower, and broccoli transplants.

Treatments included 1.1, 2.2, and 4.4 kg/ha (ai) rates of napropamide and alachlor applied over the top of the newly set transplants and immediately given 1.3cm of sprinkler irrigation.

'Market Prize' cabbage, 'Snow Crown' cauliflower, and 'Green Comet' broccoli were transplanted in rows 91cm apart on July 24 in a Murrill silt loam soil (pH 6.8, OM 2%). Cabbage plants were set 23cm apart and the others 46cm apart in 12m rows using a RCBD with four replications. Herbicides were applied in a 51cm band using a CO_2 pressurized hand sprayer that delivered 262 l/ha at 35 psi.

When the preemergence treatments were applied on July 24 the soil was dry to a depth of several inches. It was therefore imperative to irrigate to obtain good plant stands and thus earlier plans for shallow mechanical incorporation were dropped.

Predominate weed species were common lambsquarters (Chenopodium album L.), redroot pigweed (Amaranthus retroflexus L.), and galinsoga (Galinsoga spp.), yield data, and general visual ratings of weed control and crop injury are given in Table 1.

For residue data three heads were selected per replications/treatment combination in the check and 4.4 kg/ha treatments and 1/4 of the tissue was frozen for later analysis. In the case of cabbage 5 outer leaves per replication/treatment combination in the check and 4.4 kg/ha treatments were also frozen for later residue analysis.

Results indicate that both materials gave barely acceptable control of weeds present when applied at the 1.1 kg/ha rate. Excellent weed control was obtained with both materials applied at the 2.2 and 4.4 kg/ha rates.

Moderate injury of the three crops resulted with alachlor at the 4.4 kg/ha rate. This was evident by reduced plant growth early in the season, delayed maturity, and reduced yields.

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Table 1. Yield and weed control for broccoli, cabbage, and cauliflower using alachlor and napropamide.

Treatment	Rate kg/ha	Mean Yield kg/plot Broccoli	Cabbage	Cauliflower	Weed[a] Rating	Injury[b] Rating
Untreated Check	--	1.9	5.2	4.0	8	1
Alachlor	1.1	2.2	10.0	6.8	4	1
Alachlor	2.2	1.4	9.6	7.2	2	1
Alachlor	4.4	1.4	10.2	5.9	1	5
Napropamide	1.1	2.8	8.0	7.2	5	1
Napropamide	2.2	2.5	9.0	9.0	2	1
Napropamide	4.4	2.4	12.4	9.0	1	1

[a] 1 = No weeds, 10 = 100% weed coverage. Ratings made all weeds combined.

[b] 1 = No injury, 10 = complete crop destruction.

NEW HERBICIDES FOR KALE AND COLLARDS

C. E. Beste[1/]

ABSTRACT

Studies for two years on a Norfolk loamy sand (1.0% O.M.) have shown that metolachlor 1.0 and 1.5 lb/A preemergence was efficacious for kale (Brassica oleracea L. var. acephala) and collards (Brassica oleracea L. var. acephala). However, metolachlor 3.0 lb/A caused severe injury. Alachlor was efficacious at 1.0 and 1.5 lb/A, however, 2.0 lb/A caused unacceptable injury. Turnip tops (Brassica rapa L.) 'Seven top' were tolerant to metalachlor 1.0 and 1.5 lb/A preemergence; however, 3.0 lb/A caused a significant yield reduction. Alachlor was effective at 1.0 and 1.5 lb/A also. Mustard green (Brassica juncea (L.) Coss.) was the most sensitive crop and metolachlor or alachlor at 1.0 lb/A was acceptable. For early harvest, of all the greens, only the 1.0 lb/A rates of alachlor or metolachlor were acceptable because of early stunting at the 1.5 lb/A rates.

Knawel (Scleranthus annuus L.) was controlled by alachlor and metolachlor in these fall plantings.

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WEED CONTROL IN LIMA BEANS

C. E. Beste[1/]

ABSTRACT

Annual morningglory (Ipomoea spp.) is a serious weed problem in lima beans because the seeds, both mature and immature are difficult to separate from the green lima bean seed. A study was conducted in 1980, under irrigation, on a Norfolk loamy sand (0.6% O.M.) with 'Bridgeton' baby lima beans planted July 21. Postemergence treatments were applied on August 14 when the lima bean stage-of-growth was 5 fully-expanded trifoliate leaves and 6 to 7 inches tall. Annual morningglory plants were 1 to 10 inches in length and had 2 cotyledons to 10 leaves. Seed of entireleaf (Ipomoea hederacea (L.)Jacq. var. integriuscula) and small white (Ipomoea lacunosa L.) morningglory were incorporated before planting lima beans. Fall panicum (Panicum dichotomiflorum Michx.) was seeded and on August 14 the stage-of-growth was 1 to 4 leaves, 2 to 6 inches tall.

BAS-9052 at 0.06, 0.1 and 0.2 lb/A plus oil did not provide acceptable fall panicum control when foliar coverage of the grasses was complete. Metolachlor at 1.25 and 1.50 lb/A preemergence (pre) in combination with dinoseb 3.0 lb/A provided acceptable grass control. However, metolachlor 1.25 lb/A preplant incorporated (ppi) in combination with dinoseb, 3.0 lb/A did not control fall panicum but 1.5 lb/A metolachlor was acceptable. Alachlor at 1.25 and 1.5 lb/A pre or ppi in combination with dinoseb, pre at 3.0 lb/A provided acceptable grass control. SN 80786 at 0.5 and 1.0 lb/A pre or ppi in combination with dinoseb 3.0 lb/A did not control fall panicum. None of the above treatments provided acceptable morningglory control.

Trifluralin or profluralin at 1.0 lb/A ppi provided adequate control of morningglory to obtain yields equivalent to the handweeded control; whereas, 0.5 lb/A rates did not control morningglory and yield losses occurred. Postemergence treatments were applied over trifluralin, ppi, for grass control. Acifluorfen postemergence, at 0.06, 0.125 and 0.25 lb/A controlled morningglory and caused 18, 38, and 60% foliar necrosis, respectively; however, acceptable bean yields were obtained but, 0.5 lb/A caused unacceptable yield reductions. Postemergence 2,4-DB at 0.05, lb/A did not control morningglory and 0.1 and 0.2 lb/A controlled morningglory but caused yield losses. Bromoxynil, postemergence, 0.05 and 0.1 lb/A controlled morningglory without yield loss. 2,4-D amine 0.1 lb/A postemergence caused unacceptable yield losses. Dinoseb 0.375, 0.75 and 1.125 lb/A postemergence provided acceptable morningglory control and lima bean yields. Acifluorfen and dinoseb combinations were not more injurious than either alone.

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HERBICIDES FOR NARROW-ROW SNAP BEANS

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ABSTRACT

Narrow-row snap beans have increased yields by 20 to 50%. Since cultivation is not used, new weed control programs must be developed to eliminate competition from those weeds which are normally controlled by cultivation. This study is a continuation of research started in 1979.

'GV 2' snap beans were planted on June 16, 1980 in 18 inch row widths on a Norfolk loamy sand (0.6% O.M.). Postemergence treatments were applied July 8 when snap beans had two trifoliate leaves. An intense downpour of 0.16 inches total rainfall occurred immediately after the postemergence treatments. The most prevalent weeds in the trial were yellow nutsedge (Cyperus esculentus L.), common ragweed (Ambrosia artemisiifolia L.), common lambsquarters (Chenopodium album L.), goosegrass (Eleusine indica L.) and large crabgrass (Digitaria sanguinalis L.).

Dinoseb, pre, 3.0 lb/A alone did not control yellow nutsedge, ragweed or lambsquarters although early weed suppression was observed. Metolachlor, pre, at 0.5, 1.25 and 1.5 lb/A plus dinoseb, pre, 3.0 lb/A did not control ragweed or lambsquarters. Metolachlor, ppi, at 1.25 and 1.5 lb/A plus dinoseb, pre, provided acceptable control of lambsquarters but not ragweed. Metolachlor, pre and ppi, provided excellent control of nutsedge but alachlor, pre, 0.5 lb/A did control nutsedge. Diclofop, pre, 1.0 lb/A provided excellent control of crabgrass and goosegrass. Diclofop, pre, 1.0 lb/A in combination with dinoseb, post, at 0.375, 0.75 and 1.5 lb/A all provided good ragweed control, however, only the 1.5 lb/A rate controlled lambsquarters acceptably. The high rate of dinoseb burned plants but the yield was not affected. Diclofop, pre, 1.0 lb/A plus bentazon, post, 0.75 lb/A did not control lambsquarters or ragweed probably due to rainfall immediately after treatment. EPTC, ppi, at 3.0 4.0 and 6.0 lb/A provided better yields than cycloate, ppi at the same rates and both provided good grass and broadleaf weed control. Cycloate at the high rate reduced seedling vigor. EPTC, ppi,3.0 lb/A plus dinoseb, pre, 3.0 lb/A provided excellent weed control and the best yield of the study. BAS 9052 plus oil, post, at 0.1 and 0.3 lb/A provided excellent goosegrass control but poor crabgrass control. KK-80, post, 0.5 lb/A provided excellent goosegrass and crabgrass control. KK-80 or BAS 9052 tank mixed with bentazon, post, 0.75 lb/A were not antagonistic. Apparently KK-80 had better soil residual than BAS 9052. Profluralin, ppi, 0.5 lb/A provided good early goosegrass, crabgrass and lambsquarters control. Acifluorfen, post, 0.15 lb/A provided adequare weed suppression without snap bean injury for normal yields. Fluchloralin, ppi, 0.5 lb/A provided good early goosegrass, crabgrass and lambsquarters control.

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WEED CONTROL IN CUCUMBERS IN NORTHWEST OHIO

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ABSTRACT

Several new herbicides were evaluated in Northwest Ohio in 1979 and 1980, for potential use in cucumbers. Standard herbicides, bensulide and naptalam, were tested alone and in combination to determine maximum efficacy with registered materials. Ethalfluralin was identified as a promising candidate for use with cucumbers, although it did not control black nightshade when applied as a preemergence treatment. Bentazon postemergence was phytotoxic to cucumbers when applied at the one-leaf stage of development but was tolerated when application was delayed until the three-leaf stage. Cucumbers tolerated diclofop postemergence, and may be useful where annual grasses are a major problem. None of the approved herbicides: chloramben methyl ester, bensulide, or naptalam, provided acceptable season-long weed control. The need for new herbicide registrations for cucumbers is discussed.

INTRODUCTION

Bensulide (O,O-diisopropyl phosphorodithioate S-ester with N-(2-mercaptoethyl) benzenesulfonamide), and naptalam (N-1-naphthylphtalamic acid), have been the standard herbicides for cucumbers (*Cucumis sativus* L.) for several years. Bensulide has been reported to give poor control of redroot pigweed (*Amaranthus retroflexus* L.)(7); and naptalam has been reported to give erratic weed control (3, 9). Combinations of bensulide and naptalam have reduced cucumber yield (7) or been inferior to other treatments (10). The methyl-ester formulation of chloramben (3-amino-2, 5-dichlorobenzoic acid) had received commercial acceptance, in spite of studies which indicated phytotoxicity if heavy rain fell after preemergence application (1, 6). However, chloramben methyl-ester is no longer available and a replacement herbicide is badly needed for cucumbers.

Ethalfluralin (N-ethyl-N-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoromethyl) benzenamine) appears to have potential for use in cucumbers (2, 8, 10, 11). Bentazon (3-isopropyl-1H-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide) postemergence (10); and diclofop (2-(4-(2,4-dichlorophenoxy) phenoxy) propanoic acid), pre and postemergence (3), have been efficacious in cucumbers.

This study was conducted to evaluate the performance of several promising new herbicides for possible use in Northwest Ohio, and to re-evaluate the use of bensulide and naptalam in various combinations.

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MATERIALS AND METHODS

Trials were located on a sandy loam soil containing 2.1% organic matter. A four-replicate, split-plot experimental design was used with herbicide treatments as main plots and weeded/non-weeded areas as sub-plots. The weeded area was hand-hoed to prevent weed escapes from confounding crop response to herbicide treatments. The non-weeded area was used to evaluate efficacy.

Cucumber variety, Multipik, was planted May 30, 1979; and Lucky Strike was sown May 28, 1980. Two-row plots with 75 cm spacing were used in 1979; while three-row plots were sown in 1980. All plots were 9 m long, the first 6 m receiving supplemental hand weeding. Preplant treatments were made the day before planting and preemergence applications the day following planting. Preplant treatments were incorporated to a depth of 7 to 9 cm, using a rototiller. All herbicide applications were made with a bicycle plot sprayer delivering 309 L/ha, at 2.1 kg/cm^2 pressure. Visual weed control evaluations were made using a 1 to 10 rating system; in which, 1 = no control, 10 = complete control, and 8 is the minimum level of control for commercial acceptance.

In 1979, 0.8 cm of precipitation was recorded on June 8. Cucumber beetles destroyed the emerging crop and plots were resown on June 13, without reworking or disturbing the soil. Postemergence applications were made July 5, with the crop in the first true-leaf stage. Cucumbers were harvested on July 30, August 3 and 9. Fruit were graded by machine into four sizes, with fruit up to 5.4 cm in diameter classed as marketable, and larger fruit considered culls and not reported in yield data.

In the 1980 trial,2.4 cm of precipitation fell within 3 days of pre-emergence treatments. Postemergence (Post-1) treatments were made June 27, when the crop had three true leaves and weeds were 5 to 7 cm tall; or on July 10 (Post-2), when vines had 6 to 7 nodes and were in bloom. Cucumbers were harvested July 21, to permit measurement of any delay in crop maturity; and on July 30, to simulate a single destructive harvest.

RESULTS AND DISCUSSION

1979 Experiment: The dominant broadleaf weeds in this trial consisted of common lambsquarters (*Chenopodium album* L.), redroot pigweed, and black nightshade (*Solanum nigrum* L.); with green foxtail (*Setaria viridis* L.,Beauv.) the major grass species. The weed population was considered light to moderate. The standard treatment of chloramben methyl ester provided good initial weed control, as measured on June 19; but broadleaf control was unacceptable by July 18, Table 1. Ethalfluralin, at 0.86 and 1.12 kg/ha, provided excellent weed control throughout the season without crop injury. The 2.2 kg/ha rate resulted in early crop injury. It should be noted that ethalfluralin was applied as a preplant incorporated treatment. Other studies (2, 8, 10, 11) have used this herbicide only as a preemergence treatment. Crop injury from ethalfluralin may have been avoided in this study because the test was reseeded after cucumber beetles destroyed the first planting. (Greenhouse studies, unpublished data, suggest preplant incorporated ethalfluralin is more phytotoxic to cucumbers than preemergence applications).

Oryzalin (3,5-dinitro-N^4,N^4-dipropylsulfanilamide) failed to adequately control broadleaf or grass weeds in this test. Bentazon was phytotoxic to cucumbers when the crop was in the one-leaf stage, resulting in the lowest yield. Diclofop controlled green foxtail, but broadleaf weeds were barely affected, as expected. The bentazon plus diclofop postemergence combination failed to provide commercially-acceptable weed control.

1980 Experiment: The same broadleaf weeds, encountered in 1979, were dominant in 1980, but the population was judged heavy, averaging 110 plants per m^2. Grasses were too sparce to evaluate. Chloramben-ammonium salt formulation was used in 1980, because the methyl ester formulation was no longer available. At 3.4 kg/ha, this treatment resulted in the lowest cucumber stand, although not statistically different from the control, Table 2. Likewise, neither early nor final yields were significantly affected by this treatment. Cole and Jordan (4), working with chloramben methyl ester, reported that final yields of cucumbers were not necessarily correlated with seedling crop injury. Chloramben was the only herbicide in this trial to provide season-long control of all three broadleaf weed species. The importance and difficulty of controlling black nightshade would appear to justify further studies with the ammonium salt formulation of chloramben to develop a practical use pattern that will assure crop safety.

One of the main objectives of the 1980 trial was to determine if various combinations of the two registered herbicides for cucumbers, bensulide and naptalam, would provide acceptable weed control. Neither material alone or in combination, or with naptalam applied postemergence, provided satisfactory weed control under conditions of this trial.

Ethalfluralin, at 1.6 and 2.2 kg/ha preemergence, controlled lambsquarters and redroot pigweed, while lower rates were inconsistent. Nightshade escaped all ethalfluralin rates, although the 2.2 kg rate did suppress its growth. This is in contrast to 1979, when good nightshade control was achieved even at 0.8 kg/ha. However, in 1979, ethalfluralin was soil-incorporated; while in 1980, it was surface-applied. Since black nightshade is becoming a major problem, further studies are warranted with low rates of ethalfluralin, applied as a preplant incorporated treatment, to verify its efficacy and study cucumber tolerance to this program.

Bentazon postemergence improved the level of broadleaf weed control but was not effective on black nightshade. No significant phytotoxicity was observed on cucumbers with treatments delayed until the crop had three or more leaves developed. However, having to delay application of bentazon until this stage of crop development would limit its usefulness, since weed growth often requires earlier application before they become tolerant or develop a canopy which prevents proper coverage.

The hand-weeded controls in these trials yielded less than some of the better herbicide treatments. Friesen (5) has demonstrated that cucumbers sustain weed competition effects as early as 12 to 36 days after crop emergence. We removed weeds within 20 days of crop emergence; therefore, some competition effects may have taken place. However, it is also possible that the removal of weed seedlings during this critical period of seedling growth results in the physical disruption of the crop's root systems, and

also causes the soil to dry out in the root zone. In other words, effective herbicides are capable of eliminating weeds with less crop stress than can be achieved by mechanical or hand-hoeing methods. The loss of chloramben methyl ester, and the lack of efficacy with the other registered herbicides, naptalam and bensulide, makes it critical that new materials are registered for use on cucumbers if this crop is to be grown efficiently in the future.

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Table 1. Response of cucumbers and weeds to herbicides at Napoleon, Ohio, in 1979.

Treatment	Rate kg ai/ha	Applied	Crop phyto[a/]	Marketable yield kg/plot[b/]	Weed control rating, 1 to 10 B.L.W. 6/19	B.L.W. 7/18	Grass 6/19	Grass 7/18
Chloramben M-E	2.2	pre	4.5	15.2	6.0	5.0	8.5	4.0
Chloramben M-E	3.3	pre	5.0	16.8	8.5	7.6	9.0	8.7
Chloramben M-E	4.5	pre	4.8	15.2	7.5	5.0	8.0	6.0
Ethalfluralin	0.8	ppi	5.0	17.8	9.5	8.6	10.0	8.6
Ethalfluralin	1.1	ppi	4.5	16.3	9.8	9.1	10.0	9.7
Ethalfluralin	2.2	ppi	2.7	13.2	9.9	9.5	10.0	9.7
Oryzalin	0.6	pre	4.6	15.8	5.0	3.0	3.0	5.0
Oryzalin	1.1	pre	4.2	10.3	2.5	4.8	4.0	4.5
Bentazon	1.1	post	3.1	8.9	--	6.0	--	3.8
Diclofop	1.1	post	5.0	15.5	--	2.5	--	7.2
Bentazon + Diclofop	1.1 + 1.1	post	4.0	12.3	--	7.5	--	7.8
Control -- weeded			4.5	11.2	10.0	10.0	10.0	10.0
Bayes LSD 5%			0.8	3.1		1.8		3.6

a/ Crop phytotoxicity based on a 1 to 5 rating system: 5 = no injury, 1 = crop dead.

b/ Yield is from the weed-free area of each plot; therefore, represents the effects of herbicide treatment on crop yield without competition from weed escapes.

Table 2. Response of cucumbers and weeds to herbicides at Napoleon, Ohio, in 1980.

Treatment	Rate kg ai/ha	Applied	Stand plants/m	Yield[a/] kg/plot	B.L.W. control 1 to 10 rating 6/27[b/]	B.L.W. control 1 to 10 rating 7/21	Dominant[c/] escapes		
Naptalam	4.4	pre	6.5	4.8	4.5	2.3	LQ	RRP	NS
Bensulide	4.4	ppi	5.7	7.0	6.5	4.3	LQ	RRP	NS
Bensulide + Naptalam	4.4 + 4.4	ppi T.M.	7.6	6.5	6.5	5.3	LQ	RRP	NS
Bensulide 4.4 ppi + Naptalam	4.4	pre	5.8	6.5	4.7	4.3	LQ	RRP	NS
Bensulide + Naptalam + Naptalam	4.4 + 4.4 4.4	ppi T.M. post	7.3	5.5	4.5	6.7	LQ	-	NS
Bensulide + Naptalam + Naptalam	4.4 + 4.4 6.7	ppi post	5.8	6.0	6.1	7.8	LQ	-	NS
Bensulide + Naptalam + Bentazon	4.4 + 4.4 0.8	ppi post-1	6.1	6.4	5.9	8.3	-	-	NS
Bensulide + Naptalam + Bentazon	4.4 + 4.4 0.8	ppi post-2	7.2	6.3	6.7	8.5	-	-	NS
Ethalfluralin	0.8	pre	6.5	7.9	4.0	2.7	LQ	RRP	NS
Ethalfluralin	1.1	pre	7.0	5.1	5.9	6.3	LQ	-	NS
Ethalfluralin	1.6	pre	6.2	6.4	7.6	7.3	-	-	NS
Ethalfluralin	2.2	pre	6.3	8.0	7.1	8.2	-	-	NS
+ Bentazon	0.8 pre + 0.8 post-2		6.8	6.3	6.0	5.0	LQ	RRP	NS
Chloramben NH_4	2.2	pre	6.1	6.2	9.5	9.3	-	-	-
Chloramben NH_4	3.4	pre	4.7	7.1	9.6	9.3	-	-	-
Control -- weeded			6.6	5.5	--	--	-	-	-
Bayes LSD 5%			2.4	NSD	2.5	2.7			

a/ Marketable grades = less than 5.4 cm in diameter, cumulative of two harvests.
b/ Weed rating on 6/27 was prior to postemergence treatments; therefore reflect control from preemergence treatments.
c/ LQ = lambsquarters; RRP = redroot pigweed; NS = black nightshade.

SCREENING HERBICIDES FOR USE ON PEACH SEEDBEDS

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ABSTRACT

Herbicides were applied in the spring over peach seedbeds which had been prepared and planted the previous fall. Seeds had not yet germinated at the time of application.

All treatments provided very good weed control, but their phytotoxicity to the germinating peach seeds varied. Oxyfluorfen and oxadiazon killed almost all the seedlings. Alachlor, metalachlor, metribuzin, linuron, and any combination including them caused severely reduced stand and stunting of surviving plants.

Napropamide, oryzalin, prodiamine, simazine and their combinations caused slight to moderate stunting and stand reduction, with severity directly related to rate. These herbicides will be used in more extensive tests in 1981.

INTRODUCTION

No herbicides are labelled for use in peach [Prunus persica (L.)] seedbeds. Standard commercial practice includes fumigation of the seedbed prior to planting in the fall and mechanical removal of weeds following germination in the spring. When methyl bromide is used as the fumigant most weed seeds are killed, but because methyl bromide also kills beneficial soil fungi (mycorrhizae), growers are beginning to avoid using it. The less toxic fumigants now used have little or no effectiveness against weed seeds.

Because many weed seeds germinate before or at the same time as the peach seeds, a preemergence herbicide that will control the weeds without damaging the peaches is needed. The objective of this study was to determine which herbicides merit extensive study based on their limited phytotoxicity to germinating peach seeds.

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METHODS AND MATERIALS

The experiment was conducted at a commercial nursery in York Springs, Pennsylvania in 1980. The Birdsboro silt loam soil had a pH of 5.8 and contained 0.8% organic matter. Field preparation included an application of glyphosate [N-(phosphonomethyl) glycine] 2E at 2.2 kg/ha on August 1, 1979 and Terr-O-Cide 7227 (72% ethylene dibromide, 27% chloropicrin, and 1% inert) at 140 l/ha on October 20, 1979.

Plots 1.1 m x 2.4 m were arranged in a randomized complete block design and each treatment was replicated three times. On April 15 glyphosate was applied at 1.7 kg/ha to eliminate all winter annual weeds and the following treatments were applied: alachlor [2-chloro-2',6'-diethyl-N-(methoxoymethyl) acetanilide]4E, metolachlor[2 chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide]8E,metribuzin[4-amino-6-tert-butyl-3-(methylthio)-as-triazin-5(4H)-one]50W,napropamide[2-(α-naphthoxy)-N,N-diethylpropionamide]50W, oryzalin[3,5-dinitro-N^4,N^4-dipropylsulfanilamide]75W,oxadiazon[2-tert-butyl-4-(2,4-dichloro-5-isopropoxyphenyl)-Δ^2-1,3,4-oxadiazolin-5-one]2G,oxyfluorfen[2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene]2E,prodiamine[2,4-dinitro-N^3,N^3-dipropyl-6-(trifluoromethyl)-1,3-benzenediamine]50W,simazine[2-chloro-4,6-bis(ethylamino)-s-triazine]4E, and linuron[3-(3,4-dichlorophenyl-1-methoxy-1-methylurea]50W, were applied alone or in combination at the rates listed in Table 1.

During application wind speed was 10 km/hr with gusts to 19 km/hr and the air and soil temperatures were 6° and 11°C, respectively. Soil moisture was at field capacity and there was 40% cloud cover. The herbicides were applied with a CO_2 pressurized sprayer at 20 psi in the equivalent of 1016 l/ha of water through LP 8002 nozzles with 50 mesh screens. Oxadiazon, the granular material was distributed by hand. The plots were not irrigated, but 5.7 cm of rain fell on the plots in the two-week period following application. Rainfall was adequate through the remainder of the study. Weed growth and phytotoxicity data were evaluated eight weeks after application.

RESULTS AND DISCUSSION

Weed control was excellent in all treated plots (Table 1). The predominant weeds in the check plots in order of prevalence were Pennsylvania smartweed (*Polygonum pennsylvanicum* L.), common ragweed (*Ambrosia artemisiifolia* L.) yellow rocket (*Barbarea vulgaris* R. Br.), shepherdspurse [*Capsella bursa-pastoris* (L) Medic.], common cinquefoil (*Potentilla canadensis* L.), fall panicum (*Panicum dichotomiflorum* Michx.), Canada thistle [*Cirsium arvense* (L.) Scop.], common yellow woodsorrel (*Oxalis stricta* L.), common purslane (*Portulaca oleracea* L.), and broadleaf plaintain (*Plantago major* L.).

The phytotoxicity of the herbicides varied greatly (Table 1). Oxyfluorfen killed almost 100% of all the seedlings. At the 1.1 kg/ha rate approximately 20% of the plants were alive but the cotyledons were badly burned by the herbicide. Oxadiazon, an herbicide which is safe to use on a wide range of newly planted material, also gave almost total kill of the peach seedlings. At 2.2 kg/ha some seeds germinated but the epicotyl either emerged with no cotyledons or with cotyledons that were distorted and curled.

Table 1. Effect of herbicides applied to peach seedbeds on weed control and phytotoxicity to germinating peach seeds.

Chemical	Rate (kg/ha ai)	Weed Control[a]	Grasses[b]	Broad-leaves[c]	Phyto-toxicity[d]
Check		0	60	40	0
Alachlor (4E)	1.7	9.0	10	90	6.2
	3.4	9.2	10	90	7.0
	6.8	10	0	0	8.5
Metolachlor (8E)	1.7	8.5	0	100	4.3
	3.4	8.7	0	100	7.2
	6.8	9.3	0	100	9.0
Metribuzin (50W)	1.1	9.7	90	10	6.7
	2.2	10.0	0	0	6.0
	4.4	9.8	100	0	8.5
Napropamide (50W)	3.4	9.0	10	90	1.0
	6.8	9.5	5	95	4.1
	13.6	9.5	0	100	5.3
Oryzalin (75W)	2.2	8.3	20	80	1.8
	4.4	9.0	20	80	2.3
	8.8	9.1	20	80	4.1
Oxadiazon (2G)	2.2	9	30	70	8.8
	4.4	10	0	0	9.8
	8.8	10	0	0	10
Oxyfluorfen (2E)	1.1	10	0	0	9.0
	2.2	10	0	0	9.7
	4.4	10	0	0	10.0
Prodiamine (50W)	2.2	9.7	0	100	2.0
	4.4	9.2	0	100	3.6
	8.8	9.5	0	100	3.3
Simazine (4E)	1.1	9.3	100	0	1.7
	2.2	10.0	0	0	3.7
	4.4	10.0	0	0	7.0
Linuron (50W) + Metolachlor (8E)	.55 + 1.7	10	0	0	5.3
	1.1 + 3.4	10	0	0	7.0
	2.2 + 6.8	10	0	0	9.2
Metribuzin (50W) + Alachlor (4E)	.28 + 1.7	9.0	70	30	6.3
	.55 + 3.4	9.0	50	50	6.7
	1.1 + 6.8	10.0	0	0	8.8
Simazine (4E) + Napropamide (50W)	.85 + 3.4	10.0	0	0	3.0
	1.7 + 6.8	10.0	0	0	4.7
	3.4 + 13.6	10.0	0	0	7.5
Simazine (4E) + Metolachlor (8E)	.85 + 1.7	9.8	0	100	6.7
	1.7 + 3.4	10.0	0	0	9.0
	3.4 + 6.8	10.0	0	0	8.8
Simazine (4E) + Alachlor (4E)	.85 + 1.7	10.0	0	0	7.7
	1.7 + 3.4	10.0	0	0	8.7
	3.4 + 6.8	10.0	0	0	9.0
Simazine (4E) + Oryzalin (75W)	.85 + 1.7	9.3	100	0	4.3
	1.7 + 3.4	9.7	100	0	3.7
	3.4 + 6.8	10.0	0	0	6.8

[a] 0 = no control, 10 = total control
[b] The percentage of weeds which were grasses
[c] The percentage of weeds which were broadleaves
[d] 0 = no phytotoxicity, 10 = dead

The combinations of simazine + alachlor and simazine + metolachlor were highly phytotoxic to the germinating peach seeds. At the low rates the symptoms were a 40-70% reduction in stand and stunting of surviving plants. At the high rate there was a 75% reduction in stand, severe stunting, and leaf chlorosis and curl in surviving plants.

Alachlor and metolachlor alone caused symptoms similar to, but not as severe as, those seen on plants which received them in combination with simazine. At the 1.7 kg/ha rate the stand was reduced by 30% and surviving plants were stunted. At 3.4 kg/ha and 6.8 kg/ha the stand and growth of survivors was increasingly reduced. At the 6.8 kg/ha rate leaves were curled, distorted, and greatly reduced in size.

Metribuzin at 1.1 and 2.2 kg/ha caused a 40-60% reduction in stand and severe stunting. In addition to similar, but more severe, symptoms at the 4.4 kg/ha rate, surviving plants had curled, distorted leaves and marginal chlorosis that changed to necrosis.

The only symptoms of injury in linuron + metolachlor treated plots were stand reduction and stunting. Plots treated with metribuzin + alachlor showed similar symptoms at the low rates but at the highest rates the few surviving plants also had curled, distorted, severely stunted leaves.

The combinations of simazine + oryzalin and simazine + napropamide did not cause any reduction in stand, but did cause slight stunting at the lowest rate. At the medium rate there was slight reduction in stand and the stunting was more severe. At the highest rate there was a 20-40% reduction in stand, stunting, and the lower leaves were small and chlorotic. The plants appeared to be growing past the injury.

Plots treated with simazine alone at 1.1 kg/ha had a 10-20% reduction in stand, but surviving plants were growing normally. At the higher rates there was further reduction in stand and stunting increased with rate, but there was no chlorosis.

Injury caused by napropamide, oryzalin, or prodiamine was limited to slight stunting and slight reductions in stand.

Based on these results the following herbicides or combinations are considered unsuitable for use on peach seedbeds and their testing will be discontinued: alachlor, metolachlor, metribuzin, oxadiazon, oxyfluorfen, linuron + metolachlor, metribuzin + alachlor, simazine + alachlor, and simazine + metolachlor.

Herbicides and combinations which merit additional evaluation include napropamide, oryzalin, prodiamine, simazine, simazine + oryzalin, and simazine + napropamide.

RESPONSE OF POTATOES TO EPTC FOLLOWED BY PREEMERGENCE AND EARLY EMERGENCE CYANAZINE

P. J. Sollazzo, R. D. Ilnicki and S. E. Crane[1/]

ABSTRACT

Preplant incorporated EPTC at two rates was followed by cyanazine applied preemergence immediately after potato planting and approximately one week after potato emergence. On each date of application the normal use rate and twice this rate of cyanazine were applied. None of the treatment combinations effected serious injury to potatoes. Notwithstanding that chlorosis was produced by cyanazine when applied to the emerged potatoes, this response was short-lived and yields were not reduced. Weed control was similar regardless of the time or rate of cyanazine application.

INTRODUCTION

The use of S-ethyl dipropylthiocarbamate (EPTC) as a preplant incorporated herbicide in potatoes has become an accepted practice particularly for the control of nutsedge (Cyperus esculentus L.) and annual grasses. Recent work (1) has indicated that 2-chloro-4-(1-cyano-1-methylethylamino)-6-ethylamino-s-triazine (cyanazine) can be safely used to broaden the spectrum of weed control as a sequential preemergence herbicide following EPTC and immediately after planting with no injury to white potatoes. This study was designed to further explore the use of these two herbicides and to determine whether cyanazine can be safely used as a late preemergence treatment or just prior to white potato emergence.

MATERIALS AND METHODS

On April 23, 1980, white potatoes (Solanum tuberosum 'Superior') were planted in a Sassafras loam soil at the Adelphia Research Center, New Jersey Agricultural Experiment Station, Adelphia, New Jersey. Prior to planting, predesignated plot areas were established to receive EPTC at 3.25 and 6.5 lb/A and incorporated mechanically to a depth of 3 to 4 inches with a tractor-drawn roterra. Immediately after planting, preemergence applications of cyanazine were applied as overlays to EPTC-treated plots at 0.75 and 1.5 lb/A, the lower rate on the lower rate of EPTC and the higher rate of cyanazine on the higher rate of EPTC plots. A

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similar set of plots was scheduled to be treated with cyanazine over incorporated EPTC approximately May 12 just prior to the emergence of potatoes but rainy weather for several days prevented these sequential applications. Following the rainy period, applications of cyanazine were made on May 16 when better than 90% of the potatoes were emerged and were approximately 3 to 4 inches tall. The originally planned schedule, therefore, was modified but it was felt some valuable information could be obtained on crop tolerance to cyanazine applied to potatoes after emergence. Included also were EPTC and cyanazine applied alone at 3.25 lb/A and 1.50 lb/A, respectively, which served as checks in addition to the untreated checks. There were seven replications of all treatments in a randomized complete block design. All herbicide treatments are listed in Table 1.

Observations on weed control and crop tolerance were made throughout the course of the study and detailed ratings on specific weeds were made on June 9 approximately three weeks after the post-emergence applications of cyanazine. Weed control ratings were made using the scale 0 to 10 where 0 = no control and 10 = complete control. Weeds in the experimental area included lambsquarters (*Chenopodium album* L.), redroot pigweed (*Amaranthus retroflexus* L.), barnyardgrass (*Echinochloa crusgalli* L.) and fall pancium (*Panicum dichotomiflorum* Michx.). All plots were killed at layby on June 23 two weeks after rating. Potatoes were harvested during the week of August 25, graded into No. 1's and No. 2's and yields expressed as hundredweights per acre.

RESULTS AND DISCUSSION

Included in Table 1 are all the herbicide treatments used in this study. Included, also, are the week control ratings of the weed species and yields of potatoes for the treatments. From this table it can be seen that all combinations of EPTC and cyanazine effected excellent weed control and that there was no advantage in applying cyanazine as an overlay to EPTC immediately after planting or by delaying the application by three weeks. Furthermore, there was no great increase in weed control by doubling the normal use rate of either herbicide regardless of the time of cyanazine application. This lack of difference in weed control was also reflected in the yields of potatoes. There were no significant differences in yield from early or late applications of cyanazine or between the yields from normal use rates of the two herbicides from those treatments including twice the normal use rates. Yields were significantly lower where the herbicides were used alone and this was a direct effect of poor weed control.

Not included in the table are the responses of potatoes to the various herbicide treatments. At the time of rating, potatoes manifested no adverse responses to any of the treatments. However, it is noteworthy that cyanazine effected slight chlorosis within one day to the potatoes after the postemergence applications but the response was short-lived. Normal green color was restored approximately one week following the onset of chlorosis.

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Table 1. Weed control and potato yields following preplant incorporated EPTC followed by overlays of cyanazine applied preemergence and early postemergence.

Treatment	Rate, lb/A	Weed Control(1)				Yield Cwt/A(2)	
		Lambsquarters	Redroot pigweed	Barnyard-grass	Fall Panicum	No. 1	No. 2
EPTC, ppi + cyanazine, pre	3.25 0.75	9.7	9.2	9.0	9.4	160.3 a	13.6 a
	6.50 1.50	10.0	9.9	9.5	9.8	156.1 a	14.6 a
EPTC, ppi + cyanazine, post	3.25 0.75	9.7	8.5	9.4	9.7	151.2 a	12.7 a
	6.50 1.50	9.9	9.9	9.8	10.0	153.6 a	16.0 a
EPTC, ppi	3.25	4.8	4.7	8.8	7.7	114.2 b	15.0 a
cyanazine, post	1.50	6.4	9.3	6.6	4.5	72.8 c	15.5 a
Check, unweeded	-	-	-	-	-	34.9 d	12.3 a

(1) All ratings are the average of seven replications. 0 = no control, 10 = complete control.

(2) Yields followed by the same letter are not statistically significant.

PREEMERGENCE AND POSTEMERGENCE CONTROL OF ANNUAL GRASSES IN POTATOES

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ABSTRACT

Control of annual grasses continues to be the major weed problem associated with production of potatoes in eastern Virginia. Herbicide combinations provide good control initially but lack sufficient residual activity to prevent grasses from interfering with harvest operations late in the growing season. During 1979 and 1980 research was conducted on a Sassafras sandy loam soil to compare the efficacy of numerous herbicide combinations for providing control of annual grasses in potatoes. Pendimethalin incorporated at drag-off, alone and in combinations with EPTC or metribuzin, provided good control of large crabgrass (Digitaria sanguinalis (L.) Scop.) both years but did not control barnyardgrass (Echinocloa crus-galli (L.) Beauv.) adequately under high rainfall totals encountered in 1979. Preemergence combinations of linuron or metribuzin with alachlor, metolachlor, pendimethalin or oryzalin provided good control of large crabgrass but combinations involving either alachlor or metolachlor were more effective than those with pendimethalin or oryzalin against barnyardgrass; DPX 6573 was also less effective for grass control than treatments containing alachlor or metolachlor. The experimental herbicide RE-28269 provided good control of annual grasses in both years of the study. Preemergence applications of linuron or metribuzin followed by postemergence applications of diclofop, KK-80, BAS 9052 OH, and RO-13-8895 provided excellent control of annual grasses and possessed good crop safety.

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THE USE OF TREE INJECTION IN TIMBER STAND IMPROVEMENT IN MAINE

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ABSTRACT

Tree injection with herbicides for Timber Stand Improvement (TSI) is useful in controlling both the current stand composition and future regeneration. Three studies are cited to illustrate this thesis. In addition, recommendations are given for using the Hypo-Hatchet and for using certain herbicides for tree species in Maine.

INTRODUCTION

Silvicultural practice consists of various treatments of the forest stands to maintain or improve their productivity (9). Timber Stand Improvement (TSI) is a set of practices which includes improvement cutting, weeding, liberation cutting and thinning which fall intermediate in a rotation between the regeneration of a stand and the final harvest.

Previously unmanaged stands (stands not treated in some fashion) are treated by removing cull trees and low value species. This is an improvement cutting (7). Removing excess trees, called thinning, distributes growth to the desirable trees. This could occur in a managed or unmanaged stand. A liberation cut is one in which some trees are removed from around a chosen crop tree. These treatments are selective by definition. They discriminate against poor quality and low valued individual trees in a stand.

Herbicides applied by tree injection can be used to perform TSI (10) usually by leaving the undesirable trees in the woods. Herbicides are effective, easy and a low cost method of meeting objectives for TSI (5). Fischer (2) suggested stem injection is effective, efficient, minimizes use of herbicides, and has maximum public acceptance of herbicide use with no drift. They can be used in tree injection year round without terrain limitations.

Conventional TSI has usually been devoted to one of the purposes listed above in improving the current stand. In Maine, and probably elsewhere, TSI, using herbicides, can be used effectively to control the future species composition and density in addition to meeting current stand objectives. Simply cutting the low valued trees, as one would in conventional TSI, may cause trees to sprout and thereby lowering the potential of the future stand.

STUDIES

Scott Paper Company in Maine has used herbicides in three TSI applications which were designed to treat not only the current stand, but in some way affect the regeneration of that stand. The treated overstory was undesirable because of its low value and was competing with the valuable species. By treat-

1/ Research Forester, Scott Paper Company, Northeast Operations, Winslow, ME

ing the overstory with herbicides, both an improvement treatment and a thinning could be accomplished. In addition, the offspring of these low valued trees are prevented from hindering the future stand.

The first study was an attempt to weed (remove) aspen (Populus spp. L.) from a stand of aspen and fir (Abies balsamea (L.) Mill). Aspen has prolific root suckers if not treated with herbicides. The purpose of the study was to determine the effectiveness of picloram plus 2,4-D ((4-amino-3,5,6-trichloropicolinic acid) plus (2,4-dichlorophenoxy)acetic acid) to control root suckering of aspen during both the dormant and growing seasons. The overstory was treated with herbicides using a Hypo-Hatchet. Portions of the study area were treated in both the dormant and growing seasons and some portion was not treated with herbicides. Cutting of the overstory aspen occurred in both areas that were treated and not treated. In addition, MSMA (monosodium acid methanearsonate) was applied to a small area. The effectiveness of both the picloram plus 2,4-D and MSMA is shown in Table 1. The results are the number of stems per acre of aspen based on random milacre plots within each treatment block.

Table 1

The Effectiveness of Picloram Plus 2,4-D and MSMA in Controlling Root Suckering of Aspen

Treatment	Results: Stems per Acre	
1. No chemical treatment; cut aspen late summer:	17,620	a 1/
2. Treated aspen in growing season with MSMA; cut aspen late summer:	3,670	b
3. Treated aspen in dormant season with picloram plus 2,4-D; cut aspen late summer:	2,640	b
4. Treated aspen in growing season with picloram plus 2,4-D; cut aspen late summer	2,410	b
5. No chemical treatment; no cutting of aspen:	1,550	c
6. Treated aspen in growing season with picloram plus 2,4-D; no cutting of aspen	120	d

1/ The letter indicates which treatments are significantly different at the 5% level.

While the overstory stand had 8 to 12 cords per acre of aspen, the understory contained about 1,500 stems per acre (treatment 5). This balloons to over 17,000 (treatment 1) in two growing seasons after cutting the overstory. However if the overstory is treated with picloram plus 2,4-D and not cut, the understory is reduced significantly to nearly 100 stems per acre (treatment 6). This is a manageable level of undesirable regeneration.

Usually it is desirable to harvest the volume of aspen if possible. In doing so, in this study there was an increase in the number of young stems per acre vs treatment 5. While there was no significant difference between picloram plus 2,4-D either before or during the growing season and MSMA, this set of treatments had far fewer stems than treatment 1 (not treated and cut) It has to be concluded that picloram plus 2,4-D and MSMA helped control the sprouting of aspen.

A second study for which there is no data is one of attempted improvement treatment both in the present and future stand. Poor quality white birch (Betula papyrifera Marsh) is normally associated with stands of balsam fir and spruce (Picea spp. A. Dietr.). In commercial clearcuts many of these trees are left standing because they have no value. Because birch is a prolific seeder, these trees may cast their poor quality seed for a number of years into the exposed, fertile area around them. If, however, these trees could be treated before or immediately after harvest and left to die on their own, the problem of seed dispersal of poor quality trees could be reduced. Approximately 20 acres were treated with glyphosate (N-(phosphonomethyl)glycine) using Hypo-Hatchets.

A third study which was reported in 1979 (6) attempted to control hardwood regeneration after harvest by using injected herbicides prior to harvest. In this way, the future stand composition can be directed by letting the high valued species sprout or seed as they please. The treated species which are of low value hardwoods such as red maple (Acer rubrum L.) and aspen are removed in the harvest.

RECOMMENDATIONS

The question of whether the basal injector or the Hypo-Hatchet is the better tool has been raised. Looking at the literature, the Hypo-Hatchet has proved to be as effective, easier to use and less expensive than the basal injector. Peevy (8) reported that there was no difference in top kill percentage on Southern red oak whether incisions were made near the ground or 12" above the ground. This finding has been generally expanded to include all species and incisions higher on the trunk. Holt et al (3) felt that the Hypo-Hatchet had better control for certain species because of better bark penetration. They found this is particularly true for the hard to control species such as red maple. In addition, they reported a 75 to 200% increase in production with the Hypo-Hatchet over the basal injector. Hack-and-squirt was not as good as the Hypo-Hatchet (11).

Table 2 presents possible herbicide treatments for species in Maine using a Hypo-Hatchet at one ml per injection at one injection for every one inch diameter at a convenient height or about one inch edge to edge. These are drawn from experience in Maine and from literature concerning comparable species. It is recommended to choose the herbicide which will apply to the largest component of the stand to be treated. However, the herbicides with the broadest spectrum appear to be picloram plus 2,4-D, glyphosate and triclopyr. The best time of application appears to be summer, though this is not true for all species. It is best to check all labels before application.

Table 2
Possible Herbicide Treatments for Tree Species in Maine

Species	Herbicide	Season	Source
Sugar Maple (*Acer saccharum* Marsh.)	Triclopyr, Triclopyr and water,	Summer	11
	MSMA	Summer	2
Red Maple	Triclopyr	Any time	6
	Picloram (diluted)	Any time	3
	Dicamba	Summer	10
	Triclopyr	Fall	4
	Picloram + 2,4-D	Summer	1
Beech (*Fagus grandifolia* Ehrh.)	Glyphosate	Spring	6
	Picloram + 2,4-D		
	Dicamba & water (1:1)	Any time	11
	Triclopyr & water (1:2)		
	Triclopyr, Glyphosate and water (1:4)		
	Cacodylic acid		5
White Ash (*Fraxinus americana* L.)	Dicamba + water (1:1)	Any time	11
	Triclopyr		
	Triclopyr + water (1:1)		
	Glyphosate		
Aspen	Glyphosate	?	6
	Picloram + 2,4-D		(this report)
	2,4-D		1
Pin Cherry (*Prunus pensylvanica* L.)	2,4-D amine	?	1
Birch (*Betula* spp. L.)	MSMA	?	5
	2,4-D		1
Spruces, Fir	MSMA	?	2
Pine (*Pinus* spp. L.)	2,4-D	Any time	11
	Picloram + 2,4-D		
	Dicamba & water (1:1)		
	MSMA		
	Triclopyr & water (1:1)		

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AERIAL APPLICATION OF TRICLOPYR FOR CONIFER RELEASE IN MAINE

M.L. McCormack, Jr.[1/], R.H. Hendler[2/], and E.B. Sprague[3/]

ABSTRACT

The study area is a Scott Paper Company ownership in Bald Mountain Township (T2R3), Maine. Maple, birch, aspen, pin cherry, beech, and bramble brush growth over seven years following a commercial clearcut had resulted in severe competition to advanced natural regeneration of red and white spruces, white pine, and balsam fir. Release treatments were applied to 1.13 ha blocks by helicopter under operational conditions on August 4, 1977.

Triclopyr amine was applied at rates of 2.2 and 4.5 kg/ha in water as a total volume of 37.4 l/ha. Permanent sample plots, in the centers of twice-replicated spray blocks, have been evaluated over the three growing seasons since treatment. Effective suppression of undesirables has continued through three seasons with the high rate providing slightly better control than that of the low rate.

Red maple stump sprouts, one of the most serious brush problems on cutover lands in Maine, were controlled very effectively. The other undesirables were well-controlled with some regrowth by the third season of beech, willows, and brambles. Height growth responses of spruce and fir regeneration in the triclopyr treatments are two to three times the growth of the same species in control blocks. Ground cover of grasses was not suppressed by these treatments.

This study compared with other similar field studies, indicates that improved results could be achieved with similar rates of chemical applied in larger total volumes; for example, 3 kg/ha of triclopyr amine in water as a total volume of 90 l/ha. These results indicate good potential for aerial release of spruce, fir, and white pine, especially where red maple is a predominant component of competing brush, or in situations where it is desirable to maintain grasses as ground cover.

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TRIALS WITH DPX 3674-A AND DPX 3674-LE FOR RELEASE OF PLANTED LARCH

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ABSTRACT

In April, 1980 a mixed upland oak-hickory stand of timber dominated by white oak (Quercus alba L.) and hickory (Carya glabra (Mill.) Sweet) sprouts following clearcutting, was planted with two-year-old Japanese larch (Larix leptolepis, Sieb. and Zucc.) seedlings at a 2.7 x 2.7 m spacing. To assess the effect of herbicide on the control of hardwood stump sprouts and subsequent release of the planted larch, the following herbicide treatments were applied to nine 0.04 ha plots in June, 1980 approximately one month after planting: (1) DPX 3674-LE applied undiluted to individual sprout clumps with a Spot-Gun at 4 and 8 ml/5 cm stem diameter (2) DPX-3674-A 10% a.i. Gridball pellets applied in a grid pattern by hand at rates of 22.4 and 44.8 kg/ha, at 1.3 x 1.3 m and 0.9 x 0.9 m spacings respectively (3) DPX-3674-A 10% a.i. Gridball pellets applied by hand to individual sprout clumps at rates of 2 and 3 Gridball pellets per 2.5 cm of stem diameter (4) Bromacil applied undiluted to individual sprout clumps at 8 ml/5 cm stem diameter (5) handchopped with no herbicide, and (6) no herbicide-control. Preliminary results, observed three months after herbicide treatment, indicated that DPX 3674-LE and DPX 3674-A Gridball pellets effectively controlled the hardwood sprouts, and at the highest rates applied do not appear to affect the early survival and growth of the planted-released larch seedlings.

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TIMING APPLICATIONS OF GLYPHOSATE TO CONTROL FOREST BRUSH

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Glyphosate is registered in the state of Maine for site preparation and for plantation release. Due to its nonselective nature for vegetation management in softwood plantations, it can only be applied in late summer after the seedlings set winter buds but before hardwood leaves begin to color. This study was installed to determine the effectiveness of glyphosate applied at various times during the late summer and early fall to control hardwood sprouts and bracken ferns.

The treatments were applied in four replications of a randomized complete block design on five application dates: August 16, 23; September 4, 18; and October 2, 1979. The trial was located near the town of Howland, Maine on a forested hardwood site that had been clearcut and site prepared with a 10' Marden drum chopper 2 years before. The glyphosate was applied at a rate of 4.68 l/ha, delivered in 93.5 l/ha of water. On each treatment date, the material was applied to .004 ha circular plots by a backpack mist blower. In late summer of 1980, one year after treatment, the plots were subjectively evaluated for overall silvicultural effectiveness using a scale of 0-10. Little or no silvicultural advantage is represented by a score of 9 to 4; 5 represents the dividing line between noneffective and effective; 6 to 10 represents increasing silvicultural effectiveness. The average effectiveness rating for each date is presented in Table 1.

Table 1. Average* silvicultural effectiveness of glyphosate on hardwood sprouts and bracken ferns applied at different times in 1979

DATES				
Aug 16	Aug 23	Sept 4	Sept 18	Oct 2
9.8	10	7.4	5.2	4.4

*Average of the 4 replications treated with glyphosate on the dates indicated.

It was apparent that hardwood sprouts and bracken ferns were affected differently by the herbicide application date. The plots were scored a second time, and the differences are summarized in Table 2

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Table 2. Percent control of hardwood sprouts and bracken ferns for each treatment date

	APPLICATION DATES				
	Aug 16	Aug 23	Sept 4	Sept 18	Oct 2
	Percent Control				
Hardwood Sprouts	93	95	85	70	55
Bracken Fern	97	97	75	38	30

The reduction in herbicide effectiveness is probably due to seasonal physiological condition of the sprouts and ferns. After September 4 all the leaves and ferns were showing signs of senescense so that not enough glyphosate was absorbed to control the regrowth.

In making a recommendation for glyphosate, there are two different silvicultural practices it may be used for: plantation release and site preparation. To use for plantation release the forester must first evaluate the seedling condition. The softwood seedlings must have set their winter buds. When using a nonselective herbicide such as glyphosate this presents a very narrow window, late summer or early fall application, for vegetation control. To maximize glyphosate effectiveness, it should not be applied after the first week of September. Extending past this week must be based on the forester's interpretation. If fall colors are not apparent in the vegetation, application can proceed.

Site preparation using glyphosate does not have as narrow an application window since maximum vegetational control (hardwood, softwood, and herbaceous) is desired. Even with this silvicultural treatment the herbicide should not be applied if fall colors are apparent in the foliage.

In both silvicultural practices the material should not be applied after the third week in September. This final week will vary depending on area location and seasonal variation.

TOLERANCE OF DORMANT FRASER FIR TO POSTEMERGENCE IN HERBICIDES

J. F. Ahrens[1/]

ABSTRACT

In three experiments over 6 years herbicides were applied over dormant Fraser fir (Abies fraseri (Pursh)Poir.), either in September or April. September applications of asulam at 4 or 8 lb/A or glyphosate at rates up to 2 lb/A caused no injury to the firs. Results were equivalent with glyphosate applied in 50 gal/A with conventional equipment and in 4.8 gal/A with the 'Micron Herbi' controlled droplet applicator[2/]. April applications of hexazinone at 1, 2, or 3 lb/A or glyphosate at 1.12 lb/A plus simazine and oryzalin injured Fraser fir. September applications of glyphosate controlled certain deciduous woody plants that are troublesome in Christmas tree and nursery plantings of Fraser fir.

INTRODUCTION

In Christmas tree plantings and nurseries preemergence herbicides such as simazine [2-chloro-4,6-bis(ethylamino)-s-triazine] and oryzalin (3,5-dinitro-N^4,N^4-dipropylsulfanilamide) commonly are applied in the spring to control annual and certain perennial weeds. Simazine often is reapplied at low rates in the fall to control winter annuals. Deciduous woody plants are not controlled, however, and those can become serious problems, especially in the absence of cultivation (3). In earlier work we reported that certain conifers are tolerant of asulam (methyl sulfanilylcarbamate) and glyphosate [N-(phosphonomethyl)glycine] applied in the dormant season (1,2,3,4). Brambles (Rubus sp.) and other deciduous woody plants have been controlled with late season applications of glyphosate (1,5). However, little information has been available on the tolerance of Fraser fir to glyphosate or asulam, or to hexazinone [3-cyclohexyl-6-(dimethylamino)-1 methyl-1,3,5-triazine-2,4(1H,3H)-dione], normally applied in the spring.

Low volume, controlled droplet applications of glyphosate with the 'Micron Herbi' could be useful in conifer plantations if it is established that highly concentrated sprays are as safe on conifers as higher volume conventional sprays. In the work reported here we evaluated the tolerance of dormant Fraser fir to asulam, glyphosate and hexazinone and their tolerance to low volume sprays of glyphosate.

MATERIALS AND METHODS

Three herbicide trials were conducted in commercial plantings of Fraser fir growing on Narragansett silt loam soil in South Windsor, CT from 1974 to 1980. The trees were planted in field rows at 5 ft by 6 ft spacings and were

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not actively growing at the time of treatment. The herbicides were applied with a hand-held boom with two or three Teejet 8004 nozzles calibrated to deliver 50 gal/A in 3 or 4.5 ft swaths or with a 'Micron Herbi' calibrated to deliver 4.8 gal/A in a 4 ft swath. Treatments were arranged in randomized complete blocks with three to seven replicates. Weed control and injury evaluations were made on a 0 to 10 scale with 0 as no weed control or injury, and 10 as 100% control or dead plants.

In Test A, plot sizes were three trees long (15 ft) and treatments were replicated seven times, with alternate rows untreated. The trees had been planted in 1970 and were 20 to 48 in tall. Asulam and glyphosate were applied in 50 gal/A on Sept 20, 1974. Rain fell 11 h after treatment. The primary weeds in many plots were wild blackberry (Rubus sp.) and common cinquefoil (Potentilla canadensis L.). Applications of simazine at 2 lb/A plus oryzalin at 3 lb/A were applied over all trees in April each year to control annual weeds. Tree heights were measured before treatment and in July 1975.

In Test B, the herbicides were applied in 50 gal/A on April 18, 1978 over trees that were planted as 3-2 transplants in Sept 1977 and seeded to a rye cover crop. The rye was 6 to 8 in tall at treatment. Plot sizes were four plants long (20 ft) and 3 ft wide, and treatments were replicated four times. The sprays hit the lower 2/3 of most trees and the terminal leaders of the smaller trees. At the time of spraying it was 68 F and sunny, and rain fell 18 h later.

In Test C, the herbicides were applied on Sept 21, 1978 over trees that were planted as 3-2 transplants in Sept 1977. Preemergence applications of simazine at 2 lb/A plus oryzalin at 3 lb/A were made each April to control annual weeds. The plots were 6 to 7 plants long (35 ft). Conventional sprays applied at 50 gal/A in a 4.5 ft swath were compared with 'Micron Herbi' sprays at 4.8 gal/A in a 4 ft swath. The treatments were reapplied on Sept 27, 1979 and terminal growth of the firs was measured in Aug 1980. At time of treatment it was sunny with temperatures of 85 and 75 F, respectively. The first rains fell 15 h after the 1978 applications and 2 days after the 1979 applications. Woody plants present in some of the plots either time of treatment included poison ivy (Rhus radicans L.), Virginia creeper (Parthenocissus quinquefolia (L.)Planch.), staghorn sumac (Rhus typhina L.), and wild blackberry (Rubus sp.). Horseweed (Conyza canadensis L.) also was present in some plots.

RESULTS AND DISCUSSION

In Test A, asulam at 8 lb/A controlled common cinquefoil and glyphosate at 1 or 2 lb/A in September controlled cinquefoil and wild blackberry with no significant effects on height growth of Fraser fir the following season (Table 1). Observations 2 months after treatment and later showed no detectable effect of the treatments on the trees.

In Test B, hexazinone at 1, 2, and 3 lb/A and combinations of glyphosate at 0.56 lb/A or 1.12 lb/A with oryzalin plus simazine applied in April gave excellent control of the rye cover crop (Table 2). Hexazinone at all rates injured the lower foliage of the firs, resulting in increased mortality. The glyphosate combination treatments injured the firs only slightly, but reduced terminal growth with glyphosate at 1.12 lb/A.

Table 1. Control of wild blackberry and common cinquefoil and growth increase in Fraser fir treated Sept 20, 1974 with asulam and glyphosate.

Herbicide	Rate,[a] lb/A	Weed control 7/24/75		Percentage increase in terminal growth 1974 to 1975
		Wild blackberry	Common cinquefoil	
untreated		0	0	56
asulam	4	0	3	59
	8	4.5	9.5	50
glyphosate	1	6.9	10.0	54
	2	9.1	10.0	52
L.S.D. p = .05				N.S.

[a] Asulam - ai; glyphosate - ae.

Table 2. Effect of April 1978 applications of herbicides on dormant Fraser fir and control of rye cover crop.

Herbicide	Rate,[a] lb/A	% Control rye 5/23/78	Injury to firs 0-10 5/23	7/11	9/6	% Survival 9/21	Terminal leader growth of firs-cm 9/21/78
untreated		0	0	0	0	94	16.0
hexazinone	1	86	0.3	1.6	2.4	88	15.2
	2	96	0	2.9	4.0	88	16.7
	3	99	0	2.0	4.1	81	12.1
glyphosate+	0.28+2+2	79	0	0	0.7	100	14.4
oryzalin+	0.56+2+2	94	0.1	0	0.2	94	13.8
simazine	1.12+2+2	100	0	0.6	0.7	94	9.4
simazine	4	23	0	0	0.2	100	15.4
L.S.D. p = .05							3.4
p = .01							4.6

[a] All rates ai except glyphosate which is ae.

In Test C (Table 3), glyphosate applied two Septembers in succession caused no injury to Fraser firs whether applied at 4.8 gal/A with the 'Micron Herbi' or at 50 gal/A by conventional nozzles. Adding simazine to the glyphosate sprays similarly had no detectable effect on the firs. At 0.5 lb/A glyphosate controlled horseweed but no woody species. However, at 1 or 1.5 lb/A at either spray volume, glyphosate gave good to excellent control (90 to 100%) of staghorn sumac, Virginia creeper, and poison ivy.

Based on these results, the tolerance of Fraser fir to hexazinone is

questionable, but tolerance to glyphosate appears excellent, especially when applied over dormant firs in September. Although the safety of glyphosate on Fraser fir was less in April than September, the September applications are most practical for control of the deciduous woody plants that are resistant to preemergence herbicides such as simazine and oryzalin.

Table 3. Effect of glyphosate applied at two spray volumes in Sept 1978 and 1979 on injury and growth of Fraser fir in 1980.

Method of application	lb/A[a] glyphosate	simazine	Injury	Leader growth July 1980 - cm
untreated	0	0	0	31.2
	0	2	0	34.8
"Herbi" - 4.8 gal/A	0.375	0	0	34.0
	0.75	0	0	32.7
	1.125	0	0	31.2
"Teejet" 8004 - 50 gal/A	0.375	0	0	30.9
	0.75	0	0	35.7
	1.125	0	0	31.4
	0.375	2	0	26.0
	0.75	2	0	33.4
	1.125	2	0	31.8
L.S.D. p = .05				N.S.

[a] Glyphosate is ae; simazine is ai.

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SIMAZINE RESIDUES IN SOILS OF AN OLD-FIELD TREE PLANTATION

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ABSTRACT

Granular simazine band applications were evaluated over four growing seasons in an old field Fraser fir plantation in northern Vermont. Soil samples were taken from three depths for herbicide residue analyses. Though weed suppression and beneficial tree responses were still evident through the fourth season, simazine levels were reduced to zero, or near zero, at all three sampling depths.

INTRODUCTION

The herbicide simazine (2-chloro-4,6-bis(ethylamino)-s-triazine) is a well-established treatment for weed control in Christmas tree plantations. The quantity necessary for adequate control is often higher in high organic matter soils, particularly under cool, wet, northeastern conditions (1,2,3). Recent concerns (EPA, NAPIAP, etc.) have centered on pesticide impact on the natural environment. This study addresses that concern.

MATERIALS AND METHODS

The study area is located in a young Fraser fir (*Abies fraseri* (Pursh) Poir.) plantation. The growth and development of this species is similar to the native balsam fir (*Abies balsamea* (L.) Mill.) with the exception that Fraser fir initiates vegetative growth two to three weeks later than native fir species. Planting stock was well-developed (2 + 3) transplants shipped by air freight from Wolf Creek Tree Nursery, Tuckasegee, North Carolina. The planting was done at a spacing of 1.52 x 1.52 m on 20 May 1968 using planting bars. At the time of planting, 56.7 g of mono-ammonium phosphate (7-40-6) slow release fertilizer was placed adjacent to the root system of each tree.

DESCRIPTION OF SITE

The plantation is located in Wolcott, latitude 44° 36' longitude 72° 25', in Lamoille County in north-central Vermont. The site is on gently rolling topography with an east aspect at an average elevation above mean sea level of 396 m. Soil is a moderately well drained Woodbridge loam. Natural forest vegetation above the plantation is predominantly hardwoods of maples (*Acer saccharum* Marsh. and *A. rubrum* L.), eastern cottonwood (*Populus deltoides* Bartr.), gray birch (*Betula populifolia* Marsh.), and black cherry (*Prunus serotina* Ehrh.). At the bottom of the slope the natural vegetation is mainly balsam fir and red spruce (*Picea rubens* Sarg.).

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The particular area on which the plantation was established had been a hay field. Dominant grasses were timothy (Phleum pratense L.), red fescue (Festuca rubra L.), and sweet vernal grass (Anthoxanthum odoratum L.). Broadleaf weeds present were sheep sorrel (Rumex acetosellaL.), narrowleaf plantain (Plantago lanceolata L.), dandelion (Taraxacum officinale Weber.), northern bedstraw (Gallium boreale L.), orange hawkweed (Hieracium aurantiacum L.), and cinquefoil (Potentilla canadensis L.).

Analysis of the soil at the site showed an average percent organic matter of 5.2 with an accompanying high release rate for nitrogen.

Simazine was applied as granular Simazine 4G with a high-wheel lawn spreader in 61 cm bands over the trees, 7 days after transplanting. Rates used were 0, 4.5, 9.0, 12.5, and 18 kg/ha.

Weed control was rated the fall of the year of simazine application and each subsequent fall, for four years (Table 1). Grass and broadleaf weeds were rated separately on a scale of 0 for no control to 10 for no weeds present. Ratings were visual and took into account the size and density of the weeds present, and their distribution within the treatment area and width of swath controlled. Tree conditions were also evaluated on a rating system of 0 for dead and 10 for perfect condition. A summary for the second growing season is shown in Table 2.

Table 1. Weed control ratings[a] by simazine treatment over four growing seasons

Rate of Application (kg/ha)	Time After Treatment (Growing Seasons) 1	2	3	4
0	0	0	0	0
4.5	2	1	1	1
9.0	8	3	3	3
12.5	9	5	5	3
18	9	6	6	4

[a] Average ratings of weed control; 0 = no control, 10 = no weeds present.

Table 2. Fraser fir conditions by simazine rate of application after two growing seasons

Rate of Application (kg/ha)	0	4.5	9.0	12.5	18
Tree condition[a]	4	5	7	6	7

[a] Average ratings of tree growth and condition; 0 = dead, 10 = excellent growth and development.

Soil samples were taken annually with a 53 cm Hoffer soil probe from 10 randomly selected locations in each treatment plot, with samples drawn from a depth of 30.5 cm. Each soil core was subdivided into 0 to 7.6 cm, 7.6 to 15.2 cm, and 15.2 to 30.5 cm components, composited and subsampled for residue tests. Chemical analyses for simazine were done by gas chromatography in 1968 and 1969, and by the ultraviolet method in 1970 and 1971.

RESULTS

Though weed control remained evident through the fourth growing season, residue levels had decreased below .1 ppm. Laboratory analyses show trends of decreasing residue levels at the three depths sampled across the four growing seasons. The residue levels are summarized for the 0 to 7.6 cm depth in Table 3, for the 7.6 to 15.2 cm depth in Table 4, and for the 15.2 to 30.5 cm depth in Table 5.

Table 3. Simazine residues by application rate at a soil depth of 0 to 7.6 cm over four growing seasons.

Rate of Application (kg/ha)	Time After Treatment (Growing Seasons) 1	2	3	4
	- - - Simazine Residue (ppm) - - -			
0	0.12	---	---	0
4.5	0.54	0.28	0	0
9.0	1.23	0.15	0.07	0.07
12.5	1.12	0.31	0	0.09
18	1.45	0.95	0.10	0

Table 4. Simazine residues by application rate at a soil depth of 7.6 to 15.2 cm over four growing seasons

Rate of Application (kg/ha)	Time After Treatment (Growing Seasons) 1	2	3	4
	- - - Simazine Residue (ppm) - - -			
0	0.09	---	---	0
4.5	0.14	0.17	0	0
9.0	0.30	0.12	0	0.05
12.5	0.32	0.19	0	0.06
18	0.29	0.17	0	0

Table 5. Simazine residues by application rate at a soil depth of 15.2 to 30.5 cm over four growing seasons.

Rate of Application (kg/ha)	Time After Treatment (Growing Seasons) 1	2	3	4
	- - - Simazine Residue (ppm) - - -			
0	0.22	---	---	0
4.5	0.12	0.36	0	0
9.0	0.09	0.18	0.11	0.07
12.5	0.19	0.22	0	0
18	0.31	0.18	0	0

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Hexazinone for Vegetation Control in Forest Clearcuts in Maine

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Hexazinone as pellets or liquid was applied at various rates to control red maple stump sprouts and bramble vegetation on clearcut forests in Maine. Three studies were established; two to control hardwood stump sprouts and one to release planted red pine from brambles and brush.

Results indicate hexazinone pellet application rates necessary for adequate red maple sprout control are influenced by diameter and number of sprouts associated with each stump (Table 1).

Table 1. Average sprouts and average percent defoliation by diameters as related to hexazinone pellet treatments

	Stump Diameter Class (Inches)					
	0-5		5-10		10<	
Treatment # Pellets	# Sprouts	% Defol	# Sprouts	% Defol	# Sprouts	% Defol
2	13	34	13	68	28	25
4	7	90	24	10	28	10
8	8	95	38	38	40	21
16	18	88	83	17	51	25

Results with undiluted hexazinone liquid applied in May indicate the liquid is more effective than the pellets in controlling red maple stump sprouts within a diameter class. Spot gun applications

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totalling 32 mls, or more, of liquid resulted in most satisfactory levels of control (Table 2).

Table 2. Average percent defoliation of red maple stump sprouts treated with various rates of hexazinone liquid

Number of Spot Gun Applications	Amount of Herbicide	
	4 mls Shots	8 mls Shots
	% Defoliation	
1	25	23
2	43	49
4	58	80
8	71	88

During early spring 1980 single pellet applications adjacent to planted red pine selectively controlled brambles, releasing the suppressed pines.

HERBICIDE TRIALS IN NEWLY SEEDED HEMLOCK, WHITE SPRUCE, WHITE PINE, AND DOUGLAS-FIR

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ABSTRACT

Herbicides were applied about 2 weeks after emergence of Eastern hemlock, white spruce, white pine, and Douglas-fir and some treatments were repeated after 6 weeks. The standard herbicides were DCPA, 9 lb/A in hemlock and DCPA+ prometryn, 9 + 1 lb/A in the other species. Treatments that gave comparable or better weed control than the standards with tolerable injury to all conifer species included two applications of oxyfluorfen EC or napropamide F at 2 lb/A, and one application of napropamide F at 4 lb/A, or R-23758 at 2 or 4 lb/A. A single application of bifenox + napropamide at 3 + 2 lb/A gave excellent weed control over the season, but caused early injury to hemlock and white spruce, and lasting injury to Douglas-fir.

INTRODUCTION

The cost of hand weeding conifer seedbeds at the Connecticut State Forest Nursery has increased from about $1000 per acre in 1970 to about $2000 per acre in 1980. Following an extensive herbicide testing program from 1970 to 1975 (1,2), DCPA (dimethyltetrachloroterephthalate) and prometryn /2,4-bis(iso-= propylamino)-6-(methylthio)-s-triazine/ have been used with good results and have reduced hand weeding by 50 to 90%. DCPA is used on hemlock seedbeds and DCPA plus prometryn are used on other species. They are applied about 1 month after germination and repeated in 6 to 8 weeks. Shortcomings include the need for improved control of broadleaf weeds in hemlock and the need for improved controls shortly after seedling emergence when mineral spirits traditionally have been used.

Napropamide /2-(α-naphthoxy)-N,N-diethylpropionamide/, bifenox /methyl 5-= (2,4-dichlorophenoxy)-2-nitrobenzoate/ applied alone and in combination, and oxyfluorfen /2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene/ gave promising results in conifer seedbeds at this nursery or elsewhere (1,2, 3,4).

In the work reported here we evaluated these herbicides in comparison with the "standard" treatments of DCPA and prometryn, applied about 2 weeks after conifer emergence.

MATERIALS AND METHODS

Trials with herbicides in newly seeded conifers were conducted at the Connecticut State Forest Nursery at Voluntown. The sandy loam soil had been amended through the years with woody chips and contained 5% organic matter.

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Seeds of Eastern hemlock (Tsuga canadensis (L.), white spruce (Picea glauca (Moench)Voss), white pine (Pinus strobus L.), and Douglas-fir (Pseudotsuga menziesii) were drilled in separate 4-ft by 300-ft beds in November 1979 and covered with a mulch of pine needles. The mulch was removed in early May 1980 after the seeds had germinated. The herbicides were applied on May 16, 1980 when the conifer seedlings were about 1/2 inch tall. A few tiny weed seedlings were also present at treatment. A two-nozzle, hand-held boom calibrated to deliver 50 gal/A was used to spray 3-ft swaths across the beds. The herbicide plots were spaced 5 ft apart leaving 2-ft untreated between each. Fifteen percent of the plots also were left untreated. Treatments were arranged in randomized complete blocks with three replications within each species. The plots were irrigated within 30 min of the last treatment and almost daily thereafter, as in standard nursery practice. Polypropylene or cheesecloth screening was used to shade the seedlings during the growing season.

On June 25, July 31, and September 8, 1980, visual ratings of weed control and conifer injury were made on a 0 to 10 scale, with 0 as no control or injury and 10 as 100% control, or dead plants. Following each rating the weeds in all plots were removed by hand pulling. On June 25, 1980, certain plots were retreated after weeding.

The weed control ratings may be described as follows: 9 to 10 - excellent; 7.5 to 8.9 - good; 5.0 to 7.4 - fair; and less than 5 - poor. Average injury to conifers greater than 2.0 at the end of the season was considered undesirable (20% or more reduction in stand or vigor). Ratings of 1.0 or less were considered insignificant.

The principal weed species in June were crabgrasses (Digitaria spp.), horseweed (Conyza canadensis (L.)Cronq.), oldfield toadflax (Linaria canadensis (L.)Dumont), carpetweed (Mollugo verticillata L.), common groundsel (Senecio vulgaris L.), and common purslane (Portulacca oleracea L.). In July, ladysthumb (Polygonum persicaria L.), St. Johnswort (Hypericum perforatum L.), and prostrate spurge (Euphorbia supina Raf.) also were found in untreated plots. In September, the predominant weeds were common purslane, prostrate spurge, and carpetweed.

RESULTS AND DISCUSSION

The weed control and injury ratings are given in Tables 1 and 2, respectively. The weed control ratings taken on June 25 for treatments that were reapplied that day represent normal variation between two sets of plots treated alike. The weed control ratings were averaged over all conifer species treated alike.

DCPA at 9 lb/A gave good to excellent weed control for 11 weeks, but poor control at 17 weeks. Repeating the treatment in June gave fair control in September, with minor injury to the hemlocks. Control of all weeds with DCPA at 9 + 9 lb/A averaged 8.4 for the season.

DCPA + prometryn at 9 + 1 lb/A, applied on all species except the hemlocks gave results similar to DCPA alone in hemlocks. Control of all weeds with two applications averaged 8.0 for the season. However, the repeated application injured white pine and Douglas-fir more than in past trials where the combination was applied a month, rather than 2 weeks, after conifer emergence (1).

Oxyfluorfen EC at 0.25 lb/A gave good to excellent control of all weeds for 6 weeks, but poor control at 11 or 17 weeks after treatment. Broadleaf weeds were controlled better than crabgrasses. Repeating the application at 6 weeks gave good control of most weeds until September with no serious injury to any conifer species. Control of all weeds averaged 8.5 for the season. At 0.5 lb/A in May, oxyfluorfen also controlled weeds for 11 weeks, but when repeated in June, caused excessive injury to hemlock, white pine, and Douglas-fir. A single rate of 1 lb/A in May also injured these conifers excessively.

Bifenox, flowable (F), at 3 lb/A, gave good to excellent control of broadleaf weeds for 11 weeks, but poor control of crabgrasses. Repeating the treatment at 6 weeks improved control of broadleaf weeds, but gave only fair control of crabgrasses. Control of all weeds averaged only 7.1 for the season. Tolerance of hemlock, white spruce, and white pine was adequate, but tolerance of Douglas-fir was marginal with obvious growth suppression. Increasing the dosage to 6 lb/A in May gave control comparable to 3 + 3 lb/A, but increased conifer injury.

Napropamide F and its d-isomer (R-23758, WP), both injured all conifer species only slightly at 4 lb/A. Napropamide F at 2 + 2 lb/A or 4 lb/A gave fair to excellent weed control for 17 weeks with ratings of all weeds averaging 7.9 and 8.8 for the season. A single application of R-23758 at 2 lb/A controlled weeds as well as napropamide F at 4 lb/A or 2 + 2 lb/A. Control of all weeds averaged 8.4 for the season. Therefore, R-23758 WP gave more effective and longer lasting control than napropamide F without injury to the conifers.

Combining bifenox F with napropamide F at 3 + 2 lb/A in May gave excellent control of both crabgrasses and broadleaf weeds at 11 weeks, and good control at 17 weeks, with acceptable short term injury to hemlock, white spruce, and white pine, but excessive injury to Douglas-fir. Control of all weeds averaged 9.1 for the season. The combination, therefore, gave better weed control than napropamide or bifenox alone, and greater early injury than bifenox alone.

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Table 1. Weed control ratings with herbicides in conifer seedbeds.

Herbicide	Rate, lb/A ai May 16	Rate, lb/A ai June 25	June 25 (6 weeks) All weeds[a]	June 25 (6 weeks) Crab-grass[a]	June 25 (6 weeks) Bdlf[a]	July 31 (11 weeks) All weeds[a]	July 31 (11 weeks) Crab-grass[b]	July 31 (11 weeks) Bdlf[b]	Sept 8 (17 weeks) All weeds[a]	Season average[c] All weeds[a]
untreated						0	0	0	0.7	0.2
DCPA, WP	9	0	8.5	9.3	8.2	9.3	-	-	3.0	6.9
	9	9	8.5	9.5	8.2	9.5	-	-	7.3	8.4
DCPA+prometryn WP + WP	9+1	0	9.6	9.9	9.4	8.6	8.9	7.7	3.2	7.1
	9+1	9+1	9.3	9.8	9.5	9.6	9.9	9.3	5.1	8.0
oxyfluorfen,EC	.25	0	9.0	8.1	9.4	4.8	4.1	2.2	4.0	5.9
	.25	.25	8.9	7.7	9.1	9.0	8.3	8.9	7.9	8.6
	0.5	0	9.4	8.6	9.7	8.2	7.0	8.3	5.7	7.8
	0.5	0.5	9.5	9.1	9.7	9.6	9.8	9.3	8.4	9.2
	1.0	0	9.7	9.8	9.7	9.3	9.2	9.1	8.3	9.1
bifenox, F	3	0	7.6	4.9	9.5	6.5	3.3	8.0	3.4	5.8
	3	3	7.6	5.4	9.3	7.8	5.4	9.3	6.0	7.1
	6	0	7.9	5.5	9.5	7.3	6.6	8.6	5.6	6.9
napropamide, F	2	0	9.0	9.7	8.5	6.3	9.7	2.8	6.3	7.2
	2	2	8.8	9.5	8.1	7.3	9.8	6.3	7.7	7.9
	4	0	9.7	9.7	9.4	8.6	9.9	7.5	8.2	8.8
R-23758 WP	2	0	9.5	9.9	9.1	8.3	9.9	7.2	7.4	8.4
	4	0	9.6	9.8	9.4	9.3	10.0	8.7	9.0	9.3
bifenox, F+ napropamide F	3+2	0	9.7	9.8	9.5	9.5	9.7	9.1	8.2	9.1

a/ Each figure is an average of 12 plots except DCPA + prometryn treatments were averaged for nine plots and DCPA treatments were averaged for three plots (hemlocks only).

b/ Each figure is an average of 6 plots.

c/ Obtained by averaging all weed ratings for June 25, July 31, and Sept 8.

Table 2. Injury to conifers with herbicides applied in May and/or June.

Herbicide	Rate, lb/A ai 5/16	6/25	Hemlock 6/30	9/8	White spruce 6/30	9/8	White pine 6/30	9/8	Douglas-fir 6/30	9/8
untreated			0	0.3	0	0.9	0.2	0.2	0	0.8
DCPA, WP	9	0	0.7	0.3	-	-	-	-	-	-
	9	9	0.7	1.3	-	-	-	-	-	-
DCPA, WP + prometryn WP	9+1	0	-	-	1.7	0	2.7	1.0	1.7	1.7
	9+1	9+1	-	-	0.7	0.3	2.7	2.3	1.3	2.3
oxyfluorfen, EC	0.25	0	2.3	0.7	1.7	0.7	0	0	1.3	1.0
	0.25	0.25	1.7	1.0	0	0.3	1.0	0.7	1.3	0.7
	0.5	0	2.3	1.3	2.0	1.0	1.7	0.7	2.7	1.7
	0.5	0.5	3.0	3.0	2.3	1.0	3.3	3.3	2.7	3.0
	1.0	0	3.3	4.3	2.3	0	3.3	1.7	4.3	3.3
bifenox, F	3	0	1.3	1.7	0.7	1.0	0.3	0	2.7	2.3
	3	3	1.3	1.7	1.0	0.7	1.3	1.0	2.3	2.0
	6	0	3.0	0.7	3.0	1.7	1.3	0.3	3.3	4.0
napropamide, F	2	0	0.7	1.0	0.3	0.3	0.3	0.3	0.7	0
	2	2	0	0	0.3	0.3	0	0	0.3	0.7
	4	0	1.3	1.3	0.7	0.3	0.7	1.0	0.3	0.7
R-23758, WP	2	0	0.7	0.3	0.3	0	0.7	0	0.7	0.7
	4	0	0.7	1.0	0.7	0	0	0.7	0.7	0
bifenox, F+ napropamide, F	3+2	0	2.3	0.7	2.7	1.0	1.0	0.3	2.7	2.7

GLYPHOSATE AND TRICLOPYR MIXTURES TO CONTROL FOREST BRUSH

M.L. McCormack, Jr.[1/] and T.B. Saviello[2/]

ABSTRACT

The effectiveness of tank mixes of glyphosate and triclopyr for control of bracken fern, trembling aspen, red maple, and gray birch was evaluated. Applications were made with backpack mistblower from an elevated position in the center of undisturbed .004 ha circular plots in Howland, Maine on August 23, 1979. The combination treatments were .42 plus .42, .62 plus .62, and .84 plus .84 kg/ha, respectively, of glyphosate plus triclopyr amine. These were mixed in water to deliver a total volume of 93.5 l/ha. Each treatment was replicated twice for a total of six plots.

Results substantiated observations following an earlier, less formal study. Initial evaluation of these treatments showed an acceleration of foliage symptoms. Good levels of control were evident within a week after treatment. Evaluations one year after treatment showed complete suppression of all undesirable vegetation for all three combination rates. Tolerance of treatments by desirable species varied. No visual injury occurred on balsam fir, red or Norway spruces. White pines were killed.

The effectiveness of the lowest rate of glyphosate plus triclopyr indicates promise of similar ratios at very low rates. Because of no soil residual complications following good broad spectrum brush control, such treatments should be especially useful, practical site preparation for forest tree plantings. Further study and refinement of these treatments is in progress.

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APPLICATION ADVANCES FOR THE USE OF TEBUTHIURON[1/] FOR WOODY PLANT CONTROL IN NONCROPLAND AREAS

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Elanco Products Company, a division of Eli Lilly and Company, has recently received three label clearances for the use of tebuthiuron. Two of these label clearances involve different application techniques for woody plant control in noncropland areas. The remaining label clearance is for 11 tank-mix combinations with tebuthiuron for broad spectrum noncropland weed control. This presentation will deal with the proper application of tebuthiuron for woody plant control.

The new application techniques for tebuthiuron are spot treatment application and application of parallel bands to the soil surface. To understand more fully why these application techniques for tebuthiuron effectively control woody plants, the herbicidal mode of action of tebuthiuron needs to be reviewed.

Tebuthiuron is a broad spectrum soil applied herbicide which is absorbed through plant roots. After application, rainfall will move the tebuthiuron into the root zone of the target woody species. Tebuthiuron is translocated upward to the leaves of the plant where it interrupts the photosynthetic process. Initial injury symptoms usually appear as leaf chlorosis along the margins. This is followed by chlorosis of the interveinal areas of the leaf, leaf drop and eventually the death of the plant.

A typical deciduous woody plant may go through several defoliations and refoliations over the course of one or two growing seasons. The defoliation/refoliation cycle depletes the plant's food reserves and eventually results in the plant's death.

Both the spot treatment and the parallel band treatment concentrate tebuthiuron in the soil allowing for more rapid downward movement of the herbicide. The concentrated zone of tebuthiuron increases the amount of material available for root absorption by woody plants, while reducing injury to shallow rooted herbaceous vegetation in the treatment area.

Due to the fact that tebuthiuron is a root absorbed herbicide, caution should be used when applying in areas that may have desirable nontarget plants with roots extending into the treated zone.

1/ SPIKE® 80W, tebuthiuron

The spot treatment of tebuthiuron concentrates material at the base of the target woody stem. An effective way to deliver this spot is to utilize a Chem-Trol spot gun. Mixing 3.6 pounds of tebuthiuron with water to a total volume of one gallon of suspension and then applying 4 ml of this suspension to the base of the individual woody stem delivers the recommended amount of material. The residual wettable powder, when dry, allows easy identification of which stems have been treated. The resulting effects of a tebuthiuron spot treatment is brush control with a minimum of understory disturbance.

The parallel band technique involves applying tebuthiuron in a series of concentrated bands spaced 4 to 10 feet apart. Rates for this application technique range from 2.5 to 7.5 pounds tebuthiuron per acre depending on the target woody species present. The parallel band label lists 108 different woody species.

The bands can be applied using vehicle mounted sprayers or hand-pump back-pack equipment in spray volumes ranging from 5 to 75 gallons per acre. An effort should be made to keep the bands as narrow as possible to minimize injury to the understory vegetation. Nearly all vegetation, both woody and herbaceous, within the bands will be controlled. The band spacing of 4 to 10 feet allows flexibility in dealing with different brush situations. When control of young or seedling plants is desired, the bands should be closer together to allow for maximum exposure of the limited root systems. The band spacing should be wider when control of larger, more mature woody plants is desired. Band spacing will directly influence tebuthiuron's effects on the understory vegetation. The closer band spacings will result in the greatest injury to understory vegetation.

When applying the bands on steep slopes, they should run perpendicular with the slope to reduce the potential for soil erosion.

The best application techniques will only provide the desired results if the user learns to recognize and avoid potential problem areas. The tebuthiuron label clearly and emphatically warns against such hazards. Nontarget off right-of-way trees should be avoided in all application situations. As with all soil active herbicides, tebuthiuron will kill those trees whose roots underlie the treated area. A common sense alert approach to all application operations will eliminate any major concerns in this regard.

Brush control with tebuthiuron offers the broadest spectrum woody plant control available. Proper utilization of this activity can only be achieved if all elements discussed today are understood and implemented.

MULTIFLORA ROSE CONTROL STUDIES WITH SOIL APPLIED HERBICIDES

M. L. Link, P. L. Hipkins and W. E. Chappell[1/]

ABSTRACT

Various soil active compounds were applied to Multiflora rose (Rosa multiflora L. Thunb.) on March 28, 1979 at the initiation of bud break. The roses were 2-3 m in height and formed a continuous, uniform stand adjacent to a pasture. A randomized complete block design with three replications was used. Each plot was a measured 45 m^2. Applications were made by hand for the granular and pelletized formulations and with a stainless steel backpack sprayer for the wettable powders. Evaluations were made on October 11, 1979 and October 16, 1980 based on a subjective, visual estimate of crown injury (0 = no injury, 10 = complete crown death). Generally, the ratings observed in the fall of 1979, with the exception of picloram, were less than expected. However, observations made in the fall of 1980 indicated that the control provided by tebuthiuron and hexazinone had increased significantly. The control afforded by dicamba, while marginal at the first rating, was further reduced when rated a year later. A listing of the treatments, formulations, rates of application, and average control ratings are presented in Table 1.

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Table 1. Average control ratings for multiflora rose. Applied 3/28/79 and evaluated 10/11/79 and 10/16/80.

Treatment and Formulation	Rate kg(ai)/ha	Avg. Control rating 10/11/79	Avg. Control[Z/] rating 10/16/80
Picloram (10% pellet)	4.5	10.0[a]	9.3[ab]
Dicamba (5% granular)	9.0	5.3[d]	2.3[d]
Dicamba (5% granular)	11.2	6.3[cd]	2.0[d]
Dicamba (5% granular)	16.8	6.0[cd]	6.0[bcd]
Dicamba (10% pellet)	9.0	5.6[d]	2.6[cd]
Dicamba (10% pellet)	11.2	5.6[d]	4.3[cd]
Hexazinone (10% pellet)	11.2	8.7[abc]	6.0[bcd]
Hexazinone (10% pellet)	11.2	8.7[abc]	7.0[bc]
Hexazinone (10% pellet)	22.4	9.3[ab]	9.6[ab]
Tebuthiuron (20% pellet)	2.2	6.7[bcd]	7.3[bc]
Tebuthiuron (20% pellet)	3.4	7.7[abcd]	9.0[abc]
Tebuthiuron (20% pellet)	6.7	8.0[abcd]	10.0[a]
Tebuthiuron (80% WP)	3.4	7.0[bcd]	10.0[a]
Control	----	0.0[e]	0.0[e]

[Z/] Based on a subjective, visual estimate of crown injury. (0 = no control, 10 = complete crown death). Ratings within columns followed by the same letter are not significantly different at the 5% level of the Duncan's multiple range test.

EVALUATION OF SEVERAL ALTERNATIVES TO BASAL APPLICATIONS OF 2,4,5-T

John W. Goodfellow and Richard H. Mider [1/]

ABSTRACT

Forty-four alternative treatments to basal applications of 2,4,5-T were applied to woody vegetation on a utility right-of-way in Broome County, New York. Alternative treatments included modification in herbicide formulations and application techniques, as well as non-chemical methods. Treatment evaluation occurred after two growing seasons for plots established in the spring of 1979 and after one growing season for plots established in fall 1979 and spring 1980.

INTRODUCTION

A primary objective of system reliability establishes the need for vegetation control on electric utility rights-of-way. Through selective management of right-of-way vegetation, progress can be made toward the establishment of a relatively stable vegetative complex composed of those species compatible with the electrical facility above (1).

Prior to the suspension of 2,4,5-T (2,4,5-trichlorophenoxyacetic acid) by the U.S. Environmental Protection Agency in February 1979, basal application of this herbicide as an ester in fuel oil was a valuable technique in selective vegetation management. The objective of this study has been to test under field conditions available (or soon to be available) alternatives to selective basal applications of 2,4,5-T on woody species typically found on utility rights-of-way in New York State. A second objective has been to evaluate methods of reducing oil requirements through the use of alternatives to straight fuel oil as carriers of the herbicidal active ingredient.

MATERIALS & METHODS

One hundred ten plots each being 50 ft. by 50 ft. were established in Broome County, New York on a right-of-way corridor occupied by several electrical transmission lines. There had been no history of previous vegetation maintenance taking place on this site since the clearing for line construction which took place in the late 1960's.

It was felt that due to the abnormally large size of the vegetation, this site offered "worse case" conditions for a utility right-of-way. Typically stems reached heights of 20 ft. to 25 ft. Stem densities typically ranged from 2,000 to 4,000 stems per acre. Species present in abundance included quaking aspen (*Populus tremuloides* MICHX), red maple (*Acer rubrum* L),

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1/ Forester and Staff Forest Engineer, respectively, New York State Electric and Gas Corp., Binghamton, N.Y.

red oak (Quercus rubra L.), white ash (Fraxinus americana L.), pin cherry (Prunus pensylvanica L.) and black cherry (Prunus serotina EHRH.).

An effort was made to simulate procedures currently in operational practice during chemical application on each 50 ft. by 50 ft. plot. Application was made by closely supervised experienced contract personnel following standard procedures for each treatment. Table I defines the methods of application and Table II lists the herbicides which were evaluated in this study.

Table I - Methods of Application

Method	Equipment	Treatment Specifications	Carrier
Basal	5 gal. back tank	Lower 12"-18" of stem, thorough wetting, puddling at root collar	Oil
Modified Basal	5 gal. back tank or hydraulic sprayer	Lower 3' of stem, thorough wetting, puddling at root collar	Oil & Water + Surfactant
Water Basal	5 gal. back tank	Lower 3' of stem, thorough wetting, puddling at root collar	Water + Surfactant
Injection	Basal tree injector	1 ml herbicide/incision, incisions at interval <2" around circumference of stem	None
Stump Treatment	Squirt bottle	Spray cambium ring of freshly cut stumps	Undilute/Water
Pellets	By hand	Around each stem at manufacturer's rate	None
Mist Blower Basal	Back pack power mist blower	Lower 18" of stem to point of thorough wetting	Oil
Spot Treatment	Spot Gun	Liquid applied directly to soil around individual stem. Manufacturer's rate.	Water
Banding	Hand sprayer	Nonselectively to soil in two parallel bands	Water
Hack & Squirt	Brush axe	Frills cut at waist ht. <½" between frills. Chemical applied in frills	Water / Undiluted
Burn Girdling	Kerosene sprayer	Stems burned at root collar until well blackened	None
Girdling	Girdling chain	Grove encircling stem cut to a depth of ½"	None

Table II - Herbicides Evaluated

Common Name a/	Chemical Name
2,4-D	(2,4-dichlorophenoxy) acetic acid
Dicamba	3,6-dichloro-o-anisic acid
Dichlorprop	2-(2,4-dichlorophenoxy) propionic acid
Glyphosate	N-(phosphonomethyl) glycine
Hexazinone b/	3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione
Mecoprop	2-(4-chloro-o-tolyl) oxylpropionic acid
Picloram	4-amino-3,5,6-trichloropicohnic acid
Tebuthiuron	N-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl] -N,N'-dimethylurea
Triclopyr	[(3,5,6-trichloro-2-pyridinyl)oxy] acetic acid

a/ Herbicide Handbook of the WSSA, Fourth Edition 1979

b/ DuPont Product Label, EPA Reg. No. 352-392

In most cases each formulation and method being evaluated was applied to three separate plots. The volume of chemical applied per plot was dependent upon the vegetative composition and stem density of each plot as they pertain to the specifications of each application technique, and not on a predetermined rate based on unit area. The only exception was in the application of the banding technique.

The field evaluation conducted during August 1980 involved a 100% inventory of a .01 acre sample area centered within each treatment plot. Species, diameter class, and defoliation rating (Table III) were recorded for each undesirable plant within the .01 acre sample area. The location of foliage or regrowth on those stems not completely defoliated was recorded for each species. Additionally general observations of conditions within the plot were recorded.

Table III - Defoliation Rating Classes

Rating	Class Requirements
100	Plant is completely lacking of foliage
80	Plant has experienced a 80 to 99 percent reduction in foliation from normal
60	Plant has experienced a 60 to 79 percent reduction in foliation from normal
30	Plant has experienced a 30 to 59 percent reduction in foliation from normal
0	Plant has experienced a 0 to 29 percent reduction infoliation from normal

RESULTS & DISCUSSION

Table IV lists the method of application, herbicide formulation and effectiveness of each treatment investigated during this study.

Table IV - Study Treatments

Treatment Number a/	Method of Application	Herbicide Formulation	Effectiveness (%) b/
1	Basal	8 lb ae 2,4-D, 4 lb ae dichlorprop, 2 lb ae dicamba as esters + 96 gal oil	74
2	Basal	10 lb ae 2,4-D, 6 lb ae dichlorprop, 2 lb ae dicamba as esters + 95 gal oil	72
3	Basal	12 lb ae 2,4-D, 8 lb ae dichlorprop, 2 lb ae dicamba as esters + 94 gal oil	70
4	Basal	10 lb ae 2,4-D, 4 lb ae dichlorprop, 3 lb ae dicamba as esters + 95 gal oil	80
5	Basal	12 lb ae 2,4-D, 6 lb ae dichlorprop, 3 lb ae dicamba as esters + 94 gal oil	72
6	Basal	14 lb ae 2,4-D, 8 lb ae dichlorprop, 3 lb ae dicamba as esters + 93 gal oil	67
7	Basal	6 lb ae 2,4-D, 3 lb ae dicamba as esters + 97 gal oil	74
8	Basal	8 lb ae 2,4-D, 8 lb ae dichlorprop as esters + 96 gal oil	78
9	Basal	2 lb ae picloram as an ester + 99 gal oil	73
10	Basal	4 lb ae picloram as an ester + 98 gal oil	72
11	Basal	4 lb ae triclopyr as an ester + 99 gal oil	65
12	Basal	8 lb ae triclopyr as an ester + 98 gal oil	91
13	Basal	4 lb ae triclopyr, 2 lb ae picloram as esters + 98 gal oil	96
14	Mist Blower Basal	24 lb ae 2,4-D, 12 lb ae dichlorprop, 6 lb dicamba as esters + 88 gal oil	83
15	Injection	1 lb ae 2,4-D, .25 lb ae picloram as amine salts per gal	60
16	Pellets	10% ai picloram as potassium salt	86
17	Modified Basal	8 lb ae 2,4-D, 8 lb ae dichlorprop as esters + 1 lb ae picloram as potassium salt + 1 gal surfactant + 20 gal oil + 75 gal water	-- c/
18	Modified Basal	12 lb ae 2,4-D, 6 lb ae dicamba as esters + 1 lb ae picloram as potassium salt + 1 gal surfactant + 15 gal oil + 78 gal water	-- c/
19	Modified Basal	(6,8,12) lb ae 2,4-D, (3,4,6) lb ae dicamba as esters + 1 gal surfactant + 15 gal oil + (81,80,79) gal water	-- c/

Treatment Number a/	Method of Application	Herbicide Formulation	Effectiveness (%) b/
20	Water Basal	8 lb ae triclopyr as ester + 98 gal water	-- c/
21	Water Basal	11 lb ae 2,4-D, 5.5 lb ae mecoprop, 1.1 lb ae dicamba as amine salts + 1 pt surfactant + 95 gal water	-- c/
22	Stump Treatment	(.5,1) lb ae 2,4-D, (.125, .25) lb ae picloram as amine salts per gal	79
23	Basal	12 lb ae 2,4-D, 6 lb ae dichlorprop, 3 lbs dicamba as esters + 94 gal oil	72
24	Basal	4 lb ae tryclopyr as an ester + 99 gal oil	80
25	Basal	2 lb ae picloram as an ester + 99 gal oil	73
26	Basal	1 lb ae triclopyr, 1 lb ae picloram as esters + 99.25 gal oil	68
27	Basal	2 lb ae triclopyr, 1 lb ae picloram as esters + 99 gal oil	77
28	Basal	2 lb ae triclopyr, 1.5 lb ae picloram as esters + 98.75 gal oil	92
29	Modified Basal	2 lb ae triclopyr, 1 lb ae picloram as esters + 2.5 gal surfactant + 20 gal oil + 76.5 gal water	50
30	Basal	1 lb ae picloram, 6 lb ae 2,4-D, 3 lb ae dicamba as esters + 96.5 gal oil	57
31	Basal	2 lb ae triclopyr, 6 lb ae 2,4-D, 3 lb ae dicamba as esters + 96.5 gal oil	82
32	Basal	2 lb ae triclopyr, 6 lb ae 2,4-D, 6 lb ae dichloprop as esters + 96.5 gal water	73
33	Hack & Squirt	3 lb ae triclopyr as amine salt per gal	-- f/
34	Injection	1 lb ae 2,4-D, .25 lb ae picloram as amine salt per gal	72
35	Basal	1 lb ae picloram, 6 lb ae 2,4-D, 6 lb ae dichlorprop as esters + 96.5 gal oil	64
36	Water Basal	2 lb ae triclopyr, 1 lb ae picloram as esters + 10 gal surfactant + 89 gal water	<50
37	Hack & Squirt	1 lb ae 2,4-D + .25 lb ae picloram as amine salt per gal	-- d/
38	Hack & Squirt	4 lb ae glyphosate as amine salt per gal	-- d/
39	Banding	2.5 lb ai tebuthiuron per acre	19 e/
40	Spot Treatment	2.5 lb ai tebuthiuron + 1 gal water	39 e/
41	Pellets	10% ai hexazinone	37 e/
42	Spot Treatment	2 lb ai hexazinone per gal	0 e/
43	Burn Girdling	None	-- c/
44	Girdling	None	-- c/

a/ Treatment #1 through #23 established May 1979, #23 through #36 (exclusive #33) and #44 established November 1979, #39 through #43 established April 1980, #37 and #38 established August 1980.

b/ Effectiveness expressed as total # stems in defoliation rating class 100 (Table III) ÷ total # stems in sample X100. Evaluated August 1980.

c/ Plots not specifically evaluated. Visual observations made at the time of evaluation showed little or no effect of treatment on plot vegetation.

d/ Evaluation came less than one growing season after treatment.

e/ Most stems had completely defoliated and refoliated at time of evaluation. Due to mode of action of these materials, stems will probably defoliate again.

f/ Treatment not yet applied.

Recognizing the small sample size of each treatment, the following is a brief discussion of results and observations. A complete reporting of results to date for each treatment has been made in "A preliminary assessment of several potential vegetation management techniques as a substitute for basal applications of 2,4,5-T". 4/

Basal: The evaluated results of applications of several combinations of 2,4-D, dichlorprop and dicamba in oil were variable with no strong relationship readily apparent between treatment and effectiveness (Figure I). Variation in species composition between plots may be influencing this relationship.

Basal application of 4 lbs. triclopyr ester and 2 lbs. picloram ester (treatment #13) after two growing seasons had the best overall effectiveness rating. Application of these two materials at lower rates look promising over a broad spectrum of species after one growing season and may show similar results when evaluated after two growing seasons. Triclopyr alone was observed to be somewhat variable on black cherry and oak (Quercus Spp.). The ester of picloram alone was variable on oak (Quercus Spp.) and was slow to effect red maple. White ash appeared to be somewhat resistant to basal applications of picloram ester. Figure II compares the percentage of stems totally defoliated (defoliation rating 100, Table III) for the six most effective treatments evaluated.

Figure I
Combinations of 2,4-D, dichlorprop and dicamba

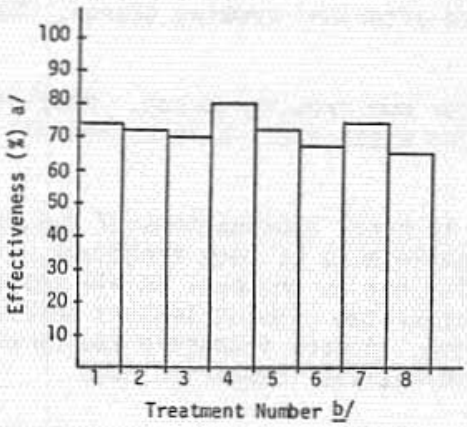
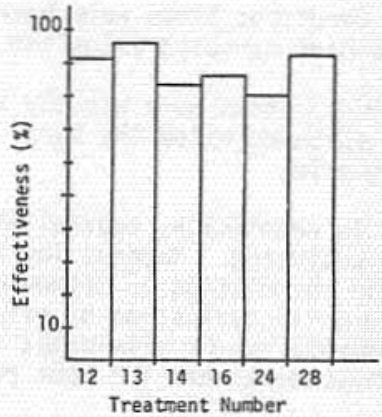


Figure II
Six most effective treatments



a/ Effectiveness (%) = $\frac{\text{\#stems in defoliation class 100}}{\text{total \#stems in sample}} \times 100$

b/ Treatment number refers to Table IV

4/ Goodfellow, J.W. and R. H. Mider 1980. Available upon request from New York State Electric & Gas Corporation, Binghamton, New York

Modified Basal & Water Basal: None of the formulations were effective enough to be considered of operational value. Significant phytotoxic effects were observed on the understory of nontarget vegetation.

Injection: Results were poor. This may be due to the fact that incisions were widely spaced on stems that were difficult to treat (ie. large clumps of stump sprouts). There seems to be a relationship between incision spacing and treatment effectiveness.

Stump Treatment: In general there was a 75% reduction in stems determined by a count of sprouting stumps.

Pellets: Picloram (as the potassium salt) in pellet form has proven to be effective after two growing seasons (Figure II). White ash and red oak were observed to exhibit some degree of resistance.

Mist Blower Basal: Results show this method to be fairly effective. The extent of oil reduction over conventional basal applications should be tested on larger areas. There was significant damage evident on nontarget vegetation.

Banding & Spot Treatments: The results after one growing season are inconclusive. There was significant damage evident on nontarget vegetation.

Hack & Squirt: Evaluation occurred less than one growing season after treatment application. It is too early to determine anything of significance.

Burn Girdling: Stems were heavily foliated after one growing season. Many stems have sprouted below the burn.

Girdling: Stems were heavily foliated after one growing season. Most stems have sprouted below the burn. Most quaking aspen stems have broken off at the girdle.

In conclusion, several alternatives to basal applications of 2,4,5-T have been evaluated. Recognizing the small sample size of each treatment, no single formulation or method can be singled out as the best in all cases. Based on an evaluation of effectiveness after two growing seasons several treatments can be eliminated as ineffective. A more intensive review may now be directed toward the most promising alternatives identified here.

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HERBICIDE VEGETATION MANAGEMENT IS SAFER[1]

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ABSTRACT.--Chemical Vegetation Management crews have fewer and less severe accidents and are more efficient than manual or mechanical crews working on utility rights-of-way. Chemical crews are not exposed to sharp cutting edges of tools such as axe, brush whip, brush axe, chain saw, and brush saw. Studies have shown that crew exposure to herbicides on utility rights-of-way do not pose a significant hazard. These factors result in a 72% lower Worker Compensation rate for chemical crews compared to other crews. Finally, Chemical Vegetation Management is less damaging to the environment than repeated manual or mechanical clearing operations.

Up-to-date information is needed concerning the 2,4,5-T controversy and on the safety of spray crews. Our purpose is to present some background information and to give reassurance that 2,4,5-T does not present an unreasonable risk to humans, livestock, wildlife, or the environment in general. In fact, it is safer for the employees than hand clearing with saws and axes.

Judging from the allegations of hazard reported in the news, one sometimes wonders about the futility or utility of trying to defend 2,4,5-T. At the North Central Weed Control Conference in St. Paul, Minnesota is December, 1978, Dr. Fred Tschirley of Michigan State talked about the efforts of the joint USDA/EPA/States assessment team to compile data on the benefits of this herbicide. He estimated very conservatively that more than $600,000 and about 12 man-years of professional time were being expended by them, EPA, Dow and others in this latest round on the 2,4,5-T issue. Dr. Tschirley also questioned whether this effort might have been spent more productively in research on new ways to control weeds and brush. However, based on what happened to DDT and other insecticides, it is imperative that we defend what we consider to be a safe product such as 2,4,5-T, or other herbicides will be regulated in a similar fashion.

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1 Paper presented at the Second Symposium on Environmental Concerns in Rights-of-Way Management, University of Michigan, Ann Arbor, October 16-18, 1979.

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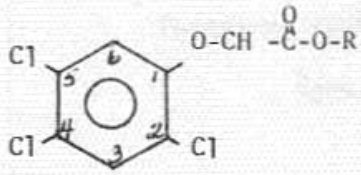
Dr. Boysie Day of the University of California at Berkeley is also on the 2,4,5-T assessment team, and has expressed frustration with the current regulatory process. Decisions about safety appear to be based on politics rather than on scientific evidence demonstrating the lack of hazard from proper use. In his opinion, 2,4,5-T is a good target for government action because less than 10 million pounds are used worldwide each year, and it is important to only a small segment of the agricultural industry.

A little background follows on the 2,4,5-T problem: the chemical structure of 2,4,5-T is:



Acid: R = H

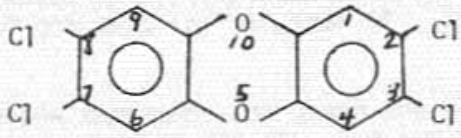
Ester: R = alcohol

Short chain esters - volatile

Long chain or complex esters - low volatile

The volatile butyl ester was one of the ingredients in Agent Orange used as a defoliant in Vietnam. Controversy over the use of chemicals in warfare was amplified in late 1969 when Bionetics Laboratory reported that 2,4,5-T could cause birth defects in mice. The problem was apparently caused by an impurity in the 2,4,5-T sample used by Bionetics.

During the manufacturing process, two molecules of 2,4,5-trichlorophenol intermediate can condense under alkaline conditions at high temperatures and pressures to form 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD).



Chlorodioxins - 75 possible isomers

Tetrachlorodioxins - 22 possible isomers

TCDD solubility 0.2 ppb in water

Note that there are 22 possible tetrachloro isomers but that the one formed from 2,4,5-trichlorophenol has the four chlorines arranged symmetrically around the molecule. Compared to most of the other "dioxins," this configuration makes it highly toxic to mammals, so it is imperative to keep the level of this isomer as low as possible. Any 2,4,5-T produced in the U.S.A. has contained less than one-tenth of a part per million TCDD since 1971.

2,4,5-T was used for selective control of weeds in rice, and for vegetation management on rights-of-way (ROWs), in grazing lands, and in conifer forests where poor quality deciduous trees crowd out the more valuable pines and fir trees. Other herbicides are not as selective or as effective as 2,4,5-T, particularly for forestry and ROW use.

In March 1979, the EPA suspended the use of 2,4,5-T on ROWs, pasture and forests.

The suspension was based mostly on a study of women in the Alsea, Oregon area. The EPA said this study showed a relationship between spraying with 2,4,5-T and spontaneous abortions.

The following June, a "Dispute Resolution Conference on 2,4,5-T" was held in Washington, D.C. Approximately 60 scientists from the United States and seven foreign countries met for four days to discuss and review the known scientific facts on 2,4,5-T. The following is part of the summary of a workshop which addressed human exposure:

> "The group considered the Alsea, Oregon data and reached a consensus that such serious deficiencies existed in the data that no conclusions were possible regarding possible abortifacient (causing abortions) effects of 2,4,5-T."

Hazard Assessment

The safety of herbicides, especially 2,4,5-T as related to human exposure, is of great concern to the ROW maintenance industry. In reviewing 2,4,5-T one of the EPA's chief concerns was that, in this day and age of "women's lib," women of childbearing age might be employed as applicators of 2,4,5-T, with potential for harm to their future offspring. According to the EPA's exposure estimates, an adequate margin of safety does not exist, especially for backpack applicators, particularly if they require a safety factor of 1000-fold for teratogenic agents. However, EPA's estimates were at least 100 times higher than the dose found in actual field studies with 2,4,5-T in applicators.

Furthermore, the margin of safety is much greater than for many drugs, including aspirin, which are taken by women not only during child-bearing years, but during actual pregnancy. Thus, this hazard appears to be academic.

With regard to actual hazard, it should be remembered that the degree of hazard from exposure to a toxic substance depends not only on its toxicity, but also on the extent of exposure. Wtihout exposure, there is no hazard regardless of the toxicity of the compound. Thus, the risk to women living near sprayed areas is exceedingly small.

In order to estimate the maximum potential risk of developing a tumor from exposure to 2,4,5-T containing 0.1 ppm TCDD, Dow used the very conservative "one-hit" model and upper 99% confidence limits for extrapolation from the data on rats fed 2,200 ppm TCDD in their total diet for life. Since the incidence of tumors was greater in female rats in the Dow study, that frequency was used to calculate the potential for tumor formation in a female backpack sprayer. Even with this very conservative approach, the extrapolated annual risk was only 0.4 per million women who had applied 2,4,5-T containing 0.1 ppm TCDD each day, 5 days per week, 4 months per year for 30 years. In other words, there might be one tumor per 2,500,000 such female backpack sprayers per year. In contrast, what is the potential for developing cancer from exposure to known carcinogens? Based on data presented by Dr. Richard Wilson of Harvard during the 1978 OSHA carcinogen hearings, the relative risk for a backpack sprayer is very small compared to exposure to cigarette smoke, alcohol, saccharin, aflatoxin, chlorinated chemicals in water, and various forms of radiation.

Relative Risk of Cancer per Million People Exposed per Year

Female backpack sprayer applying 2,4,5-T containing 0.1 ppm TCDD, 5 days per week, 4 months per year, for 30 years.	0.4
Smoking cigarettes	1200
Being in a room with a smoker	10
Eating and drinking	
Charcoal broiled steak, ½ lb. per week	0.4
Water in Miami or New Orleans	1.2
Diet soda (saccharin), 1 per day	10
Milk (aflatoxin), 1 pint per day or cheese equivalent	10
Peanut butter (aflatoxin) 4 Tbsp. per day	40
Beer (alcohol), 1 can per day	20
Exposure to radiation	
One transcontinental flight per year	0.5
Frequent airline passenger	15
Living in Denver vs. New York	10
Average U.S. diagonostic medical X-rays	10
Living in brick vs. wood building	5
Natural background at sea level	15
Sunbathing or mountain climbing (skin cancer, curable)	5000

According to these figures, being in a room with a smoker or drinking one diet soda per day is 25 times more hazardous than 30 years of spraying 2,4,5-T containing the maximum permissible level of 0.1 ppm TCDD; so is drinking milk, eating cheese or peanut butter, all of which may contain aflatoxins permitted by the Food and Drug Administration at levels up to 20 parts per billion. Exposure to various forms of radiation such as from traveling by air, living at high elevations, or even sunbathing is also more hazardous than being a backpack sprayer applying only 2,4,5-T for 30 years.

Just as no exposure means no hazard when discussing the herbicides we use on ROWs, exposure to sharp tools creates a hazard to workers when the option of manual clearing ROWs is evaluated.

Chemical Vegetation Management crews have a good safety record. Asplundh's experience through the years has been that accidents are fewer and less severe on crews using chemicals than on manual crews. Some typical workmen's compensation rates, expressed as the percent of the total labor cost spent on workmen's compensation, show the relationship between manual tree operations and chemical crews.

8-1-79

State	Manual Tree Trimming %	Outside Supervision %	Clerical %	Chemical Crews %
California	23.77	0.82	0.43	*
Minnesota	40.74	0.69	0.23	5.95
New Jersey	9.59	.77	.36	*

State	Manual Tree Trimming %	Outside Supervision %	Clerical %	Chemical Crews %
New York	20.62	.87	0.38	*
Oregon	27.56	1.29	0.50	*
Pennsylvania	11.60	0.84	0.30	*
West Virginia	7.53	0.50	0.16	*
Virginia	12.35	0.40	0.18	*

* not published separately from manual crews.

Even though Minnesota is the only state to publish a workmen's compensation rate for chemical crews, the number is significant. Based on Asplundh's internal data, the Minnesota statistics showing a lower workmen's compensation rate for chemical crews could be repeated in all states. An analysis of Asplundh operations in West Virginia for 1978 found that while chemical operations accounted for 14% of the total manhours, they had less than 2% of the accidents. As shown by the data below, there was only one accident in 100,000 manhours worked by chemical crews. The accident occurred as a worker was using a wrench to tighten some fittings; it slipped and the employee bruised his elbow.

1978 ACCIDENT STATISTICS FOR ASPLUNDH

CREWS WORKING IN WEST VIRGINIA

TOTAL NUMBER OF ACCIDENTS RESULTING FROM MANUAL AND MECHANICAL OPERATIONS 58

TOTAL NUMBER OF ACCIDENTS RESULTING FROM CHEMICAL OPERATIONS 1

NOTES

Numbers of Employees on Payroll During the Year 335

Total Manhours 710,000

" - Chemical Operations = 100,000

" - Manual & Mechanical = 610,000

West Virginia is a "monopolistic" state for Worker Compensation funding.

A study in the Pacific Northwest of manual versus chemical release of small conifers from competing hardwood vegetation showed that the cost of insuring a single worker to clear one acre of land is greater than the total cost of helicopter application of herbicide to one acre of forest land.

Manual clearing of vegetation on electric utilities ROWs is a hazardous occupation. The job calls for the use of hand-operated tools such as the axe, brushhook, chain saw, and brush saw. Saw cuts of the leg and feet are common. More serious cuts of the upper body and head sometimes result whenever a chain saw kicks back. Sharp edges of axes and brushhooks sometimes bounce off rocks into workers' legs and feet.

A 1978 survey by Asplundh Environmental Services estimated that electric utility transmission line ROWs cover 5 million acres in the United States. Of these, over 1 1/2 million acres are managed with herbicides. Crew size varies from large 5 to 7 man foliage crews to small 1 or 2 man stump, injection, or pellet crews. Manpower requirements for chemical crews are less per acre than that needed for manual ROW clearing crews. Hand cutting brush, like mowing a lawn, can result in only a temporary reduction in plant growth. Sprouts grow from stumps and roots and soon replace those cut. The sheer number of stems that may grow on a ROW is a problem. Stems growing with a 2-foot by 2-foot spacing would number 10,890 per acre. Stem counts of over 20,000 per acre are not unusual. In some eastern utilities, records show that it takes less than 10 manhours per acre for chemical vegetation management. On the same utilities, between 30 to 70 manhours per acre are needed to cut interfering plant growth with manual crews. With the millions of acres involved in vegetation management and the 300% to 700% potential increase in manpower needed per acre, the safety of chemical crews becomes increasingly important.

1980 PREEMERGENCE WEED CONTROL IN NURSERY LINERS

A. Bing[1/]

ABSTRACT

Postplant preemergence treatment on nursery liners was very safe and effective with metolachlor 8E or 15G at 4 lb AI/A, but more effective using metolachlor 8E at 4 lb AI/A plus simazine 4L at 1 lb AI/A. Crop tolerance to oxyfluorfen, napropamide and alachlor was very good. As the rate of simazine is increased over 1 lb AI/A there is increased injury to azalea, euonymous and andromeda. Higher rates of metolachlor may be harmful to azalea.

INTRODUCTION

This year's experiment is a continuation of a series (1,2) to find safe effective postplant preemergence herbicides for newly planted small ornamental plants and also to facilitate labeling through IR-4. Work is done both at Farmingdale and Riverhead, New York because of the differences in weed populations and the more protected area at Farmingdale is safer for some plants such as hemlock and azalea.

MATERIALS AND METHODS

The nursery liners shown in Table 1 were from the State Forest Tree Nursery of the Department of Conservation, donated by local nurserymen or propagated the previous year in another experiment. They were planted 2 feet apart in rows 34 inches apart at Riverhead and 36 inches apart at Farmingdale because of differences in machinery and cropping procedures. Each row contained one cultivar. After planting the area in Riverhead was cultivated, but there was a breakdown of equipment at Farmingdale, so cultivation was not possible. The planting at Riverhead was on April 22 & 23 and at Farmingdale April 23 & 25. As is seen in Table 1, some cultivars were planted at both locations, others at only one location. Some plants were used at both locations to compare all the treatments. Some could not be planted at Riverhead because of the strong winds. Another factor that determined location was the chemical tolerance data required for each cultivar.

The postplant preemergence herbicides shown on Table 2 were applied at Riverhead mostly on May 5 & 6 with some on the 16th. The treatments at Farmingdale were made May 2 & 7. Liquids were applied with a hand-pumped sprayer and granules applied with a hand shaker. Each treatment area was 6 ft wide across all the rows, therefore covering 3 plants of each cultivar. There were 4 blocks with 17 treatments at Farmingdale and 18 at Riverhead each with 3 plants of each cultivar except the napropamide 10G and 4F treatments at Farmingdale which contained only 2 replicates.

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Weed control was evaluted on June 30 at Riverhead and July 8 & 10 at Farmingdale. Ratings of 10 = no weeds, 7 = satisfactory control to 1 = no control were made for general weeds, grassy weeds, broadleaved weeds, and the more numerous ones. At Riverhead barnyardgrass (Echinochloa crus-galli [L.] Beauv.) was most predominant with some large crabgrass (Digitaria sanguinalis [L.] Scop), common groundsel (Senecio vulgaris L.), and common purslane (Portulaca oleracea L.). At Farmingdale there was a better assortment of weeds: crabgrass, yellow foxtail (Setaria glauca [L.] Beauv.), common ragweed (Ambrosia artemisiifolia L.), common groundsel, redroot pigweed (Amaranthus retroflexus L.), purslane, hairy galinsoga (Galinsoga cilata [Raf.] Blake) and assorted mustards.

After weed ratings were made all plots were handweeded and then the weeds were allowed to grow with no cultivation. It was a hot dry summer. Irrigation was applied as needed at Riverhead but there was a water ban at Farmingdale so there was no irrigation during the hot dry mid and late summer.

Growth ratings were made on the crops July 28 at Riverhead and October 15 at Farmingdale. A rating of 10 is for a well-grown plant both as to size and appearance. A rating of 7 is for a satisfactory plant and down to 1 for a dead or missing plant. Each unit of 3 plants was assigned 1 rating. The values in Tables 5 & 6 are the averages of 4 replicates except for 2 replicates for the napropamide 10G and 4G formulations.

RESULTS AND DISCUSSION

Weed control at Farmingdale as seen by the low weed control numbers in Table 3 was unsatisfactory probably because of the lack of cultivation prior to treatment and general weed control looked poorer in many plots because of heavy stands of Canada thistle (Cirsium arvense [L.] Scop). At Riverhead, the lumps of soil that resulted from the cultivation made it necessary to hand-rake all plots immediately before treatment. Weed control at Riverhead was much better especially with use of metoloachlor plus simazine. Metolachlor spray at 4 lb AI/A rating 8 was better than the granular rating of 6. Oxyfluorfen was not as effective against barnyardgrass or crabgrass as metolachlor.

In general plant tolerance was very good to all the herbicides at lower rates. In Table 5 it is evident that rates of simazine over 1 lb AI/A are harmful to euonymus and azalea and higher rates of metolachlor may be harmful to azalea. The spray of metolachlor injured white pine and andromeda.

LITERATURE CITED

1. Bing, A. 1978. Preemergence weed control in nursery liners. NEWSS 32:295-299.

2. Bing, A. 1980. 1979 results with postplant preemergence treatments on nursery liners. NEWSS 34:309-14.

Table 1. Nursery liners used in preemergence weed control experiments at Farmingdale(F) and Riverhead(R) in 1980.

Common name	Location	Scientific name
California privet	FR	Ligustrum ovalifolium Hassk.
Golden bells	FR	Forsythia intermedia Zab.
White pine	FR	Pinus strobus L.
Japanese black pine	F	Pinus thunbergii Parl.
Torringo crabapple	FR	Malus Sieboldii (Regel) Rehd.
Redstemmed dogwood	R	Cornus stolonifera Mich.
Cranberry viburnum	FR	Viburnum trilobum Marsh
Hicks yew	R	Taxus cuspidata Hicksii Rehd.
Andorre juniper	R	Juniperus horizontalis plumosus Rehd.
Japanese holly	R	Ilex crenata Thunb.
Norway maple	F	Acer platanoides L.
Roseum elegans rhododendron	F	Rhododendron catawbiense var Roseum Mich.
Evergreen azalea	F	Rhododendron obtusum CV Hershey Red (Lindl.) Planch
Deciduous azalea	R	Rhododendron gandavense Rehd.
Euonymus	R	Euonymus fortunei vegeta Rehd.
English ivy	F	Hedera helix L.
Canadian hemlock	F	Tsuga Canadensis (L.) Carriere
Japanese andromeda	R	Pieris japonica (Thunb.) D. Don
Miniature rose	R	Rosa L.
Japanese spurge	F	Pachysandra terminalis siebold & Zucc.
Golden mock orange	F	Philadelphus coronarius var aureus L.

Table 2. Preemergence herbicides used in 1980 on nursery liners.

Common name	Chemical name	Formulation
alachlor	2-chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide	15G
metolachlor	2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide	8E
metolachlor	2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide	15G
napropamide	2-(a-naphthoxy)-N,N-diethylpropionamide	50WP
napropamide	2-(a-naphthoxy)-N,N-diethylpropionamide	4F
napropamide	2-(a-naphthoxy)-N,N-diethylpropionamide	10G
oxyfluorfen	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-trifluoromethyl)benzene	2G
simazine	2-chloro-4,6-bis(ethylamino)-s-triazine	4L

Table 3. Postplant preemergence weed control on nursery liners planted April 22 & 23, treated May 5, 6 & 16, and rated June 30, 1980 at Riverhead, New York.

Treatments		Weed control ratings[a]						
Common name	Rate lb a/a	General	Grasses	Non-grass	Barnyard-grass	Crabgrass	Groundsel	Purslane
Metalachlor 8E	2	6	9	7	10	9	8	8
	4	9	10	9	10	10	10	9
	8	8	10	8	10	10	9	8
	16	10	10	10	10	10	10	10
Metolachlor 8E + Simazine	2 + .5	8	10	8	10	10	10	8
	4 + 1	9	10	10	10	10	10	10
	8 + 2	10	10	10	10	10	10	10
	16 + 4	10	10	10	10	10	10	10
Metolachlor 15G	2	6	10	8	10	10	8	8
	4	6	9	6	10	9	8	8
	8	8	10	8	10	10	8	9
	16	9	10	9	10	10	9	10
Oxyfluorfen 2G	1	6	6	8	7	7	9	9
	2	8	8	10	9	9	10	9
	4	8	8	10	9	8	10	10
	8	9	9	10	10	9	10	10
Untreated		4	6	5	7	6	6	6
Handcultivated		10	10	10	10	10	10	10

[a] Ratings are from 1 = full of weeds to 10 = no weeds, ratings are based on an average of 4 replications.

Table 4. Postplant preemergence weed control on nursery liners planted April 23 & 25, treated May 2 & 7, and rated July 8 & 10, 1980 at Farmingdale, New York.

Treatments		Weed control ratings[a]										
Common name	Rate lb a/a	Gen[b]	Gr	Nongr	Cg	Fox	Rag	Ground	Rg	Purs	Mus	Gal
Oxyfluorfen 2G	1	1	4	3	5	8	7	9	9	10	8	5
	2	4	6	6	6	7	8	10	10	10	8	8
	4	5	7	8	8	10	10	10	10	10	10	8
	8	5	6	7	9	10	10	10	10	10	10	10
Alachlor 15G	2	3	8	4	8	10	6	9	9	9	8	8
	4	4	8	5	8	10	8	10	10	10	7	10
	8	5	10	6	10	10	6	10	10	10	8	10
	16	7	10	7	10	10	8	10	10	10	8	9
Napropamide 50 WP	2	3	6	4	7	9	6	9	8	9	8	7
	4	3	7	4	7	10	8	9	8	10	9	7
	8	2	7	4	8	10	7	10	9	10	6	7
	16	5	10	5	6	10	8	10	10	10	8	9
Napropamide 10G[c]	2	3	6	4	6	8	7	10	10	10	9	6
	4	2	8	2	8	8	10	10	10	10	10	7
	8	2	6	4	8	8	8	10	8	8	8	6
	16	5	8	6	8	10	8	10	9	10	8	9
Napropamide 4F[c]	2	4	8	4	10	10	7	10	10	10	8	10
	4	3	8	6	8	10	6	9	8	9	9	7
	8	4	8	4	10	10	6	10	10	10	7	10
	16	5	10	5	10	10	8	10	9	10	8	10
Untreated		1	4	2	5	7	6	10	7	10	8	4

[a] Ratings are from 1 = full of weeds to 10 = no weeds. Ratings are based on an average of 4 replications unless otherwise noted.

[b] Gen = General, Gr = Grass, Nongr = Non-grass, Cg = Crabgrass, Fox = Foxtail, Rag = Ragweed. Ground = Groundsel, Rr = Redroot, Purs = Purslane, Mus = Mustard, Gal = Galinsoga.

[c] Weed control ratings based on 2 replications.

Table 5. Growth ratings of nursery liners planted April 22 & 23, treated May 5, 6 & 16, and rated July 28, 1980 at Riverhead, New York.

Treatments		Growth ratings[a]													
Common name	Rate lb aia	Yew	Pri[b]	Dwd	For	Vib	Ca	Jun	Jrn	Wp	And	Eun	Az	Il	Rose
Metolachlor 8E	2	10	9	9	10	9	6	10	8	7	7	10	5	8	10
	4	10	9	9	9	8	8	9	8	5	9	10	4	8	10
	8	10	10	8	10	7	7	10	8	3	6	9	4	8	10
	16	8	8	8	8	7	9	9	8	4	4	8	3	8	9
Metolachlor 8E + Simazine 4L	2 + .5	9	9	9	10	8	7	9	6	5	7	7	5	8	10
	4 + 1	9	9	9	9	7	8	10	8	4	8	8	4	8	10
	8 + 2	9	7	9	10	6	7	9	8	3	6	6	2	7	10
	16 + 4	9	7	6	9	6	8	9	9	5	4	2	1	6	8
Metolachlor 15G	2	10	10	9	10	8	9	10	9	4	8	9	6	8	10
	4	10	10	9	10	8	8	9	9	8	7	8	4	9	10
	8	9	9	8	8	8	8	9	9	5	6	8	3	8	10
	16	10	8	8	10	7	7	9	8	6	7	8	3	8	9
Oxyfluorfen 2G	1	10	10	9	10	8	7	10	9	4	8	9	6	9	9
	2	9	10	9	10	8	8	10	8	6	6	9	5	8	9
	4	9	10	9	10	8	8	9	8	4	8	9	5	8	8
	8	10	10	8	10	8	6	10	6	4	4	9	4	8	8
Untreated		8	10	9	9	9	8	9	8	6	9	8	5	8	10
Handcultivated		9	10	9	10	10	8	10	10	4	7	[illegible]	5	8	10

(a) Growth ratings are an average of 4 replications. Ratings are from 1 = dead or missing plant to 10 = maximum growth.

(b) Pri = Privet, Dwd = Dogwood, For = Forsythia, Vib = Viburnum, Ca = Crabapple, Jun = Juniper, Jrn = Japanese red maple, Wp = White pine, And = Andromeda, Eun = Euonymous, Az = Azalea, Il = Ilex.

Table 6. Plant growth ratings of nursery liners planted April 23 & 25, treated May 2 & 7, and rated October 15, 1980 at Farmingdale, New York.

Treatments		Growth ratings[a]													
Common name	Rate lb aia	Hra[b]	Res	Hem	Wp	Bp	Map	Ivy	Pac	Vib	Phi	For	Dwd	Pri	Ca
Oxyfluorfen 2G	1	8	5	6	7	5	4	7	7	5	7	10	10	10	6
	2	7	6	7	6	4	4	7	6	6	9	10	10	9	8
	4	8	4	7	6	5	4	7	7	6	8	10	10	10	7
	8	9	5	7	6	4	2	8	5	8	9	10	10	9	8
Alachlor 15G	2	7	5	6	3	6	7	6	6	6	7	10	10	9	8
	4	8	5	6	4	5	4	8	7	7	7	10	10	9	6
	8	8	3	7	4	8	5	7	7	7	9	10	10	10	8
	16	8	3	6	5	6	4	7	8	5	9	10	10	9	7
Napropamide 50WP	2	7	6	7	5	7	4	6	6	6	7	10	10	10	5
	4	6	5	6	6	6	5	7	6	6	8	10	10	9	5
	8	8	6	6	6	5	6	6	7	7	7	10	10	9	8
	16	8	4	8	4	5	6	7	7	6	7	10	10	9	8
Napropamide 10G	2*	8	6	7	7	4	4	8	8	8	8	10	10	9	8
	4*	7	6	7	6	3	6	8	6	6	6	10	10	8	8
	8*	8	6	6	7	5	8	8	8	8	8	10	10	10	8
	16*	8	1	6	6	8	6	8	8	8	8	10	10	10	5
Napropamide 4F	2*	6	8	6	6	8	4	7	6	8	8	10	10	0	5
	4*	6	6	7	3	6	6	8	6	6	6	10	10	8	8
	8*	8	2	8	6	6	4	8	7	8	8	10	9	8	8
	16*	8	4	4	6	5	4	8	6	9	8	10	10	9	8
Untreated		6	4	6	5	4	6	6	6	6	8	10	10	9	8

(a) Growth ratings are an average of 4 replicates of 3 plants each unless rate is followed by * which indicates 2 replicates. Growth ratings are from 1 = dead or missing plant to 10 = maximum growth.

(b) Hra = Hershey red azalea, Rer = Roseum elegans rhododendron, Hem = Hemlock, Wp = White pine, Bp = Black pine, Map = Maple, Pac = Pachysandra, Vib = Viburnum, Phi = Philadelphus, For = Forsythia, Dwd = Dogwood, Pri = Privet, Ca = Crabapple.

PREEMERGENT HERBICIDES ON NEWLY PLANTED LINERS

C. Haramaki and L. Kuhns [1/]

ABSTRACT

Sprays of alachlor, alachlor plus simazine, metolachlor, metolachlor plus simazine, oxyfluorfen, and prodiamine produced good weed control especially at the higher rates and also the combinations gave excellent weed control. The granular form of oxyfluorfen did not prove as effective as the spray in controlling weeds. All of the Korean azaleas and many of the Laland firethorns had severe transplant injury. At the lower rates of application common boxwood, cranberry cotoneaster, convexleaf holly, Baltic ivy, Andorra juniper and purpleleaf wintercreeper had little or no injury. Common boxwood, convexleaf holly, and Baltic ivy exhibited some chlorosis when sprayed with both the alachlor plus simazine combination and the metolachlor plus simazine combination. Oxyfluorfen produced lateral bud distortion in the common boxwood and some necrosis in the convexleaf holly and Baltic ivy.

INTRODUCTION

Many of the new as well as some of the not so new herbicides have not been cleared for use with a large number of ornamental plants. Some of these herbicides give excellent control of grasses but only fair control of broadleaf weeds. Herbicide combinations have given excellent control of a broad spectrum of weeds. The objectives of this experiment were to obtain a commercially acceptable control of weeds with herbicides used singularly or in combinations with minimum damage to newly planted liners.

METHODS AND MATERIALS

The Hagerstown silt loam was double disced, harrowed and rototilled prior to planting on June 20, 1980. Liners of eight species were planted on a cool, (50's) cloudy day with continuous winds between 10-25 miles per hour. The plants were Korean azalea (Rhododendron yedoense poukhanense), common boxwood (Buxus sempervirens), cranberry cotoneaster (Cotoneaster apiculata), Laland firethorn (Pyracantha coccinea lalandi), convexleaf holly (Ilex crenata convexa), Baltic ivy (Hedra helix 'Baltic'), Andorra juniper (Juniperus horizontalis plumosa), and purpleleaf wintercreeper (Euonymus fortunei coloratus). Four liners of each species were planted in each of the 120 plots.

On June 24, 1980 the plots were treated with the following herbicides: alachlor (2-chloro-2',6' diethyl-N-(methoxymethyl) acetanilide), alachlor plus simazine (2-chloro-4,6-bis (ethylamino)-5-triazine), metolachlor (2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl acetanilide), metolachlor plus simazine, oxyfluorfen (2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-trifluoromethyl)

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benzene) and prodiamine (2,4 dinitro-N^3,N^3-dipropyl-6-(trifluoromethyl)-1,3-benzenediamine). All of the herbicides and combinations were applied with a CO_2 pressured, sprayer at 20 PSI at the rate of 40 gallons per acre. The four nozzle boom was fitted with LP8002 nozzles with 50 mesh screens. Granular oxyfluorfen was also applied. All herbicides and combinations were applied at four concentrations.

The weather at the time of treatment was: wind - 3 to 5 MPH, sky - hazy, air temperature - 72°F, soil surface temperature - 81°F, 2 inches below the soil surface - 66°F and the soil was at field capacity. Each herbicide and herbicide combination was applied at four rates and replicated four times. There were eight check plots and each plot was 135 square feet. The plots were irrigated immediately after herbicide application and periodically throughout the summer. On September 5, 1980 the plots were examined for weed growth and crop injury.

RESULTS AND DISCUSSION

The predominant weeds in the check plots were smooth pigweed (Amaranthus hybridus L.), yellow foxtail (Setaria lutescens Hubb.) redroot pigweed (Amaranthus retroflexus L.) and common lambsquarter (Chenopodium album L.). In lesser quantities were giant foxtail (Setaria faberi Herrm.), witchgrass (Panicum capillare L.), quackgrass (Agropyron repens Beauv.), yellow woodsorrel (Oxalis stricta L.), shepardspurse (Capella bursa-pastoria Medic.), tumble pigweed (Amaranthus albus L.), and common chickweed (Stellaria media Cyrillo).

Alachlor at all rates reduced grass growth especially at 2, 4 and 8 pounds per acre. Broadleaved weeds were also reduced at all rates with acceptable control at 4 and 8 pounds per acre. Shepardspurse and common chickweed were more resistant at the lower rates. The combination of alachlor with one pound of simazine produced good to excellent grass and broadleaved weed control at all rates. Metolachlor reduced both grasses and broadleaf weeds at all rates and was commercially acceptable at 8 pounds per acre. At the lower rates metolachlor had some difficulty in controlling common lambsquarter and smooth pigweed. Metolachlor in combination with simazine at one pound reduced grasses and broadleaf weeds at all rates and gave commercially acceptable weed control except at the lowest rate. Oxyfluorfen when sprayed on the soil did an excellent job of controlling all weeds at all rates. When it was used in a granular form it was not as effective as when it was sprayed. Good weed control was obtained at 4 pounds of granular oxyfluorfen per acre. At the lower rates, granular oxyfluorfen had some difficulty in controlling quackgrass, giant foxtail and yellow foxtail. Prodiamine reduce weed growth at all rates but there were some shepardspurse, quackgrass and yellow foxtail.

All of the azaleas exhibited extensive injury primarily due to insufficient moisture at the time planting. Many of the firethorns were also injured at this time. Except for the azalea and firethorn plants, the plants in the alachlor treated plots exhibited little or no injury. A few of the boxwoods, and many of the hollies and ivys had chlorotic leaves and some necrotic leaves and stems when sprayed with alachlor and simazine combinations. The azaleas also showed much chlorosis. Other than the azaleas and firethorn the plants in the metolachlor treated plots exhibited little or no injury although some of the lower leaves on the holly were chlorotic. The azaleas, boxwoods and hollies all had chlorotic

Table 1. Effect of Preemergent Herbicides on Weed Growth Ten Weeks After Application, 1980.

Chemical	Rate	Grasses	Broad-leaves	All Weeds
Check	0	2.35 [a/]	5.65	7.87
Alachlor, 4E	1#/A	1.38	2.38	3.75
	2#/A	0.75	1.25	2.00
	4#/A	0.38	0.75	1.12
	8#/A	0.25	0.63	0.88
Alachlor, 4E + Simazine, 80W	1+1#/A	0.25	0	0.25
	2+1#/A	0.25	0.75	1.00
	4+1#/A	0.12	0	0.12
	8+1#/A	0	0.12	0.12
Metolachlor, 8E	1#/A	0.88	1.62	2.50
	2#/A	0.88	2.25	3.12
	4#/A	1.00	1.50	2.50
	8#/A	0	0.50	0.50
Metolachlor, 8E + Simazine, 80W	1+1#/A	1.50	0.75	2.25
	2+1#/A	0.75	0.13	0.88
	4+1#/A	0	0	0
	8+1#/A	0.75	0	0.75
Oxyfluorofen, 2E	½#/A	0.25	0.50	0.75
	1#/A	0.50	0	0.50
	2#/A	0.25	0	0.25
	4#/A	0	0	0
Oxyfluorofen, 2G	½#/A	2.75	3.00	5.75
	1#/A	1.75	1.00	2.75
	2#/A	1.75	0.50	2.25
	4#/A	0.88	0.12	1.00
Prodiamine, 50W	1#/A	1.38	1.62	3.00
	2#/A	1.25	1.75	3.00
	4#/A	0.88	0.88	1.75
	8#/A	1.12	0.88	2.00

a/ 0 = No weeds

10 = 100% weed coverage, heavy infestation.

Table 2. Effect of Postplant Applications of Preemergent Herbicides on Liners Ten Weeks After Application, 1980.

Chemical	Rate	Azalea	Box-wood	Coton-easter	Fire-thorn	Holly	Ivy	Juni-per	Winter-creeper
Check	0	2.94[a/]	1.25	1.56	3.50	1.66	2.25	1.56	0.44
Alachlor, 4E	1#/A	3.12	0.69	1.50	2.69	1.69	1.38	1.69	0.75
	2#/A	3.75	0.63	2.38	1.62	2.00	1.56	1.81	0.69
	4#/A	3.75	0.69	1.06	1.69	2.06	1.75	1.81	1.00
	8#/A	4.06	1.00	1.44	2.75	1.94	1.69	2.19	0.88
Alachlor, 4E + Simazine, 80W	1+1#/A	3.25	1.69	1.50	3.50	2.50	2.12	2.19	1.38
	2+1#/A	4.00	1.12	1.69	3.50	2.50	1.62	2.19	1.25
	4+1#/A	4.00	1.81	0.69	3.81	2.31	2.18	1.81	1.06
	8+1#/A	3.88	1.94	1.81	3.37	1.94	2.00	1.50	1.38
Metolachlor, 8E	1#/A	4.56	0.75	1.25	2.38	1.81	1.38	1.12	0.81
	2#/A	3.75	0.69	1.06	2.94	2.38	1.94	1.56	0.88
	4#/A	2.94	0.62	1.38	2.44	1.44	1.19	1.38	0.75
	8#/A	3.62	0.56	1.81	3.75	2.19	1.62	1.50	1.19
Metolachlor, 8E + Simazine, 80W	1+1#/A	3.25	2.31	1.19	2.75	2.75	1.81	2.25	0.88
	2+1#/A	3.88	1.31	1.94	2.50	2.38	2.06	2.31	1.44
	4+1#/A	3.94	2.62	2.19	3.19	2.56	1.81	2.38	0.81
	8+1#/A	4.00	2.50	2.12	2.19	3.25	2.12	2.62	2.75
Oxyfluorfen, 2E	½#/A	3.94	0.62	1.12	2.75	2.19	1.75	1.88	1.19
	1#/A	3.38	0.69	0.69	2.44	2.00	2.38	1.62	1.25
	2#/A	4.38	1.38	1.81	3.75	2.56	2.38	1.75	1.81
	4#/A	3.81	2.00	2.00	3.06	2.12	2.94	2.12	2.31
Oxyfluorfen, 2G	½#/A	3.38	0.75	1.00	1.94	1.25	1.81	1.44	0.94
	1#/A	3.12	0.94	0.56	1.69	1.25	2.06	1.12	0.69
	2#/A	3.19	1.31	0.88	2.25	1.75	1.56	1.81	1.06
	4#/A	2.94	1.06	1.44	2.69	2.00	1.94	2.00	1.62
Prodiamine, 50W	1#/A	3.75	0.50	1.25	2.63	0.94	1.44	1.44	0.69
	2#/A	3.50	0.31	0.88	1.56	1.25	1.69	1.44	0.62
	4#/A	4.12	0.69	1.69	2.63	1.44	1.50	1.19	0.75
	8#/A	3.88	0.62	1.44	1.44	1.56	1.75	2.06	0.62

a/ 0 = No injury.
1 = Very slight injury.
2 = Slight injury.
3 = Moderate injury.
4 = Severe injury.
5 = Dead.

leaves and some necrosis when sprayed with metolachlor and simazine. The junipers also had some dead leaves as did the cotoneaster and wintercreeper at the highest rate. In the plots sprayed with oxyfluorfen some of the plants of all species showed some damage at 4 pounds per acre. The boxwood at the higher rates had either dead or badly distorted lateral buds. The hollies and ivys had some leaf and stem necrosis. The other species at the lower rates exhibited little or no injury other than the azaleas and firethorns. Oxyfluorfen when applied in the granular form also caused some lateral bud distortion in boxwoods and stem and leaf necrosis in the hollies and ivys at the higher rates. Prodiamine treated plots had plants which had little or no injury except for the azaleas and firethorn. The wintercreeper was tolerant to most rates of all herbicides.

PREEMERGENCE HERBICIDES ON ESTABLISHED ORNAMENTAL LINERS

L. Kuhns, C. Haramaki, and J. Staub[1/]

ABSTRACT

Oxyfluorfen (2E) at 0.55, 1.1, 2.2, and 4.4 Kg/ha ai; alachlor (15G) at 1.7, 3.4, 6.8, and 13.6 Kg/ha; and metolachlor (8E), oryzalin (75W), and prodiamine (50W) at 1.1, 2.2, 4.4, and 8.8 Kg/ha were broadcast over weed free soil on April 4, 1980. Ornamental plants in the plots which had been established for one year included elegantissima and Woodward arborvitae, azalea, cotoneaster, euonymus, firethorn, blue Hetz and andorra juniper, pieris, rhododendron, and Hicks and Hatfield yew. Weed control and phytotoxicity data were recorded 10 weeks after application.

Alachlor at 13.6 Kg/ha, oryzalin at 4.4 and 8.8 Kg/ha, and oxyfluorfen at 2.2 and 4.4 Kg/ha provided excellent weed control for the duration of the study. Metolachlor at 8.8 Kg/ha, oryzalin at 2.2 Kg/ha, oxyfluorfen at 0.55 and 1.1 Kg/ha, and prodiamine at 8.8 Kg/ha gave adequate weed control, but additional control measures were required at the time of evaluation. Compared with the check plots, other treatments reduced the weed populations, but not to economically acceptable levels.

Oryzalin and prodiamine did not induce phytotoxicity symptoms in any of the test plants. Alachlor at 6.8 and 13.6 Kg/ha caused leaf chlorosis on firethorn, but otherwise caused no apparent injury.

Metolachlor at 2.2, 4.4, and 8.8 Kg/ha caused leaf chlorosis and stunting of cotoneaster, euonymus, and firethorn. Metolachlor caused a slight chlorosis on pieris at 4.4 and 8.8 Kg/ha and on rhododendron at 8.8 Kg/ha. Only at the highest rate on cotoneaster, euonymus, and firethorn were the damages of economic significance.

Oxyfluorfen did not damage the junipers, yews, or elegantissima arborvitae. At 4.4 Kg/ha it severely damaged azalea, cotoneaster, euonymus, firethorn, and pieris and caused moderate damage to Woodward arborvitae. Injury symptoms included stunting, marginal chlorosis and necrosis, red spotting of leaves, tip kill, rosetting of new growth, and in some cases death of the plant. At 2.2 Kg/ha oxyfluorfen severely damaged cotoneaster, euonymus, and firethorn and caused moderate damage to Woodward arborvitae, azalea, and pieris. At 1.1 Kg/ha cotoneaster, euonymus, and firethorn were severely damaged and Woodward arborvitae received moderate damage. Even the 0.55 Kg/ha rate caused slight injury to these plants.

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METOLACHLOR AND METOLACHLOR + SIMAZINE FOR USE ON ORNAMENTALS

H. A. Collins and C. Buchholz[1/]

ABSTRACT

Metolachlor and metolachlor + simazine have been observed to be efficacious on several weed species, while exhibiting selectivity to many woody ornamentals.

Researchers have evaluated metolachlor and metolachlor plus simazine applied prior to weed emergence in both containerized and field grown ornamentals. These results center on field grown ornamentals, many of which involve liners.

Rates of metolachlor evaluated ranged from 0.6 to 18 kg/ha. Rates of simazine ranged from 0.6 to 4.5 kg/ha. All herbicide rates were not evaluated on each species of ornamentals mentioned herein.

Examples of ornamentals exhibiting tolerance to selected rates of metolachlor and metolachlor plus simazine as broadcast or directed spray treatments or as broadcast granular treatments are shown in Table 1. The rates shown in Table 1 exceed those suggested for use on ornamentals for which metolachlor is registered. Current registered use rates for metolachlor on ornamentals range from 2.2 to 3.4 kg/ha whether alone or tank mixed with simazine. Simazine, in tank mix combination with metolachlor, is recommended at 0.9 to 1.1 kg/ha.

Examples of weeds controlled by the suggested use rates of metolachlor include barnyardgrass (*Echinochloa crus-galli* [L.] Beauv.), carpetweed (*Mollugo verticillata* L.), fall panicum, (*Panicum dichotomiflorum* Michx.), giant foxtail (*Setaria faberi* Herrm.), goosegrass (*Eleusine indica* [L.] Gaertn.), green foxtail (*S. viridis* [L.] Beauv.), large crabgrass (*Digitaria sanguinalis* [L.] Scop.), pigweed (*Amaranthus* sp.), signalgrass (*Brachiaria* sp.), smooth crabgrass (*D. ischaemum* [Schreb.] Muhl.) and yellow foxtail (*S. lutescens* [Weigel] Hubb).

In addition to weeds controlled by metolachlor alone, examples of weeds controlled by metolachlor plus simazine include galinsoga (*Galinsoga* sp.), groundsel (*Senecio* sp.), lambsquarters (*Chenopodium* sp.), mustard (*Brassica* sp.), purslane (*Portulaca* sp.), ragweed (*Ambrosia* sp.) and Venice mallow (*Hibiscus trionum* L.).

These results suggest that metolachlor and metolachlor plus simazine are useful for weed control in woody ornamentals.

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Table 1. Tolerance of selected ornamentals to metolachlor and metolachlor plus simazine under field conditions.

Ornamentals		Metolachlor (kg/ha)*
Andromeda	*Andromeda* sp.	9
Azalea	*Rhododendron* sp.	"
Barberry	*Berberis* sp.	"
Crabapple	*Pyrus* sp.	"
Leucothoe	*Leucothoe* sp.	"
Osmanthus	*Osmanthus* sp.	"
Pachysandra	*Pachysandra* sp.	"
Privet	*Ligustrum* sp.	"
Redstem dogwood	*Cornus stolonifera* Mich.	"
Viburnum	*Viburnum* sp.	"
Arborvitae	*Thuja occidentalis* L.	18
Cotoneaster	*Cotoneaster* sp.	"
English ivy	*Hedera helix* L.	"
Euonymus	*Euonymus* sp.	"
Forsythia	*Forsythia* sp.	"
Japanese holly	*Ilex crenata* Thunb.	"
Juniper	*Juniperus* spp.	"
Weigela	*Weigela hybrida*	"
Yew	*Taxus* spp.	"

Ornamentals		Metolachlor + Simazine (kg/ha)*
Azalea	*Rhododendron* sp.	9 + 2.2
Crabapple	*Pyrus* sp.	"
English ivy	*Hedera helix* L.	"
Euonymus	*Euonymus* sp.	"
Forsythia	*Forsythia* sp.	"
Redstem dogwood	*Cornus stolonifera* Mich.	"
Viburnum	*Viburnum* sp.	"
Cotoneaster	*Cotoneaster* sp.	18 + 1.1
Weigela	*Weigela hybrida*	"
Arborvitae	*Thuja occidentalis* L.	18 + 4.5
Japanese holly	*Ilex crenata* Thunb.	"
Juniper	*Juniperus* spp.	"
Yew	*Taxus* spp.	"

*Weeds are controlled at lower rates as indicated in text.

CHEMICAL CONTROL OF ESTABLISHED WEEDS IN FIELD-GROWN ARBORVITAE

J. F. Ahrens[1/]

ABSTRACT

Sprays of asulam and glyphosate alone or in combination with simazine and oryzalin or surfactant were applied in early April to control established winter annual weeds in dormant arborvitae. Repeated applications were made in June and July. Simazine at 2 lb/A alone was more effective in controlling winter annual weeds than simazine 1 lb/A + oryzalin 3 lb/A, but control in June and July was better with the latter. Asulam at 1.67 or 3.34 lb/A plus simazine-oryzalin and glyphosate at 0.375 lb/A or 0.75 lb/A plus simazine-oryzalin gave better control of winter annual weeds than simazine-oryzalin alone without injury to dormant arborvitae. Repeating the applications of asulam did not injure actively growing arborvitae, but repeating the applications of glyphosate at 0.75 lb/A or 0.375 lb/A plus surfactant injured the arborvitae.

INTRODUCTION

Preemergence herbicides are available to control many of the weeds in ornamental nursery stock, but weeds develop resistance once they are established. If winter annual weeds could be controlled in the spring their presence in nurseries during the fall and winter could be beneficial for erosion control and reducing wind burn. In past studies we have found that certain dormant narrowleaf evergreens were more tolerant of the postemergence herbicides asulam (methyl sulfanilylcarbamate) and glyphosate [N-(phosphonomethyl)glycine], than actively growing plants of the same species (2,3). However, plants such as juniper and taxus have tolerated treatments of asulam during any season. The use of surfactants with these herbicides has sometimes increased weed control, but also injury to woody plants (5). In this work we investigated the effects of asulam and glyphosate, applied alone or in combination with preemergence herbicides, or surfactant, on established weeds in dormant and actively growing arborvitae (*Thuja* sp.).

MATERIALS AND METHODS

Herbicides were applied in a commercial planting of 'Dark American' arborvitae (*Thuja occidentalis nigra*) in East Windsor, Connecticut. The 12 to 18 in plants were spaced 2 ft apart in rows 3 ft wide and had been planted in April 1979. The soil was an Enfield silt loam. Plot sizes were 2 rows (6 ft) wide and 16 ft long, with 16 plants. Untreated border rows separated the plots. The treatments were replicated four times in a randomized complete block design.

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The herbicides were applied as broadcast sprays in 50 gal per acre using a calibrated hand-held boom with four Teejet 8004 nozzles. The boom was held high enough to obtain uniform coverage on the weeds and the arborvitae. The first application was made on April 3, 1980 when the arborvitae were dormant and the plot area was infested with several annual weeds including horseweed (Conyza canadensis (L.)Cronq.), common chickweed (Stellaria media (L.)Cyrillo), pineappleweed (Maticaria matricarioides (Less.)Porter), corn speedwell (Veronica arvensis L.), and whitlowwort (Draba verna L.). About 0.75 in of rain fell 24 h after the April 3 treatments, and about 6 in of rain fell in the next 30 days. Weed control and plant injury were evaluated visually on April 25 and 29. Sprays of asulam and glyphosate were reapplied on June 4 and July 24, 1980, on weed regrowth. The weeds present in each plot were noted at the time of retreatment. By June the winter annuals common chickweed, pineappleweed, and corn speedwell were maturing and dying and being replaced by summer annual weeds. On July 24, simazine /2-chloro-4,6-bis(ethylamino)-= s-triazine/ at 1 lb/A was added to the asulam and glyphosate sprays. A heavy rain shower occurred 1/2 h after the June 4 treatments. About 2 in of rain fell 5 days after the July treatments. The major weeds in the plots in June were horseweed, redroot pigweed (Amaranthus retroflexus L.), large crabgrass (Digitaria sanguinalis (L.)Scop.) and common lambsquarters (Chenopodium album L.). By July these weeds were in the seedhead stage. On July 24, horseweeds were removed from all plots that were not treated on that day with asulam or glyphosate plus simazine. Weed control and injury ratings were made on a 0 to 10 scale, with 0 as no control or injury, and 10 as 100% control or dead plants.

RESULTS AND DISCUSSION

The results of the April 3 applications are given in Table 1. Simazine + oryzalin at 1 + 3 lb/A gave excellent control of common chickweed and corn speedwell, and fair control of pineappleweed. Adding a surfactant slightly increased control with the combination. Simazine alone at 2 lb/A gave good to excellent control of all established weeds, confirming past results (1). Asulam controlled horseweed and pineappleweed but not common chickweed or corn speedwell. All treatments except those with asulam alone controlled whitlowwort at 3 weeks, but by May 29 this weed had matured and died. Glyphosate alone at 0.375 lb/A controlled most established weeds at 3 weeks but germinating weeds reinvaded the glyphosate plots by May 29. Unlike past studies a surfactant did not significantly improve weed control with the low rates of asulam or glyphosate alone. Combining asulam or glyphosate with simazine plus oryzalin generally improved weed control over simazine plus oryzalin alone. None of the April treatments on dormant arborvitae caused any observable injury or affected early growth.

Residual weed control in July and August from the April applications of all simazine plus oryzalin combinations was good (Table 2), regardless of whether glyphosate or asulam were initially added. As expected, residual control was better with these combinations than with simazine alone.

The June 4 retreatments of asulam and glyphosate were essentially negated by a sudden heavy rain shower that occurred immediately after treatment. However, even though weeds in the glyphosate plots were only mildly

affected, the arborvitae were injured. On July 7, injury was greater with glyphosate at 0.375 lb/A plus X-77 than at 0.75 lb/A without surfactant.

When reapplied July 24, asulam plus simazine gave good to excellent control of large crabgrass and horseweed, but poor control of the mature redroot pigweed and lambsquarters. X-77 slightly increased control of crabgrass with asulam, but had no effect on pigweed and lambsquarters. None of the asulam treatments significantly affected the arborvitae. The July 24 applications of glyphosate plus simazine gave excellent control of horseweed, redroot pigweed, and crabgrass, but poor control of lambsquarters with glyphosate at 0.375 lb/A, and good control at 0.75 lb/A. Glyphosate at 0.375 lb/A caused no injury, but at 0.75 lb/A it injured actively growing shoot tips as in past studies (4) at higher rates. Although X-77 surfactant did not improve weed control with glyphosate plus simazine it again increased injury to the arborvitae, resulting in necrotic tip buds and reduced growth as late as October.

This trial indicates that both asulam and glyphosate at low rates could be useful for controlling established weeds in arborvitae, when combined with residual herbicides such as simazine or simazine plus oryzalin. Arborvitae tolerated the dormant applications of glyphosate better than those during active growth. Using such treatments could allow the use of weeds for erosion control during the winter and provide for their removal in the spring.

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Table 1. Weed control and injury with herbicides in dormant arborvitae.

Herbicide	Rate,[a] lb/A	Common chickweed 4/25	Common chickweed 5/29	Horseweed 4/25	Horseweed 5/29	Pineapple-weed 4/25	Pineapple-weed 5/29	Corn speedwell 4/25	Corn speedwell 5/29	All weeds 4/25	All weeds 5/29	Plant injury 5/29
untreated		0	0	0	0	0	0	0	0	0	0	0
simazine+ oryzalin	1+3	9.5	9.1	4.3	6.0	3.0	6.3	8.0	10.0	7.7	7.8	0
simazine+oryzalin + 0.25% X-77	1+3	9.5	9.8	4.8	7.3	3.5	7.0	9.0	10.0	8.7	8.4	0
simazine	2	10.0	10.0	4.8	8.9	5.3	9.4	8.5	10.0	8.6	9.0	0
asulam	1.67	0	2.5	7.8	8.1	7.5	8.7	0	0	1.8	3.6	0
	3.34	0	2.0	7.8	9.8	7.3	9.5	0	0	2.8	4.1	0
	6.68	0	4.8	8.5	10.0	7.5	10.0	1.5	0	4.3	6.1	0
asulam+0.25% X-77	1.67	0	4.3	7.3	8.0	7.0	4.7	0	0	3.8	3.5	0
asulam+simazine+ oryzalin	1.67+1+3	9.3	10.0	7.3	9.1	7.0	8.7	8.0	10.0	8.9	9.3	0
	3.34+1+3	9.8	9.9	7.8	9.9	7.8	9.5	9.5	10.0	8.8	9.6	0
glyphosate	0.375	9.8	5.3	8.8	8.1	9.0	6.0	9.5	6.0	8.9	3.8	0
	0.75	9.9	5.0	9.5	9.5	9.5	9.5	10.0	4.3	9.4	3.5	0
glyphosate+ 0.25% X-77	0.375	9.9	5.0	9.5	8.8	8.5	9.3	8.0	8.5	9.2	3.0	0
glyphosate+ simazine+oryzalin	0.375+1+3	9.5	9.8	9.0	9.4	8.3	8.8	9.5	10.0	9.4	9.2	0
	0.75+1+3	10.0	10.0	9.5	9.7	9.5	10.0	9.5	10.0	9.8	9.7	0

[a] Rates for glyphosate were ae, all others were ai.

Table 2. Weed control and injury to arborvitae with single or repeated applications of herbicides.

Herbicide	Rate lb/A	Time[a]	Injury July 7	Weed control: All weeds July 24	Weed control: All weeds Aug 25	Weed control: Aug 25[b] HW	Weed control: Aug 25[b] RR	Weed control: Aug 25[b] LQ	Weed control: Aug 25[b] CG	Injury Aug 25	Injury Oct 9
untreated			0	0	0	0	0	0	0	0	0
simazine+ oryzalin	1+3	Apr	0	8.6	8.1	-	-	-	-	0	0
simazine+ oryzalin+ 0.25% X-77	1+3	Apr	0	8.2	8.6	-	-	-	-	0	0
simazine	2	Apr	0	5.7	4.8	-	-	-	-	0	0
asulam	1.67	Apr,June, July	0	0	3.3	8.7	5.8	2.8	9.5	0	0
	3.34	"	0	0	2.8	9.9	5.5	1.3	10.0	0	0
	6.68	"	0	0	3.6	10.0	6.1	0.8	10.0	0.5	0
asulam+ 0.25% X-77	1.67	"	0.3	0	5.2	9.1	6.0	3.0	10.0	0	0
asulam+ simazine+ oryzalin	1.67+1+3	Apr	0	8.7	8.6	-	-	-	-	0	0
	3.34+1+3	Apr	0	9.3	8.8	-	-	-	-	0	0
glyphosate	0.375	Apr,June, July	0	0	5.9	9.2	9.4	4.0	9.8	0	0
	0.75	"	1.0	0	8.7	10.0	10.0	8.8	10.0	1.5	0.3
glyphosate+ 0.25% X-77	0.375	"	2.8	0	6.8	8.8	8.0	4.3	9.8	3.3	1.8
glyphosate+ simazine+ oryzalin	0.375+1+3	Apr	0	8.8	8.4	-	-	-	-	0	0
	o.75+1+3	Apr	0	9.4	8.5	-	-	-	-	0	0

a/ All were initially applied on April 3, 1980. Asulam and glyphosate were reapplied on June 4. On July 24, asulam and glyphosate were reapplied with simazine 1 lb/A added to all rates.

b/ HW = horseweed, RR = redroot pigweed, LQ = lambsquarters, CG = crabgrass.

POSTEMERGENT HERBICIDES FOR WEED INFESTED NURSERIES

C. Haramaki and L. Kuhns[1/]

ABSTRACT

Mature Hunnewell yews in an established sod and selected established broadleaf evergreen liners growing in a weed infested field were treated with several postemergent herbicides. Asulam had little or no effect on weed growth or yew injury. Glyphosate initially controlled the weeds but the area was invaded by other weeds. No injury was observed on the mature yews. Paraquat gave initial control of the weeds but the area was later infested with other weeds. Paraquat at 2 pounds per acre caused extensive injury to the yews. The area treated with glyphosate plus simazine gave good weed control. Most of the established one year old broadleaf evergreen liners were injured when either glyphosate alone or in combination with simazine were applied.

INTRODUCTION

Glyphosate (N-(phosphonomethyl) glycine) is a broad spectrum postemergent herbicide which has been effective on deep rooted perennial weeds (3). Paraquat (1,1'-dimethyl -4,4'-bipyridinium ion) is a general contact herbicide and has been used extensively by nurseries as a directed postemergence herbicide for annual weeds (3). Asulam (methyl sulfanilycarbamate) is a postemergent herbicide which is effective on perennial grasses and some annual weeds (3). It has shown promise as a postemergent herbicide in established ornamental plantings (1,2). The addition of preemergent herbicides to postemergent herbicide sprays have been effective in controlling germinating weed seedlings after the existing weeds have been killed. The objectives of this experiment were to compare the efficacy of three postemergent herbicides in controlling existing annual and perennial weeds, to evaluate the effectiveness of adding a preemergent herbicide to the spray to control germinating weed seeds and to assess the amount of damage to the nursery plants.

METHODS AND MATERIALS

Established yews. The Hunnewell yews (Taxus hunnewettiana) which were approximately three feet tall were pruned of all injured leaves and stems prior to herbicide application there were six yews in each of the 500 square feet plots. The Hagerstown silt loam was covered by an established sod of Kentucky fescue 31 (Festuca elatior, Kentucky 31) with a heavy infestation of common dandelion (Taraxacum officinale Weber). Other weeds were red clover

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Table 1. Effect of Postemergent Sprays on Weed Growth 3 Months After Application 1980.

Chemical	Rate	Grasses 7/7	Grasses 10/3	Broadleaves 7/7	Broadleaves 10/3	All Weeds 7/7	All Weeds 10/3	Weed Height 7/7	Weed Height 10/3
		a/						b/	
Check	0	3.7	4.5	5.2	4.8	8.7	9.3	0.5	1.2
Asulam,3.38E	1#/A	3.5	4.8	5.3	5.3	8.8	10.0	0.5	1.0
	2#/A	3.8	4.3	4.8	4.8	8.5	9.0	0.5	1.0
	4#/A	3.8	4.7	4.8	4.7	8.5	9.3	0.5	1.0
	8#/A	3.8	4.0	5.0	4.0	8.5	7.8	0.5	1.0
Glyphosate,4E	½#/A	3.8	4.3	4.8	4.8	8.5	9.0	0.5	1.0
	1#/A	3.5	3.8	4.8	4.0	8.3	7.8	0.5	1.3
	2#/A	3.5	3.3	5.3	3.5	8.8	6.8	0.5	1.8
	4#/A	3.8	4.5	4.8	2.5	8.5	7.0	0.5	2.0
Paraquat,2E	¼#/A	3.8	4.3	4.5	4.0	8.3	8.3	0.5	0.9
	½#/A	3.5	5.3	5.5	3.5	9.0	8.8	0.5	1.0
	1#/A	3.5	4.8	5.5	3.0	9.0	7.8	0.5	1.1
	2#/A	3.5	4.0	4.8	3.0	8.3	7.0	0.1	0.9

a/ 0 = No weeds

10 = 100% Weed Coverage, heavy infestation

b/ Height in feet

(*Trifolium pratense*), Canada bluegrass (*Poa compressa* L.), buckhorn plantain (*Plantago lanceolata* L.) and orange hawkweed (*Hieracium aurantiacum* L.). The area had been mowed to a height of six inches. On July 7, 1980 asulam, glyphosate and paraquat were applied at three rates each at the rate of 40 gal/A at 20 PSI. The weather was clear and sunny with winds between 2 and 6 MPH. The air temperature ranged from 68 to 76°F and the soil surface temperature was from 74 to 82°F. All herbicide treatments were replicated four times and there were six check plots. The weeds and yews were examined prior to herbicide application and also three months later on October 3, 1980.

Established liners. Established liners of Mentor barberry (*Berberis x mentorensis* L.M. Ames), Warty barberry (*Berberis verruculosa* Hemsl.), rockspray cotoneaster (*Cotoneaster horizontalis* Dcne.), winterjasmine (*Jasminum nudiflorum* Linde.) and chionoides rhododendron (*Rhododendron chionoides* J. Wat.) were growing in a heavily weed infested field. The predominant weeds were 1/8 inch seedlings of field pepperweed (*Lepidium compestre* R. Br), common ragweed (*Ambrosia artemisiifolia* L.), yellow foxtail (*Setaria lutens* Hubb.),

Table 2. Effect of Postemergent Sprays on Hunnwell yews, 3 Months After Application, 1980.

Chemical	Rate	Plant Injury [a]
Check	0	0.22
Asulam, 3.38E	1#/A	0.08
	2#/A	0.32
	4#/A	0.32
	8#/A	0.29
Glyphosate, 4E	½#/A	0.17
	1#/A	0.08
	2#/A	0.34
	4#/A	0.37
Paraquat, 2E	¼#/A	0.66
	½#/A	0.79
	1#/A	1.02
	2#/A	2.87

[a] Plant injury scale (amount of dead leaves in area hit by spray)

0 - none

1 - 1 or more limbs

2 - 1/8 of area

3 - 1/4 of area

4 - 1/2 of area

5 - All of area

common lamsquarter (*Chenopodium album* L.) quackgrass (*Agropyron repens* Beauv.) common dandelion (*Taraxacum officinale* Weber.), wild buckwheat (*Polygonum convolvulus* L.) and horseweed (*Conyza canadensis* Cronq.). The plots were sprayed with three rates of glyphosate and three rates of glyphosate plus simazine on July 25, 1980 at the rate of 40 gallons per acre. The treated plots, which were 135 square feet, were replicated 12 times for each treatment and there were 20 check plots. The plots were examined 10 weeks later for weed prevalence and crop injury.

Table 3. Weed Prevalence Prior to Herbicide Application, July 25, 1980.

Herbicide	Rate	Grasses	Broadleaves	All Weeds
Check	0	3.15 [a/]	3.85	7.10
Glyphosate,4E	1#/A	3.08	4.58	7.67
	2#/A	3.17	3.83	7.00
	4#/A	3.17	3.50	6.67
Glyphosate,4E	1+1#/A	3.75	3.42	7.17
+ Simazine,80W	2+1#/A	3.33	4.00	7.33
	4+1#/A	3.00	3.92	6.92

[a/] 0 = No weeds

10 = 100% weed coverage, heavy infestation.

Table 4. Differences in Weed Prevalence 10 Weeks After Herbicide Application, 1980.

Herbicide	Rate	Grasses	Broadleaves	All Weeds
Check	0	-0.20	+0.85	+1.05
Glyphosate,4E	1#/A	-2.91	+2.67	-0.24
	2#/A	-2.75	+3.42	+0.67
	4#/A	-2.92	+2.58	-0.34
Glyphosate,4E	1+1#/A	-3.00	-2.67	-5.67
+Simazine,80W	2+1#/A	-3.20	-3.29	-6.50
	4+1#/A	-2.87	-3.21	-6.09

RESULTS AND DISCUSSION

Established yews. The plots treated with all rates of asulam showed little or no difference in weed population (Table 1). Three months after application the predominant weeds were still Kentucky fescue 31 and common dandelion. The weeds in the plots treated with glyphosate started to show injury after 1 to 2 weeks after application. After 3 months the predominant weeds in the 1/2 and 1 pound per acre treated plots were still Kentucky fescue 31 and common dandelion. At 2 pounds the dandelion was reduced but it still was the primary weed. Kentucky fescue 31 was greatly reduced and

Table 5. Plant Injury on Established Evergreen Liners Prior to Herbicide Application, July 25, 1980.

Herbicide	Rate	Mentor Barberry	Warty Barberry	Winter-green Barberry	Winter-jasmine	Cotoneaster	Rhodo-dendron
Check	0	0.72 a/	1.08	1.77	2.40	1.06	3.20
Glyphosate,4E	1#/A	0.82	1.41	1.26	2.41	1.12	3.25
	2#/A	0.75	0.97	1.36	2.43	1.38	3.33
	4#/A	0.83	1.26	1.50	2.39	1.04	3.23
Glyphosate,4E	1+1#/A	0.87	1.13	1.47	2.47	1.29	3.49
+ Simazine,80W	2+1#/A	0.73	1.02	2.21	2.73	1.17	3.46
	4+1#/A	0.71	1.01	1.26	2.89	1.05	3.35

a/ 0 = No injury, 5 = Dead

Table 6. Difference in Plant Injury on Established Evergreen Liners 10 Weeks After Herbicide Application, 1980.

Herbicide	Rate	Mentor Barberry	Warty Barberry	Winter-green Barberry	Winter-jasmine	Cotoneaster	Rhodo-dendron
Check	0	0.36	-0.26	-0.17	0.80	0.30	0
Glyphosate,4E	1#/A	2.65	0.40	1.10	1.45	1.86	0.10
	2#/A	3.75	2.75	0.87	1.69	3.04	0.77
	4#/A	3.71	2.90	3.15	1.84	3.96	1.16
Glyphosate,4E	1+1#/A	3.31	1.05	1.27	1.33	2.41	-0.32
+ Simazine,80W	2+1#/A	4.01	2.77	2.20	1.21	3.38	0.57
	4+1#/A	4.21	3.57	3.32	2.26	3.34	0.79

replaced by smooth crabgrass (Digitaria ischaemum Muhl.) and yellow foxtail. At 4 pounds the common dandelion was reduced and the Kentucky fescue 31 almost eliminated. These plots were invaded by witchweed (Panicum capillare L.) yellow foxtail, smooth crabgrass, large crabgrass (Digitaria sanguinalis Scop.) and fall penicum (Panicum dichotomiflorum Michx.). All of the yews in the glyphosate treated plots had little or no injury (Table 2). The plots treated with paraquat showed damage to the weeds within 1 or 2 days after application.

After three months the predominant weeds in the 1/4 pound per acre plots were still Kentucky fescue 31 and common dandelion with some Canada bluegrass. At 1/2 pounds there were mostly dandelion with a reduction in Kentucky fescue 31. There were some yellow foxtail and Canada bluegrass. The 1 pound per acre plots had mostly common dandelion, smooth crabgrass and yellow foxtail, with some Kentucky fescue 31. At 2 pounds, the plots contained mostly common dandelion with some fall panicum, yellow foxtail, Kentucky fescue 31 and smooth crabgrass. There was little or no injury at 1/4, 1/2 and 1 pound of paraquat per acre although there was one plot at 1 pound per acre which had some yews injured. At 2 pounds the area of the yew hit by the spray had extensive leaf and stem kill. The check plots after 3 months were still primarily infested with Kentucky fescue 31 and common dandelion with some orange hawkweed, green foxtail, buckhorn plantain and yellow woodsorrel. These yews exhibited little or no injury.

Established liners. The plots treated with glyphosate initially had a reduction in weeds with almost complete control at 2 and 4 pounds per acre. After 10 weeks the plots were covered again with weeds. There was a reduction in the grasses but there were a number of broadleaf weeds such as annual fleabane (*Erigeron annuus* Pers.), shepardspurse, common purslane (*Portulaca oleracea* L.), and 1/2 inch high purslane speedwell seedlings (*Veronica peregrina* L.) (Table 3,4). At 1 pound of glyphosate per acre the liners showed some injury but at 2 and 4 pounds the liners were extensively damaged (Table 5,6). The plots treated with glyphosate and simazine had almost complete control of weeds after 3 weeks after application. After 10 weeks the weed control was still good to excellent. There were some annual fleabane, 1/2 inch tall purslane speedwell seedlings, shepardspurse and redroot pigweed. There was injury on all of the liners in all of the treatments, with death or severe injury at 2+1 and 4+1 pounds per acre combinations (Table 5,6).

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PREEMERGENCE WEED CONTROL IN GROUND COVERS

A. Bing[1/]

ABSTRACT

If seedling weeds are controlled in new plantings of ground covers there is less competition from the taller growing annuals and the establishment of perennials by seed is delayed. At Farmingdale, field divisions of Ajuga reptans L, Sedum acre L., and Vinca minor L. and rooted cuttings of Hedera helix L., Euonymus alata, Compacta (Thunb.), and Pachysandra terminalis Siebold & Zucc. were planted on May 2, 1980. The plants were one foot apart in rows 3 feet apart with one cultivar per row and a double space after every fourth plant to separate treatment plots.

Postplant preemergence herbicides were applied using a hand shaker for granules and a hand-pumped sprayer for liquids. Each treatment plot covered 4 plants in each row across the 6 rows. There were two blocks each with all the treatments. Irrigation followed treatment. Later in the growing season irrigation was not available.

As seen in Table 1, weed control from the combinations of herbicides was good (8) to excellent (10) except for the napropamide plus simazine with a poor rating of 4 due to poor control of ragweed, mustard, purslane and crabgrass.

Because of poor cultural conditions, the Ajuga did not grow well, also rabbits severely pruned the Euonymus. None of the treatments had any adverse effects on the Sedum, Vinca, Hedera, or Pachysandra.

Many combinations of herbicides are safe and effective on ground cover plants.

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Table 1. Postplant preemergence weed control in ground covers planted May 21, treated May 22 and rated July 8, 1980 in Farmingdale, New York.

Treatments		Weed control ratings[a]							
Common name	Rate lb aia	General	Grasses	Non-grasses	Crab grass	Foxtail	Purslane	Galinsoga	Groundsel
Oxadiazon 2G	4	8	9	9	8	10	10	10	10
Oxadiazon 2G + simazine 4G	2 + 1	8	8	9	10	10	10	10	10
Oxadiazon 2G + alachlor 15G	2 + 4	10	10	10	8	10	10	10	10
Napropamide 10G + simazine	4 + 1	4[b]	7	6	8	10	5	10	10
Metolachlor 15G + simazine 4G	4 + 1	9	9	10	10	9	10	10	10
Oxyfluorfen 2G + simazine 4G	2 + 1	7	8	9	8	10	9	10	10
Napropamide 10G + oxadiazon 2G	4 + 2	8	8	8	9	10	10	10	10
Oxyfluorfen 2G	2	6	7	8	8	8	8	8	9
Metolachlor 15G	4	8	10	8	10	10	8	10	10
Untreated		2	4	3	5	5	4	6	6
Handcultivated		10	10	10	10	10	10	10	10

[a] Ratings are based on an average of 2 replications. Ratings are from 1 = full of weeds to 10 = no weeds.

[b] Low rating due to growth of unlisted common ragweed, mustard and grass.

GRASS CONTROL IN SELECTED PERENNIAL GROUNDCOVERS WITH NEW HERBICIDES BAS 9052 AND KK-80

C. B. Coffman, W. A. Gentner, and J. R. Frank[1/]

ABSTRACT

Field evaluations of BAS 9052 and KK-80 herbicides revealed potential postemergent grass control in selected dicotyledonous plants. A subsequent greenhouse study showed crabgrass (Digitaria sanguinalis (L.) Scop.), tall fescue (Festuca arundinacea Schreb.), Kentucky bluegrass (Poa pratensis L.) and Italian ryegrass (Lolium multiflorum Lam.) were satisfactorily controlled within 27 days by application of BAS 9052 or KK-80 at 1.1 kg/ha. Bermudagrass (Cynodon dactylon (L.) Pers.) was controlled within 27 and 41 days by BAS 9052 at 1.1 kg/ha and KK-80 at 2.2 kg/ha, respectively. Andorra juniper (Juniperus horizontalis plumosa Rehd.) was tolerant of both BAS 9052 and KK-80 applications of 8.9 kg/ha. KK-80 was tolerated by lowfast cotoneaster (Cotoneaster dammeri Schneid.), Hicks yew (Taxus media Hicksii Rehd.), crownvetch (Coronilla varia L.), Japanese spurge (Pachysandra terminalis Sieb. and Zucc.), periwinkle (Vinca minor L.), and English ivy (Hedera helix L.) at rates up to 8.9 kg/ha. Hinocrimson azalea (Rhododendron x Hinocrimson) was susceptible to KK-80 at 4.4 kg/ha. All the above groundcovers were tolerant of BAS 9052 at 4.4 kg/ha. Slight growth regulator effects were observed on azalea, English ivy, and pachysandra treated with either herbicide.

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WEED CONTROL IN ANNUAL FLOWERING PLANTS

A. Bing[1/]

ABSTRACT

Alachlor, chloramben and oxadiazon were very effective in controlling seedling weeds in transplanted annual flowers. Tolerance of the annuals to herbicides was variable with severe injury to begonia from nitrofen, alachlor, oxadiazon and chloramben. Nitrofen also injured snapdragon, impatiens and petunia severely.

INTRODUCTION

There is great demand for safe effective herbicides on landscape plantings of what are called bedding plants. These are mostly annuals that are started in the greenhouse and transplanted outdoors in beds or borders once the danger of frost is past to provide color. Keeping these plantings free of highly competitive weeds before the plants provide sufficient cover is usually done by hand labor and is very expensive. This is the second year of this series of experiments to find safe effective herbicides.

MATERIALS AND METHODS

Flats of seedlings, empty flats and inserts were donated by Ivy Acres Greenhouse, Calverton, New York. Students in the Ornamentals Horticulture Department of the State University at Farmingdale planted the seedlings in the inserts and took care of them until they were planted on June 11 & 12 at Riverhead. The plants used are listed in Table 1. The plants were set 1 foot apart with 34 inches between rows. Each row contained one kind of plant with a 2-foot space after every 6 plants to separate the treatments. There were 4 blocks with 10 treatments across 9 rows in each block.

Postplant preemergence treatments were applied on June 17 using a hand shaker for granules and a 1 1/2 gallon hand-pumped sprayer for liquids. All quantities of the herbicides shown in Table 2 were weighed ahead of time and the determined amount applied to each 7 ft x 34 in x 9 row plot which was 178.5 sq ft.

The growth of weeds was observed on July 7 giving a rating of 10 for no weeds and 1 for full of weeds. The higher ratings indicate a lack of weeds which may be due to good control or poor weed stand in the area. The predominant weeds were barnyardgrass (*Echinochloa crus-galli* [L.] Beauv.) and pennsylvania smartweed (*Polygonum pensylvanicum* L.).

On July 7 and again on September 19 the growth of the bedding plants was observed. A rating of 1 was given for dead or missing plants to 7 for a satisfactory plant to 10 for maximum expected growth and appearance.

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RESULTS AND DISCUSSION

The weed control data in Table 3 are the averages of 4 plots each across the 9 rows. Most materials gave fair to excellent weed control. Only alachlor, oxadiazon and chloramben gave control ratings of 9 or 10 for all weeds at the rates normally used. Chlorpropham and trifluralin gave mediocre ratings of 6. Napropamide, nitrofen, diphenamid and DCPA with ratings of 8 showed fairly good control.

The field was irrigated as needed but the area was exposed to high winds creating considerable stress on the plants. Ratings show that even the hand-cultivated begonia (5), dalhia (5), coleus (6) and petunia (5) did not do as well as was expected. The data in Tables 4 and 5 show that napropamide was safe on all the plants tested. Early observation showed stunting of marigolds by the napropamide spray. Nitrofen is very harmful to begonia, snapdragon, impatiens and petunia. Chlorpropham was safe on all varieties tested. Chloramben is not safe on begonia. Trifluralin, DCPA, and diphenamid were safe on all plants. Alachlor may be harmful to begonia and oxadiazon may be harmful on petunia and impatiens.

CONCLUSION

It may not be easy to find a very effective herbicide that will be safe on a wide variety of bedding plants. The results of 1979 (1) and 1980 will be followed with another study in 1981. There also may be a big difference between varieties within a species on their tolerance to herbicides.

LITERATURE CITED

1. Bing, A. 1980. Weed control in field grown bedding plants. Bedding Plant News, Sept. 1980 12-13.

Table 1. Bedding plants treated with postplant preemergence herbicides.

Common name	Scientific name
Begonia	Begonia semperflorens-cultorum var Derby Hort.
Coleus	Coleus blumei var Velvet Rainbow Benth.
Dahlia	Dahlia pinnata var Rigaletto Car.
Geranium	Pelargonium hortorun var Ringo Salmar
Impatiens	Impatiens balsamina var Minette Salmar L.
Marigold, French	Tagetes patula L.
Petunia	Petunia hybrida pink single Hort.
Salvia	Salvia splendens F.
Snapdragon	Antirrhinum majus var Pixie L.

Table 2. Postplant preemergence herbicides used for weed control on bedding plants at Riverhead, New York.

Common name	Chemical name	Formulation
Alachlor	2-chloro-2',6'-diethyl-N-(methoxymethyl) acetanilide	15G
Chloramben	3-amino-2,5-dichlorobenzoic acid	3.9G
Chlorpropham	isopropyl m-chlorocarbanilate	20G
DCPA	dimethyl tetrachloroterephthalate	75WP
Diphenamid	N,N-dimethyl-2,2-diphenylacetamide	50WP
Napropamide	2-(a-naphthoxy)-N,N-diethylpropionamide	50WP
Nitrofen	2,4-dichlorophenyl p-nitrophenyl ether	50WP
Oxadiazon	2-tert-butyl-4-(2,4-dichloro-5-isopropoxyphenyl)- -1,3,4-oxadiazolin-5-one	2G
Trifluralin	a,a,a,-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine	5G

Table 3. Postplant preemergence weed control in bedding plants planted June 11 & 12, treated June 17 and rated July 7, 1980, at Riverhead, New York.

Treatments		Weed control ratings[a]				
Common name	Rate lb aia	General	Grasses	Nongrass	Barnyard-grass	Smartweed
Napropamide 50 WP	4	8	9	9	9	9
	8	6	8	9	8	9
	16	10	10	10	10	10
Napropamide 10G	4	7	8	9	8	9
	8	8	8	9	8	9
	16	10	10	10	10	10
Nitrofen 50 WP	4	8	9	10	8	10
	8	10	10	10	10	10
Chlorpropham 20G	4	6	6	10	6	10
	8	8	8	10	8	10
Chloramben 3.9G	4	9	9	10	9	10
	8	10	10	10	10	10
	16	10	10	10	10	10
Trifluralin 5G	2	6	6	8	6	8
	4	6	7	8	10	8
DCPA 75 WP	10	8	8	10	8	10
	20	8	8	10	8	9
Alachlor 15G	4	9	9	9	9	10
Diphenamid 50 WP	4	8	8	10	8	10
Oxadiazon 2G	4	10	10	10	10	10
Untreated		6	7	9	7	9
Handcultivated		10	10	10	10	10

[a] Ratings are an average of 4 replications, ratings are from 1 = full of weeds to 10 = no weeds.

Table 4. Growth ratings of bedding plants planted June 11 & 12, treated June 17, and rated July 7, 1980 at Riverhead, New York.

Treatments		Growth ratings[a]								
Common name	Rate lb aia	Begonia	Dahlia	Marigold	Snap-dragon	Coleus	Geranium	Impatiens	Petunia	Salvia
Napropamide 50 WP	4	6	6	7	7	6	7	5	8	5
	8	6	7	7	7	5	5	5	8	6
	16	5	6	6	6	6	6	5	7	6
Napropamide 10G	4	6	8	10	8	7	7	7	7	6
	8	5	8	10	8	7	6	6	8	7
	16	6	8	9	8	7	7	5	8	7
Nitrofen 50 WP	4	2	6	7	2	6	5	1	3	7
	8	1	6	6	2	4	6	1	2	6
Chlorpropham 20G	4	6	8	10	9	6	6	6	6	7
	8	6	8	9	8	6	6	6	6	7
Chloramben 3.9G	4	3	6	9	7	7	6	6	7	6
	8	3	8	8	6	6	6	6	5	5
	16	2	6	6	5	6	6	4	3	5
Trifluralin 5G	2	5	8	10	8	7	7	6	8	7
	4	6	8	10	8	7	7	6	8	6
DCPA 75 WP	10	5	8	9	7	5	8	6	6	7
	20	5	8	9	7	6	7	6	6	5
Alachlor 15G	4	4	7	8	7	6	6	5	7	5
Diphenamid 50 WP	4	7	7	9	8	6	6	6	8	7
Oxadiazon	4	4	6	7	7	6	6	4	4	7
Untreated		6	7	9	8	7	6	6	8	6
Handcultivated		6	9	10	8	5	7	7	6	7

[a]Growth ratings are based on an average of 4 replications of 6 plants each. Ratings are from 1 = dead or missing plant to 10 = maximum growth.

Table 5. Growth ratings of bedding plants planted June 11 & 12, treated June 17, and rated September 19, 1980 at Riverhead, New York.

Treatments		Growth ratings[a]								
Common name	Rate lb aia	Begonia	Dahlia	Marigold	Snap-dragon	Coleus	Geranium	Impatiens	Petunia	Salvia
Napropamide 50 WP	4	7	6	9	9	8	7	6	6	8
	8	5	6	6	8	6	6	4	6	8
	16	4	5	7	5	8	4	4	4	8
Napropamide 10G	4	4	6	9	9	8	6	8	6	7
	8	3	7	8	10	7	7	3	3	8
	16	4	6	8	6	7	7	2	4	8
Nitrofen 50 WP	4	2	4	8	2	7	5	3	4	9
	8	1	5	8	1	6	8	2	4	9
Chlorpropham 20G	4	6	6	8	9	6	5	6	5	7
	8	3	4	7	9	6	7	5	5	4
Chloramben 3.9G	4	2	6	8	9	8	5	6	7	6
	8	1	7	8	8	5	4	4	3	4
	16	1	5	6	5	5	4	4	2	5
Trifluralin 5G	2	4	7	8	8	7	8	6	6	6
	4	6	6	8	9	7	8	6	6	6
DCPA 75WP	10	4	4	7	8	4	10	6	6	8
	20	3	5	8	8	5	7	8	6	6
Alachlor 15G	4	2	6	8	10	6	6	7	3	6
Diphenamid 50 WP	4	5	6	9	8	7	7	5	6	7
Oxadiazon 2G	4	2	5	6	8	8	7	4	6	8
Untreated		6	8	10	9	8	6	4	5	7
Handcultivated		5	5	8	9	6	7	7	5	8

[a]Growth ratings are based on an average of 4 replications of 6 plants each. Ratings are from 1 = dead or missing plant to 10 = maximum growth.

PREEMERGENCE HERBICIDES FOR TRANSPLANTED HERBACEOUS PERENNIALS

J. F. Ahrens[1/]

ABSTRACT

Twenty-two herbicide treatments including nine herbicides at single and double rates, simazine at 1 lb/A, and five herbicide combinations were applied as granules or sprays over 19 or 20 newly planted perennial ornamentals in the field. All treatments gave good to excellent control of annual weeds for 25 days and generally less control for 65 days. Two-way combination treatments gave better weed control at 65 days than individual herbicides. All treatments injured at least one perennial plant. The numbers of species that suffered acceptable injury (20% or less) by individual herbicides were: napropamide G at 4 lb/A - 19; diphenamid WP at 4 lb/A and oxadiazon G at 2 lb/A - 18; DCPA WP at 9 lb/A and oryzalin WP at 1.5 lb/A - 17; alachlor G at 4 lb/A - 15; oxyfluorfen G at 1 lb/A - 14; bifenox F at 3 lb/A - 10; and simazine WP at 1 lb/A - 8. Simazine WP at 0.5 lb/A plus oxadiazon G at 2 lb/A, DCPA WP at 9 lb/A or oryzalin WP at 1.5 lb/A injured most plants that were injured by simazine WP at 1 lb/A, or by oxadiazon, DCPA, or oryzalin alone. Twelve, 12, and 10 species tolerated these treatments, respectively. Bifenox F at 3 lb/A plus napropamide F at 2 lb/A and oxadiazon G at 2 lb/A plus napropamide G at 2 lb/A were tolerated by 10 and 17 species, respectively.

INTRODUCTION

A wide variety of herbaceous perennial ornamental crops are grown, both in the field and in containers. Preemergence herbicides could greatly reduce the high costs of weeding in these crops, but more information on the tolerance of perennials to herbicides is needed. Corell and Bing (1) and Elmore, et. al. (2) have reported varied results with preemergence herbicides in perennials. In this work we tested several preemergence herbicides on 20 newly transplanted perennials under field conditions.

MATERIALS AND METHODS

A field study was conducted at the White Flower Farm in Litchfield, CT on a fine sandy loam soil with an organic matter content of 4.9%. Twenty species of perennial plants were machine-planted into field rows on July 2, 1980. A light rain followed the planting. The plants were spaced 1 ft apart in rows 1.5 ft apart. On July 3, 22 herbicide treatments were applied across all species of perennials. A randomized complete block design was used with three replicates, and two untreated plots per replicate. The herbicides were applied as sprays in 50 gal/A, or as granules either with a 3-ft calibrated auger-feed applicator or a 21-in calibrated lawn spreader. The herbicide plots were 3 or 3.5 ft wide and 33 ft long, with 2 or three plants of each perennial species.

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The plots were spaced 5 ft apart, leaving 1½ or 2-ft untreated borders between each. These borders also contained one or two perennial plants of each species. Irrigation (0.75 in) was applied 30 min after the last herbicide treatment and as needed during the season to maintain good plant growth.

The plant species were: yarrow (Achillea ptarmica 'Pearl'), Hosta undulata erromena, daylily (Hemerocallis 'Downy'), foxglove (Digitalis ambigua), bellflower (Campanula carpatica), Phlox divaricata, Phlox subulata, Helenium 'Riverton Beauty', Tradescantia 'Brilliant', Pyrethrum alba (also called Chrysanthemum coccineum), woodland strawberry (Frageria vesca), columbine (Aquilegia 'McKana'), Artemisia 'Silver Mound', Aster 'Amellus Triumph', Potentilla aurea verna, coral bells (Heuchera sp.), bee balm (Monarda sp.), Lythrum salicaria 'Dropmore Purple', perennial candytuft (Iberis sempervirens 'Snowflake'), and Shasta daisy (Chrysanthemum maximum 'White Bomb'). Achillea, Hosta, Hemerocallis and Tradescantia were bare root and the others were multi-tray or peat-potted transplants.

At 25 and 65 days after treatment visual ratings of weed control and plant injury were made on a 0 to 10 scale, with 0 as no control or injury, and 10 as 100% control or all plants dead. Following each rating the plots were hand-weeded.

The weed control ratings are described as follows: 9 to 10 - excellent; 7.5 to 8.9 - good; 5.0 to 7.4 - fair; and less than 5 - poor. Injury ratings of 2.0 or less at the season end were considered acceptable tolerance; ratings of 2 to 3 were considered marginal; and injury ratings greater than 3 were considered excessive for commercial production.

The principal grasses were large crabgrass (Digitaria sanguinalis (L.)Scop.) and old witchgrass (Panicum capillare L.). The broadleaf weeds included horseweed (Conyza canadensis (L.)Cronq.), lambsquarters (Chenopodium album L.), black nightshade (Solanum nigrum L.), Pennsylvania smartweed (Polygonum pensylvanicum L.), common chickweed (Stellaria media (L.)Cyrillo), common purslane (Portulacca oleracea L.), yellow rocket (Barbarea vulgaris R.Br.), shepherdspurse (Capsella bursa-pastoris (L.)Medic , and common eveningprimrose (Oenothera biennis L.).

RESULTS AND DISCUSSION

All treatments gave good to excellent control of weeds at 25 days (Table 1), but some gave fair to poor control at 65 days. However, all treatments greatly reduced weed populations and could greatly reduce weeding costs in perennial flower crops. The injury ratings averaged for 25 and 65 days after treatment are given in Table 2. All of the treatments injured one or more perennial species. Phlox divaricata was injured much more frequently than P. subulata. The Monarda plants were poor in some areas and injury evaluations there were discarded.

DCPA (dimethyltetrachloroterephthalate) WP at 9 or 18 lb/A gave good to excellent control of grasses and fair to good control of braodleaf weeds for 65 days. Yellow rocket, horseweed, and purslane were found at 65 days. Plant tolerance to DCPA at 9 lb/A was adequate for all species except the two Phlox cultivars and Campanula. However, injury to Campanula was less at 65 days than

at 25 days.

Diphenamid (N,N-dimethyl-2,2-diphenylacetamide) WP at 4 or 8 lb/A controlled grasses for 65 days, but gave only poor to fair control of broadleaf weeds during the second month. At 4 lb/A injury was marginal only in Digitalis and Artemisia. The severe injury at 8 lb/A in Aquilegia, Digitalis, and Phlox divaricata makes the tolerance of these plants questionable.

Oxadiazon /2-tert-butyl-4-(2,4-dichloro-5-isopropoxyphenyl)-Δ^2-1,3,4-oxadiazolin-5-one/ granules at 2 or 4 lb/A gave good to excellent weed control for 65 days. At 2 lb/A injury was excessive only in Phlox divaricata and marginal in Hosta, and at 4 lb/A injury also was excessive in Campanula and Heuchera and marginal in Hemerocallis. Injury was greater with oxadiazon at 25 days than at 65 days. Corell and Bing, however, reported no injury with oxadiazon at 2 or 4 lb/A in container-grown Hosta, Heuchera, and Hemerocallis cultivars.

Granular alachlor /2-chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide/ at 4 or 8 lb/A gave excellent weed control for 65 days. Injury at 4 lb/A was excessive only in Campanula, Phlox divaricata, Heuchera, and Artemisia.

Oryzalin (3,5-dinitro-N^4,N^4-dipropylsulfanilamide) at 1.5 or 3 lb/A gave good to excellent control for 65 days. Injury was marginal or excessive only in the two Phlox cultivars.

Granular napropamide /2-(α-naphthoxy)-N,N-diethylpropionamide/ at 4 or 8 lb/A gave excellent control of grasses but only fair of broadleaf weeds for 65 days. Black nightshade and horseweed were not well controlled. At 4 lb/A, napropamide caused marginal injury only in Digitalis. At 8 lb/A, injury was marginal or excessive in the Phlox cultivars, Lythrum, and Aquilegia.

Granular oxyfluorfen /2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene/ at 1 or 2 lb/A gave fair to good control of weeds at 65 days. Old witchgrass, horseweed, and common chickweed were found in the plots. At 1 lb/A injury was marginal or excessive in Campanula, Digitalis, Phlox divaricata, Hosta, Heuchera, and Lythrum. Contact injury and poorer growth were observed. At 2 lb/A injury was also marginal or excessive in Hemerocallis, Tradescantia, Pyrethrum, and Frageria. The tolerance of Phlox divaricata is questionable because more injury was obtained at 1 lb than at 2 lb/A.

Simazine /2-chloro-4,6-bis(ethylamino)-s-triazine/ WP at 1 lb/A gave good control at 65 days, but caused early chlorosis and marginal or excessive injury in 12 of the 20 species treated. The most tolerant plants were Hemerocallis, Hosta, Tradescantia, Lythrum, Aquilegia, Campanula, Helenium, and Monarda.

Bifenox /methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate/ F at 3 or 6 lb/A gave fair control at 65 days, but injured half of the species. The most tolerant plants were Achillea, Helenium, Pyrethrum, Potentilla, Aster, Chrysanthemum maximum, Lythrum, Aquilegia, Iberis, Artemisia, and Monarda. Injury usually was greater at 25 days than at 65 days.

The herbicide combinations all gave better weed control at 65 days than the same herbicides applied alone. Corell and Bing (1) reported good tolerance

of many herbaceous perennials to granular simazine at 0.5 lb/A plus granular oxadiazon at 2 or 4 lb/A. In this test where we applied wettable simazine at 0.5 lb/A plus granular oxadiazon at 2 lb/A, injury was marginal or excessive only on plants that were injured by oxadiazon alone at 2 lb/A or simazine alone at 1 lb/A. In Achillea, Aster, and Chrysanthemum, injury was tolerable with the combination and excessive with simazine alone at 1 lb/A. Similar results were obtained with the combinations of simazine at 0.5 lb/A plus DCPA at 9 lb/A, or oryzalin at 1.5 lb/A. Species that were not excessively injured by simazine at 1 lb/A or oryzalin at 1.5 lb/A or DCPA at 9 lb/A were not excessively injured by the combination treatments, and in some species injury was less with the combination than with simazine at 1 lb/A alone. However, Heuchera and Aquilegia were not injured by simazine alone, but were marginally injured by one of the combinations.

Plant responses to the combination treatments of bifenox plus napropamide and oxadiazon plus napropamide were about the same as responses to the herbicides applied alone. Plants tolerant of both herbicides applied alone were tolerant or marginally tolerant of the combinations.

LITERATURE CITED

1. Corell, T. and A. Bing. 1980. Preemergence weed control in ornamental perennial crops. Proc. Northeast. Weed Sci. Soc. 34:334-339.

2. Elmore, C.L., W.D. Hamilton, E.J. Johnson and T.M. Kretchun. 1974. Weed control in ornamentals. Progress Report, Univ. of Calif. Coop. Ext., Santa Clara Field Station.

Table 1. Weed control ratings at 25 and 65 days after herbicide application.

Herbicide	Rate, ai lb/A	July 28 25 days) Grass	Bdlf	Sept 4 (65 days) All weeds	Grass	Bdlf
untreated		0	0	0	0	0
DCPA, 75WP	9	9.8	8.8	6.3	7.7	6.0
	18	10.0	8.3	6.0	8.3	5.3
diphenamid, 50WP	4	10.0	8.3	5.0	9.0	3.0
	8	10.0	9.8	7.5	9.8	6.8
oxadiazon, 4G	2	9.8	9.9	8.7	8.8	8.7
	4	10.0	9.8	9.0	9.9	8.7
alachlor, 15G	4	10.0	10.0	9.3	9.6	9.2
	8	10.0	10.0	9.6	9.9	9.3
oryzalin,75WP	1.5	9.8	9.5	8.8	9.0	8.7
	3	10.0	9.7	9.5	9.6	9.5
napropamide, 10G	4	9.9	9.2	6.3	9.2	5.0
	8	10.0	9.2	8.0	9.6	7.2
oxyfluorfen, 2G	1	8.5	9.7	5.8	5.8	5.7
	2	10.0	10.0	8.2	8.8	7.8
simazine, 80W	1	10.0	9.9	8.5	7.5	9.3
bifenox,4F	3	9.5	9.9	7.8	6.3	8.4
	6	9.8	9.9	8.7	8.7	8.7
simazine, WP+ oxadiazon,G	0.5+2	10.0	10.0	9.5	9.5	9.5
bifenox,F+ napropamide,F	3+2	10.0	9.9	9.6	9.9	9.5
simazine,WP+ DCPA,WP	0.5+9	10.0	10.0	9.0	8.5	9.2
simazine,WP+ oryzalin,WP	0.5+1.5	10.0	9.9	9.4	9.7	9.2
oxadiazon,G+ napropamide,G	2+3	10.0	9.9	9.2	9.4	9.2

Table 2. Plant injury ratings averaged for 25 and 65 days after treatment.

Herbicide	Rate, lb/A	Campanula	Digitalis	P. divaricata	P. subulata	Achillea	Hemerocallis	Hosta	Trandescantia	Helenium	Pyrethrum	Heuchera	Potentilla	Aster	Chry. maximum	Lythrum	Aquilegia	Iberis	Artemisia	Fragaria	Monarda
untreated		1.0	0.3	0.8	0	0	0	0.1	0	0	0.3	0	0	0	0	0	0.1	0	0	0	0
DCPA	9	2.5	0.5	3.8	5.7	0	0.7	0.7	0.2	0.3	0.2	0.2	0	0.2	0	0	0	0.2	0	0.2	0.3
	18	3.7	0.3	6.3	1.7	0	0	1.2	0	0	0.5	2.2	0	0	0	0	0.5	2.2	0.3	0.8	0.2
diphenamid	4	0.8	3.0	1.8	1.0	0.3	0.5	0.7	0	0.2	0.7	1.8	0	0.2	0	0	1.3	0.5	2.3	0.5	0
	8	1.2	5.0	5.0	3.0	0	1.2	0.7	0.3	0.2	1.0	1.2	0.7	0.3	0.3	2.5	5.2	0.8	2.2	0.3	0.3
oxadiazon	2	1.3	0.2	3.3	1.0	0.3	1.0	2.5	0.2	0	0.5	0.8	0	0.7	0.2	0.5	0	0	0.8	2.0	0
	4	3.7	1.7	4.2	1.0	0	2.2	3.3	0.8	0.3	0.7	4.7	0.2	0.5	0	0.8	0.3	0.2	1.2	3.0	0
alachlor	4	4.5	1.7	3.8	1.2	1.7	1.2	0.3	1.3	0.5	1.7	3.7	0.7	0.3	0.7	1.2	1.8	0.7	4.0	1.0	-
	8	5.7	2.2	6.3	2.0	5.5	1.5	0.5	1.2	0.2	1.5	4.2	2.7	1.7	3.7	5.3	4.0	0	6.0	1.8	-
oryzalin	1.5	0.5	1.3	7.3	2.7	0	0.8	0.5	0	1.0	0.7	1.5	0	0.3	0	0	0.2	0	0	0.7	-
	3	1.3	1.3	5.7	4.3	0.2	0.2	0.3	0.2	0	0.3	0.7	0.8	0	0	0.3	0.7	0.7	0.8	0.2	-
napropamide	4	1.0	2.2	0.8	0.5	0	0.2	0	0.2	0	0.7	0.3	0	0.5	0.5	0.3	1.0	0.2	0	0.2	0
	8	1.8	2.5	2.2	0.8	0	0.2	0.7	0.2	0	0.8	0.8	0	0.2	0	3.5	2.7	0	1.7	1.0	0
oxyfluorfen	1	5.7	2.3	3.2	0	0.2	1.3	2.5	2.0	1.0	1.8	4.4	0	0.3	0	2.8	0.3	0	0.7	1.7	2.0
	2	4.5	2.0	1.0	1.0	0	2.3	4.2	2.8	0.7	3.7	3.9	0.3	1.3	0	3.8	1.0	0	0.5	3.0	0
simazine	1	2.3	5.2	3.8	3.7	3.2	0.5	0.8	0.3	2.0	6.3	1.8	6.7	2.2	4.5	0.2	0.8	5.8	5.3	2.7	0
bifenox	3	3.5	2.3	6.0	3.8	0	2.2	3.7	3.2	1.0	0.8	3.5	0.7	0.5	0	0.3	0.3	1.3	2.2	2.8	0.2
	6	5.0	5.0	6.8	2.0	0	2.8	5.2	3.5	0.7	1.2	5.8	0.7	0.5	0.2	2.5	2.5	1.0	0.7	3.7	0.5
simazine+oxadiazon	0.5+2	3.8	4.2	4.0	2.8	0.3	1.7	3.0	0.8	0.3	2.8	1.8	3.0	0.7	0.5	0.5	2.0	2.0	4.3	2.0	0
bifenox+napropamide	3+2	2.2	2.2	5.5	3.7	0.5	2.3	3.3	4.0	1.3	1.3	3.7	0.5	1.3	0.3	2.2	3.0	0.5	0	1.8	0
simazine+DCPA	0.5+9	4.3	3.0	6.0	4.5	1.8	0.3	1.3	0	0.3	2.8	2.5	4.3	0.5	1.2	1.0	0.8	1.0	2.5	0.2	0
simazine+oryzalin	0.5+1.5	3.0	3.7	5.0	5.8	2.0	0.7	0.5	0.5	0.5	2.8	0	2.3	0.3	1.3	0.8	2.3	3.8	3.0	1.2	-
oxadiazon+naprop.	2+2	2.0	3.3	2.8	0	0	0.5	1.7	0.7	0.2	1.5	1.7	0	0.3	0.2	2.0	2.0	0.2	0.7	2.2	0

WEED CONTROL ON HARDWOOD CUTTINGS, 1980

A. Bing[1/]

ABSTRACT

Hardwood cuttings are pieces of woody stems cut in the early winter, put in cold storage until conditions are favorable for outdoor planting. They are planted close together in beds or in rows in the field. They root and grow new tops and in one or two years produce a saleable plant. Post-plant preemergence weed control would save a lot of expense and allow for closer planting.

As part of their horticultural training students in the ornamental horticulture program at State University Farmingdale stuck cuttings of California privet, redstemmed dogwood and forsythia on April 23 and 25. The cuttings were 3 inches apart in rows 6 inches apart across the bed, each row containing 6 cuttings of each species. On May 2 granules or sprays were applied to each plot which contained 6 rows and was 3 ft long and 6 ft across the bed.

All treatments showed near excellent weed control when rated on July 8. The predominant weeds were hairy galinsoga (Galinsoga cilata [Raf.] Blake), and common groundsel (Senecio vulgaris L.).

There was no injury from any of the treatments as seen in Table 1.

Table 1. Plant growth ratings of hardwood cuttings planted April 23 & 25, treated May 2, and rated October 15, 1980 at Farmingdale, N.Y.

Treatments		Plant growth ratings[(a)]		
Common name	Rate lb/aia	Forsythia	Redstemmed dogwood	Privet
Oxadiazon 4G + simazine 4G	2 + 1	9	8	8
Napropamide 10G + simazine 4G	4 + 1	9	7	8
Alachlor 15G + simazine 4G	4 + 1	10	8	10
Oxadiazon 4G + alachlor 15G	2 + 4	10	7	8
Oxyfluorfen 2G + simazine 4G	2 + 1	10	7	8
Metolachlor 8E + simazine 4L	2 + 1	9	9	8
Untreated		8	9	8
Handcultivated		9	6	9

(a) Ratings are based on an average of 4 replications of 6 rows containing 6 cuttings of each cultivar. Ratings are from 1 = dead or missing plant to 10 = maximum growth.

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EVALUATION OF HERBICIDES FOR BROADLEAF WEED CONTROL IN LAWN TURF

J.S. Ebdon and J.A. Jagschitz [1]

ABSTRACT

Four studies were conducted to evaluate standard, experimental and substitute chemicals, alone and in combinations, for the selective control of six broadleaf weeds in lawn turf. Various formulations of certain herbicides were evaluated. Ten studies were also initiated over a five year period to evaluate the effectiveness of spring and fall applied herbicides in controlling little starwort. MCPA had shown merit as a potential substitute for 2,4-D. MCPA or 2,4-D provided excellent control of dandelion, white clover, buckhorn plantain and broadleaf plantain. Combinations of 2,4-D or MCPA with dicamba, dichlorprop or mecoprop provided broad spectrum control by controlling all six weeds (including mouseear chickweed and red sorrel). Experimental materials, DPX-4065 and DPX-4189, had demonstrated merit as potential herbicides, further research is justified. The other experimental material AXF-1124 controlled only one of the six weeds (mouseear chickweed). Fall treatments were generally more effective in controlling little starwort with little variability between years. When applied alone, 2,4-D did not provide excellent control of little starwort. Combinations of 2,4-D with dicamba, dichlorprop, mecoprop, silvex, triclopyr (variable turf injury) did provide excellent control of little starwort when fall applied. There were no differences in the control between the various formulations, 2,4-D amine, dacamine or ester, and the combination of 2,4-D plus dichlorprop ester or oil amine.

INTRODUCTION

Herbicides are used to selectively control broadleaf weeds in turfgrasses. It is the goal of many researchers to evaluate the merits of newer chemicals and find better combinations. Single herbicide applications have not provided the broad spectrum control and effectiveness as combinations (1,2,3,4 and 5). Variable control with some herbicide applications have surfaced in recent studies (4). Substitute herbicides are needed to replace those no longer available or banned from the market.

Studies were initiated to evaluate standard, experimental and substitute chemicals alone and in combinations, for control of dandelion (*Taraxacum officinale* Weber.), white clover (*Trifolium repens* L.), mouseear chickweed (*Cerastium vulgatum* L.), red sorrel (*Rumex acetosella* L.), buckhorn plantain (*Plantago lanceolata* L.), broadleaf plantain (*Plantago major* L.) and little starwort (*Stellaria graminea* L.). Various formulations of 2,4-D [(2,4-dichlorophenoxy) acetic acid] and of 2,4-D plus dichlorprop [2-(2,4-dichlorophenoxy) propionic acid] were also compared. MCPA [[(4-chloro-*o*-tolyl)oxy] acetic acid] and 2,4-D in combination with dicamba (3,6-dichloro-*o*-anisic acid), dichlorprop and mecoprop [2-[[4-chloro-*o*-tolyl)oxy] propionic acid] were evaluated for effectiveness and improved broad spectrum control. Since the

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effective control of little starwort is relatively difficult, studies were initiated over a period of several years to evaluate the effectiveness of spring and fall applied herbicides.

MATERIALS AND METHODS

Fourteen weed control studies were initiated at the Turf Research Farm and the atheletic field complex of the University of Rhode Island. The turf had been established for several years and was a mixture of red fescue (Festuca rubra L.), Kentucky bluegrass (Poa pratensis L.) with some colonial bentgrass (Agrostis tenuis Sibth.). This turf had been maintained at a cutting height of approximately 1.5 inches. The chemicals were applied in a spray application with water at a rate of 50 gallons to the acre. The herbicides, rates, formulations and dates of application or control are presented in Tables 1 and 2. Treatments were applied to plots measuring 4 by 4 feet and replicated three to four times. Except for the little starwort trials all treatments were applied on the 22nd or 23rd of May, 1980. The ten little starwort trials were initiated over a five year period to evaluate the effectiveness of seasonal herbicide applications. Fall treatments were made September or October while spring treatments were made in May or June. No appreciable precipitation had occurred within 24 hours following any treatment. Initial estimates of weed populations were made in each of the plots for white clover, mouseear chickweed, buckhorn plantain, broadleaf plantain and little starwort. Percent control determinations were computed by comparing the initial and final estimates of weed populations with adjustments made to account for changes in untreated check plots. Percent control determinations for dandelion and red sorrel were computed by comparing estimates of weed populations in treated plots to that of the untreated check plots. Percent controls of 85% or higher without objectionable turf injury was considered excellent control. Turf injury was estimated periodically throughout the tests in all plots. The visual scale ranged from 0 to 10, 10 being brown turf or bare substrate with turf injury readings of 2 or higher considered objectionable. At the time of treatment some dandelion, buckhorn plantain, mouseear chickweed and red sorrel plants were flowering.

RESULTS AND DISCUSSION

Dandelion

AXF-1124, dichlorprop, DPX-4065 (.25 lb rate) and mecoprop applied alone did not provide excellent control (85% or higher without turf injury). MCPA and 2,4-D alone or in combination with other chemicals provided excellent control as did DPX-4189 and DPX-4065 (.125 lb rate).

White Clover

AXF-1124 and DPX-4065 (.25 lb rate) were the only materials to provide less than excellent control. Dichlorprop, 2,4-D, MCPA,mecoprop and any combinations of these as well as 2,4-D plus dicamba provided excellent control as did DPX-4189 and DPX-4065 (.125 lb rate). Past studies have shown that 2,4-D is generally not effective in controlling white clover.

Mouseear chickweed

AXF-1124 (2 lb rate), 2,4-D (1 lb rate), DPX-4065 (.25 lb rate) and MCPA applied alone did not provide excellent control. AXF-1124 (4 lb rate), dichlorprop, 2,4-D (2 lb rate), DPX-4189, DPX-4065 (.125 lb rate) and mecoprop all provided excellent control. The combination of 2,4-D or MCPA with either dicamba, dichlorprop or mecoprop provided excellent control as well. Earlier studies have shown dicamba to provide excellent control while 2,4-D was variable in its control (4).

Red sorrel

AXF-1124, dichlorprop, 2,4-D, DPX-4065 and MCPA all demonstrated to have less than excellent control, as did the combination of 2,4-D plus dichlorprop (1 + 1 lb rate). Dicamba, mecoprop and any combinations containing one or more of these materials all provided excellent control, as did DPX-4189. The combinations of MCPA plus dichlorprop, and 2,4-D plus dichlorprop (1.5 + 1.5 lb rate) also provided excellent control.

Buckhorn plantain

AXF-1124, dicamba, DPX-4065 (objectionable turf injury at .25 lb rate) and DPX-4189 all provided less than excellent control. Dichlorprop, 2,4-D, MCPA, mecoprop and any combinations containing one or more of these materials all provided excellent control.

Broadleaf plantain

AXF-1124, DPX-4065 (objectionable turf injury at .25 lb rate) and DPX-4189 provided less than excellent control. MCPA, 2,4-D and any combination containing one of these materials all provided excellent control.

Little starwort

Control of little starwort with spring applications of herbicides had shown variability between years. Fall treatments were generally more effective in controlling little starwort than spring treatments. Fall or spring applied 2,4-D provided less than excellent control of little starwort. Other materials applied alone performed better, however more data is required in order to generate more reliable conclusions. Combinations of 2,4-D with one or more of the following, dicamba, dichlorprop, mecoprop, silvex [2-(2,4,5-trichlorphenoxy) propionic acid] or triclopyr [[(3,5,6-trichloro-2-pyridinyl)oxy] acetic acid] applied as a fall treatment provided excellent control of little starwort with little variability between years. There were variable turf injuries with some triclopyr treatments.

COMMENTS

There were no differences in the control between the following formulations, 2,4-D amine, dacamine or ester, and the combination of 2,4-D plus dichlorprop ester or oil amine. MCPA had shown merit as a potential replacement or

substitute for 2,4-D alone or in combination with dicamba, dichlorprop or mecoprop. Herbicide combinations were more effective than materials applied alone for broad spectrum control. MCPA or 2,4-D in combinations with dicamba, dichlorprop or mecoprop provided excellent control of dandelion, white clover, mouseear chickweed, red sorrel, buckhorn plantain and broadleaf plantain. These 2,4-D combinations, and combination of 2,4-D with silvex or triclopyr, when fall applied, provided excellent control of little starwort as well. Experimental materials DPX-4065 and DPX-4189 demonstrated merit as potential herbicides, further research is justified. The .125 lb rate of DPX-4065 and DPX-4189 provided excellent control (85% or higher with no objectionable turf injury) of dandelion, white clover and mouseear chickweed. The .25 lb rate of DPX-4065 controlled in addition to these weeds, three others; red sorrel, buckhorn plantain and broadleaf plantain with objectionable turf injury, the lower rate of .125 lb was not used as a treatment for the latter weeds. DPX-4189 at the higher rate of .25 lb provided excellent control of red sorrel but not buckhorn and broadleaf plantains. The .25 lb rate of DPX-4189 did not provide the broad spectrum control that the equivalent rate of DPX-4065 provided, however no objectionable turf injury was observed. The other experimental material, AXF-1124 (4 lb rate) provided excellent control of only mouseear chickweed.

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TABLE 1. Effectiveness of herbicides for control of dandelion, white clover, mouseear chickweed, red sorrel, buckhorn plantain and broadleaf plantain in lawn turf.

Treatment, May 22 to 23, 1980			Percent control					
Herbicide	Rate lb ai/A	Other information	Dandelion July 28	White clover July 28	Chickweed July 28	Red sorrel Aug 14	Buckhorn plantain Aug 4	Broadleaf plantain Aug 4
2,4-D	1	Weedar 64 amine	97	97	80	9	100	96
2,4-D	2	Weedar 64 amine	99	99	96	75	100	99
2,4-D	2	Weedone LV4 ester	96	98	91	-	-	-
dicamba	.25	Banvel	-	-	-	93	0	-
2,4-D + dicamba	1.25 + 1.25	Super D	97	100	93	89	100	-
2,4-D + dicamba	1 + .25	Weedar 64 + Banvel	100	100	100	98	100	99
dichlorprop	1	Weedone 2,4-DP ester	-	-	-	45	100	-
dichlorprop	2	A-287 oil amine	73	100	100	-	-	-
2,4-D + dichlorprop	1 + 1	A-510 ester	94	100	100	78	100	99
2,4-D + dichlorprop	1 + 1	A-582 oil amine	98	99	99	70	100	-
2,4-D + dichlorprop	1.5 + 1.5	A-510 ester	97	100	100	94	100	-
2,4-D + dichlorprop	1.5 + 1.5	A-582 oil amine	99	99	99	-	-	-
mecoprop	1.25	MCPP-K-4 (potassium)	79	100	100	94	100	-
mecoprop	2	MCPP-K-4	45	100	100	-	-	-
2,4-D + mecoprop	1 + 1	Turf Kleen	98	99	100	98	94	99
2,4-D + mecoprop	1 + 1.25	amine 4D + MCPP-K-4	100	100	100	95	100	-
2,4-D + mecoprop	1 + 1.25	dacamine + MCPP-K-4	98	100	100	-	-	-
2,4-D + mecoprop	1 + 2	amine 4D + MCPP-K-4	98	100	100	-	-	-
2,4-D + mecoprop	1 + 2	dacamine + MCPP-K-4	97	100	100	-	-	-
(2,4-D + mecoprop)	(.5 + 1)	Diamond amine	98	100	100	96	100	99
(2,4-D + mecoprop) + 2,4-D	(.5 + 1) + 1	Diamond + amine 4D	99	100	100	94	100	-
(2,4-D + mecoprop) + 2,4-D	(.5 + 1) + 1	Diamond + dacamine	99	100	100	-	-	-
2,4-D + mecoprop + dicamba	.61 + 1.1 + .11	33 plus	93	99	100	99	100	99
2,4-D + mecoprop + dicamba	1 + .5 + .125	Trex-San	100	100	99	97	86	100
2,4-D + mecoprop + dicamba	1.1 + .55+ .11	Trimec	99	100	100	99	100	100
MCPA	1	Weedar	90	95	65	57	100	90
MCPA	1.5	Weedar	98	99	82	70	100	99
MCPA + mecoprop	1 + 1	Weedar + Chipco Turf	95	99	100	87	100	100
MCPA + dicamba	1 + .25	Weedar + Banvel	100	100	100	99	100	99
MCPA + dichlorprop	1 + 1	Weedar + A-287	100	100	98	91	99	95
AXF-1124	2	45% WP	0	12	70	-	-	-
AXF-1124	4	45% WP	5	9	91	0	16	1
DPX-4065	.125	80% WP	100	100	100	-	-	-
DPX-4065	.25	80% WP	99*	100*	100*	100*	100*	98*
DPX-4189	.125	80% WP	100	99	95	-	-	-
DPX-4189	.25	80% WP	99	100	100	93	82	53
Weed cover in check plots - at time of treatment			-	35%	15%	-	10%	17%
- at time of control			6%	39%	14%	11%	13%	23%

* Objectionable turf injury, 2.4 to 3.5 on scale of 0 to 10, 10 = brown.

TABLE 2. Effectiveness of spring and fall applied herbicides in controlling little starwort in lawn turf.

Treatment		Percent little starwort control [a]									
		Fall application					Spring application				
Herbicide	lb ai/A	1974	1975	1976	1977	1978	1975	1976	1977	1978	1979
2,4-D	1	46	25	52	16	23	3	28	13	60	75
2,4-D	1	59	-	-	-	31	-	-	-	84	79
dicamba	.25	-	-	98	-	-	-	-	-	93	87
mecoprop	1	-	-	94	-	-	-	-	-	90	81
dichlorprop	1	-	-	98	-	-	-	65	-	-	94
silvex	.5	-	-	94	-	-	-	-	-	75	-
triclopyr	1	-	-	97 b	-	-	-	-	-	-	-
2,4-D + dicamba	1 + .25	76	98	93	97	99	39	79	57	83	57
2,4-D + mecoprop	1 + 1	69	98	95	99	93	49	74	67	98	92
2,4-D + silvex	1 + .5	73	98	93	95	92	37	63	46	81	-
2,4-D + dichlorprop	1 + 1	-	-	93	88	94	-	79	49	96	95 b
2,4-D + triclopyr	1 + .75	-	-	-	95	-	-	-	85	-	-
2,4-D + triclopyr	1 + 1	-	-	94 b	-	-	-	95 b	-	-	-
2,4-D + mecoprop + dicamba	1 + .5 + .1	-	99	-	-	-	62	-	-	-	92
2,4-D + mecoprop + dicamba	1 + .5 + .125	-	-	93	99	99	55	74	40	85	92
2,4-D + silvex + dicamba	1 + .5 + .125	87	97	87	99	99	66	91	33	98 b	-
Weed cover in checks - at time of treatment		42%	43%	44%	55%	28%	61%	49%	58%	42%	38%
at time of control		42%	49%	31%	40%	35%	64%	50%	67%	19%	23%

a Estimates made 2 to 3 months following spring treatment and 7 to 8 months after fall treatment.

b Objectionable turf injury, 2.0 to 2.9 on a scale of 0 to 10, 10 = brown.

GRANULAR DICOT WEED CONTROL AND FERTILIZER INTERACTIONS IN TURFGRASS

H. E. Davis and J. F. Ahrens 1/

ABSTRACT

A granular fertilizer product containing 2,4-D (1.5 lb. ae/A) and mecoprop (1.5 lb. ae/A) and an inert carrier granular 2,4-D (1.5 lb. ae/A) and dicamba (0.25 lb. ae/A) product were applied to a poorly nourished weedy turf sward. The inert carrier product was applied with and without a separate 34-4-4 fertilizer application. Best control of dicot weeds was achieved when a fertilizer was applied at the same time as the inert carrier product or when the combination product was used. Better weed control resulted when the product was applied to wet turf and weed foliage than when applied to dry foliage. A single fall application of the inert carrier product gave more effective control of common dandelion than a single spring application (89% vs. 75%). Both fertilizer and dicot weed control applications increased turfgrass density from 40% at the start to 90% after two applications of the combination product. Turfgrass density in the untreated plots decreased to 15% during the same period.

INTRODUCTION

The chlorophenoxy herbicides and dicamba have been used to control dicot weeds in turfgrass for many years, both as liquid sprays or on granular fertilizer or inert carriers. The combination products on fertilizer carriers are widely used by homeowners and professionals because of their convenience and ease of application. This work is part of a continuing effort to define factors that influence the activity of these products and to test these products on different weeds and in different environments.

MATERIALS AND METHODS

Granular products containing 2,4-D (2,4-dichlorophenoxy acetic acid), mecoprop {2-[(4-chloro-o-tolyl) oxy] propionic acid} and dicamba (3,6-dichloro-o-anisic acid) were applied with a 21 inch drop spreader calibrated to deliver the correct amount of product per unit area. Two passes were made to treat an area 42 inches by 8 ft. The test site was located at Windsor, Connecticut, on an old turf sward. The soil was a Merrimac sandy loam pH 5.3 with 2.7% organic matter. The turfgrass sward had been maintained by mowing only for at least 10 years prior to this test. The site was infested with common dandelion (*Taraxacum officinale* Weber), white clover (*Trifolium repens* L.), yellow hawkweed (*Hieracium pratense* Tausch), annual fleabane [*Erigeron annus* (L.) Pers.] and silvery cinquefoil (Potentialla argentea L.). The turfgrass was predominantly red

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fescue (Festuca rubra L.) with some Kentucky bluegrass (Poa pratensis L.). The test was designed as a randomized complete block with four replications. The fertilizer application with the 2,4-D and dicamba formulation was made as a split plot with 21 inches fertilized and 21 inches left unfertilized. All data were analyzed by analysis of variance. All formulations used were produced by the O. M. Scott & Sons Company. The active ingredients and product names are listed in Table 1.

Table 1. Formulations used in test.

		Ingredients in Acid Equivalent					
		2,4-D		Dicamba		Mecoprop	
Product 1/	Carrier	%	lb./A	%	lb./A	%	lb./A
A	Vermiculite	2.95	1.5	0.48	0.25	-	-
B	32-4-4	1.1	1.5	-	-	1.1	1.5
C	34-4-4	-	-	-	-	-	-

Visual ratings were used to estimate percentage cover of each weed and of turfgrass before and at various intervals after treatment. Percent control of each weed was calculated from the data on percent cover in treated versus untreated plots. For wet foliage applications turf foliage was sprayed with H_2O to run off from a backpack sprayer prior to product application. Applications were made 9/25/79 and 5/27/80 in the early afternoon.

RESULTS AND DISCUSSION

Herbicides applied with fertilizer gave consistently better weed control than herbicides alone (Tables 2 and 3). Granular herbicide applications on wet foliage were more effective than those on dry foliage in the control of dandelion and white clover. However, yellow hawkweed and annual fleabane were controlled equally by applications on wet or dry foliage.

Fertilizer alone decreased the percent cover of certain weeds such as common dandelion, white clover, silvery cinquefoil and annual fleabane, but increased the percent cover of yellow hawkweed. This was probably caused by the increased competitiveness of the fertilized turfgrasses and hawkweed. Both fertilizer and herbicide treatments resulted in incresed turfgrass density, but combinations of fertilizer plus herbicide gave turf density greater than either alone. With two fertilizer and herbicide applications turf density was increased from less than 40% at the beginning of the test to over 80% at the end of the test, while in the untreated control turf density declined to 15%. A single application of 2,4-D and dicamba applied in the fall was more effective than a single spring application (Table 4). Common dandelion control was 91% in the fall and only 82% in the spring. Turfgrass density also increased more from a fall application than from a spring application. The fall application of fertilizer and dicot weed control products converted a poor, weedy turf sward into a good turf sward.

1/ A) Lawn Weed Control, B) Super Turf Builder Plus 2, C) Turf Builder

Table 2. Control of dicot weeds and turf density following a single fall application of dicot herbicides and fertilizer. Application made 9/25/79 at Windsor, Connecticut.

Rates Herbicide Lb. ae/A				Turf[2/]	Percent Weed Control[3/]								Percent Turf Density		
					Common Dandelion		White Clover		Hawkweed		Silvery Cinquefoil				
2,4-D	Mecoprop	Dicamba	Lb N/M[1/]	Foliage	10/24/79	5/27/80	10/24/79	5/27/80	10/24/79	5/27/80	10/24/79	5/27/80	9/25/79	10/24/79	5/27/80
1.5	1.5	-	1.0	Wet	93	100	100	100	97	100	98	100	39	73	85
1.5	1.5	-	1.0	Dry	73	87	96	100	97	100	98	98	36	66	81
1.5	-	0.25	+1.0	Wet	70	91	98	100	79	100	100	97	39	66	81
1.5	-	0.25	-	Wet	71	87	98	100	58	100	98	98	39	60	56
1.5	-	0.25	+1.0	Dry	75	72	96	100	76	100	89	92	38	63	78
1.5	-	0.25	-	Dry	87	70	89	93	63	100	97	87	38	36	60
Fertilizer Control			1.0	Dry	2	20	22	0	-100	-90	28	35	35	38	48
Untreated Control					-	-	-	-	-	-	-	-	36	33	41

1/ Pounds of nitrogen per 1,000 ft^2 using a 34-4-4 fertilizer either as the carrier with the 2,4-D, mecoprop formulation or as a separate application (+1.0).

2/ Turf and weed foliage either dry or artificially moistened (wet) using a backpack sprayer.

3/ Percent weed control as determined by percent weed coverage in treated plot versus percent weed cover in untreated check. Negative numbers indicate increased coverage over untreated check.

Table 3. Control of dicot weeds and turf density following applications of fertilizers and dicot herbicides on 9/25/79 and 5/27/80 at Windsor, Connecticut.

Rates Lb. ae/A							Percent Control										
						Turf	Common Dandelion		White Clover		Hawkweed		Silvery Cinquefoil		Turf Density		
2,4-D	Mecoprop	Dicamba	Lb N/M[1/]	Dates of Application		Foliage	7/21	8/19	7/21	8/19	7/21	8/19	7/21	8/19	5/27	7/21	8/19
1.5	1.5	-	1.0	9/25	5/27	Wet	100	100	100	100	100	100	100	100	85	86	90
1.5	1.5	-	1.0	9/25	5/27	Dry	91	83	97	96	100	100	100	100	81	86	84
1.5	-	0.25	1.0	9/25	5/27	Wet	99	99	100	100	100	100	100	100	81	81	83
1.5	-	0.25	-	9/25	5/27	Wet	96	91	100	100	100	100	100	100	56	64	55
1.5	-	0.25	1.0	9/25	5/27	Dry	84	79	100	100	100	100	99	100	77	81	79
1.5	-	0.25	-	9/25	5/27	Dry	78	69	100	100	100	100	91	100	60	63	53
1.5	-	0.25	1.0	5/27		Wet	94	82	100	100	100	100	99	100	45	69	73
1.5	-	0.25	-	5/27		Wet	90	68	100	100	84	75	100	100	45	48	50
Fertilized Control			1.0	9/25	5/27	Dry	33	48	77	77	-115	-60	22	56	48	50	35
Untreated Control			-	-		-	-	-	-	-	-	-	-	-	41	38	15

1/ Pounds of nitrogen per 1,000 ft^2 per application. Fertilizer used was in a 34-4-4 composed of urea, methylene ureas, monoammonium phosphate and potassium sulphate.

Table 4. Maximum percent weed control observed from wet foliage applied 2,4-D and Dicamba on vermulite applied in the spring or fall with and without a separate fertilizer application.

Rates lb. ae/A				Percent Weed Control				% Turf
2,4-D	Dicamba	Lb. N/M	Date of Application	Common Dandelion	Hawkweed	White Clover	Silvery Cinquefoil	Density
1.5	0.25	1	Fall	91	100	100	97	81
1.5	0.25	1	Spring	82	100	100	100	73
1.5	0.25	0	Fall	87	100	100	98	56
1.5	0.25	0	Spring	68	75	100	100	50

SUMMER CONTROL OF WHITE CLOVER USING LOW RATES OF 2,4-DP (OSA) IN COMBINATION WITH OTHER HERBICIDES[1/]

D.D. Minner and P.H. Dernoeden[2/]

ABSTRACT

Five herbicides were evaluated alone and in various combinations with very low concentrations of 2,4-DP (OSA). Data showed that a single application using low rates of 2,4-DP (OSA) in combination with reduced rates of 2,4 D (OSA and dimethylamine salt) plus dicamba and 2,4-D (OSA and dimethylamine salt) plus mecoprop provided good control of white clover (Trifolium repens L.). Best control was provided by dicamba at 1.0 lb ai/A rate and 2,4-D (OSA) plus 2,4-DP (OSA) plus mecoprop plus dicamba at 0.1 + 0.1 + 0.38 + 0.25 lb ai/A. The propylenediamine salt of 2,4-D at 0.75 or 1.50 lb ai/A gave excellent white clover control, but 2,4-D dimethylamine salt did not. Dicamba at 1.0 lb ai/A provided a significantly better level of control than dicamba at 0.5 lb ai/A and mecoprop at 0.75 and 1.0 lb ai/A.

INTRODUCTION

A common weed in drought stressed Kentucky bluegrass (Poa pratensis L.) turf is white clover. Used alone, 2,4-D (2,4 dichlorophenoxyacetic acid) does not adequately control white clover (1). A relatively new herbicide entering the market is 2,4 DP (oil soluable amine (OSA) of 2-(2,4-di-chlorophenoxy)propionic acid). The objective of this study was to determine what benefit, if any, could be achieved in controlling white clover using very low rates of 2,4-DP (OSA) in various combinations with reduced rates of 2,4-D, dicamba (2-methoxy-3,6,-di-chloro-benzoic acid), and mecoprop (2-(2-methyl-4-chlorophenoxy) propionic acid). An important parameter of this study was to determine the level of white clover control using a single, mid-summer application of herbicides.

MATERIALS AND METHODS

This experiment was conducted on a 2 year old 'Adelphi' Kentucky bluegrass stand grown on chillum loam soil at the University of Maryland Plant Research Farm. All materials were applied with a CO_2 pressurized back pack sprayer at 30 psi, using a dilution rate of 200 gal/A. The experimental design was a randomized complete block with three replications and individual plot size was 4 feet by 4 feet. The experimental area was heavily infested with white clover (Table 1).

Herbicides were applied on August 8, 1980, (sunny, 87°F) and data were collected on those dates appearing in Table 1. Percent white clover in plots, using a 0-100 percent scale, was determined by visual estimates.

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[1]The herbicides tested were 2,4-D (dimethylamine salt, N-oleyl-1-1,3-propylenediamine salt, and oil soluable amine of 2-(2,4-di-chloro-phenoxy)propionic acid), dicamba, and mecoprop. Rates used appear in Table 1.

RESULTS AND DISCUSSION

All herbicide treatments significantly reduced white clover cover when compared to the untreated control (Table 1). Best control was provided by dicamba at 1.0 lb ai/A, and by 2,4-D (OSA) + 2,4-DP (OSA) + mecoprop + dicamba at 0.1 + 0.1 + 0.38 + 0.25 lb ai/A. There was no significant difference between the aforementioned treatments and most other herbicide combinations containing 2,4-DP (OSA). Least effective in controlling white clover was 2,4-D (dimethylamine salt) used alone at both rates, 2,4 D (OSA and dimethylamine salt) + 2,4-P (OSA) at the lowest rates, and the low rate of 2,4-D (OSA) + 2,4-DP OSA) + mecoprop. Dicamba at 1.0 lb ai/A was more effective than mecoprop at 1.0 lb ai/A in controlling white clover. The propylenediamine salt of 2,4-D when used alone was superior to 2,4-D dimethylamine salt used alone. Also, there was no significant difference between the 0.75 and 1.50 lb ai/A rates of the propylenediamine salt.

Data collected on October 20 showed all treated plots, except 2,4-D (dimethylamine salt) alone and the lowest rates of 2,4-D + 2,4-DP (OSA) had significantly lower white clover percentages in comparison to the untreated control (Table 1). The percentage of white clover in untreated control plots had decreased from 65% on August 26 to 38% on October 20. The decrease in white clover was attributed to the return of cool, moist weather in autumn which favored growth of Kentucky bluegrass more than the growth of white clover. During the prolonged heat and drought stress of the summer, however, white clover had the competitive advantage.

CONCLUSIONS

Data showed that a single mid-summer application of herbicides using low rates of 2,4-DP (OSA) (0.1 or 0.2 lb ai/A) in combination with reduced rates of dicamba, 2,4-D (OSA and dimethylamine salt) and mecoprop provided good to excellent control of white clover. It was also revealed that the propylenediamine salt of 2,4-D used alone provided excellent white clover control, but the dimethylamine salt of 2,4-D did not.

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Table 1. Effectiveness of various herbicide mixtures for summer control of white clover in Kentucky bluegrass.

Treatment[3]	Rate	Percentage of Plot Area Covered by white Clover and Percent Control[2]				
		8/8[1]	8/26		10/20	
	(lb ai/A)	(%Cover)	(%Cover)	(%Control)	(%Cover)	(%Control)
2,4-D (Dimethylamine salt)	0.75	80	40.0b	38	21.0c	45
2,4-D (Dimethylamine salt)	1.50	76	30.0bc	54	12.0d	69
2,4-D (Propylenediamine salt)	0.75	62	3.6ef	94	1.6e	96
2,4-D (Propylenediamine salt)	1.50	56	4.0ef	94	0.3e	99
Dicamba	0.50	66	8.3e	87	0.0e	100
Dicamba	1.00	64	1.3f	98	0.0e	100
Mecoprop	0.75	84	18.3cde	72	2.6e	93
Mecoprop	1.50	74	18.3cde	72	0.6e	98
2,4-D (OSA) + 2,4-DP (OSA)	0.20 + 0.20	80	40.0b	38	15.0cd	61
2,4-D (OSA) + 2,4-DP (OSA)	0.40 + 0.40	72	10.6ef	84	0.3e	99
2,4-D (Dimethylamine salt) + 2,4-D (OSA) + 2,4-DP (OSA)	0.40+0.1+0.1	78	40.0b	38	31.0b	19
2,4-D (Dimethylamine salt) + 2,4-D (OSA) +2,4-DP (OSA)	0.8 + 0.2 + 0.2	70	14.0cdef	78	2.3e	94
2,4-D (OSA) + 2,4-DP (OSA) + dicamba	0.1+0.1+0.25	72	13.3def	79	2.3e	94
2,4-D (OSA) + 2,4-DP (OSA) + dicamba	0.2+0.2+0.5	82	9.0ef	86	0.0e	100
2,4-D (OSA) + 2,4-DP(OSA) + mecoprop	0.10+0.10+0.38	66	29.0bcd	55	0.6e	98
2,4-D (OSA) + 2,4-DP (OSA) + mecoprop	0.2 + 0.2 + 0.75	68	7.3ef	89	1.0e	97
2,4-D (OSA) + 2,4-DP (OSA) + mecoprop + dicamba	0.1+0.1+0.38+0.25	64	0.7f	99	0.0e	100
2,4-D (OSA) + 2,4-DP + mecoprop + dicamba	0.2+0.2+0.75+0.5	68	4.0ef	94	0.0e	100
Control		80	65.0a		33.3a	--
LSD 5%			16.4		7.1	

[1]There was no significant difference between percent plot area colonized by white clover in treatment plots prior to application of herbicides.
[2]Means followed by the same letter in the same column are not significantly different at the 5% level according to LSD multiple comparison test.
[3]Herbicides were applied on August 8, 1980.

PROSTRATE SPURGE CONTROL IN TURFGRASS USING HERBICIDES

J. A. Jagschitz [1]

ABSTRACT

Trials were initiated from 1978 to 1980 to evaluate pre- and post-emergent herbicides for the selective control of prostrate spurge in bentgrass lawn and putting green areas. The tolerance of several cool season grasses to selected postemergent herbicides was also investigated. Effectiveness of treatments was based on percent spurge control and turfgrass injury. Of seven preemergent herbicides tested DCPA provided the best results. Siduron provided some spurge control while oxadiazon injured velvet bentgrass in a putting green area. No antagonistic effects were noted from combination pre- and post-emergent treatments in putting green turf. The most effective postemergent herbicide with the least potential for bentgrass injury was bromoxynil. There was some variability in the results of other post-treatments from one test to another. The combination of 2,4-D plus mecoprop provided more consistant results than that of 2,4-D plus either dicamba or dichlorprop. The experimental material DPX-4189 appeared more promising for spurge control with safety to the grass than did DPX-4065. Kentucky bluegrass, red fescue and several bentgrasses were found to be tolerant to DPX-4189 and especially to bromoxynil.

INTRODUCTION

Prostrate spurge (Euphorbia supina Raf.) is a troublesome annual weed which becomes very obvious in lawns and putting greens during July and August. Few herbicides are effective for the selective control of spurge in cool season turfgrasses. Putting green bentgrasses and grasses growing under summer stress conditions are usually less tolerant to these herbicides. Herbicides that are more effective and safer to the turf are needed. Silvex [2-(2,4,5-trichlorophenoxy)propionic acid] has been one of the most effective postemergent herbicides for spurge control (4,6). Since silvex is presently banned from use a substitute herbicide is needed and especially one which will not injure bentgrasses.

Recent studies have revealed new and various combinations of postemergent herbicides that will control other broadleaf weeds (1,3,5). Good spurge control has been obtained with bromoxynil (3,5-dibromo-4-hydroxybenzonitrile) on the west coast (2). Preemergent herbicides, such as DCPA (dimethyl tetrachloroterephthalate) and siduron [1-(2-methylcyclohexyl)-3-phenylurea], have shown some promise for spurge control (2,7). Six tests were initiated to evaluate these pre- and post-emergent herbicides and some newer materials in bentgrass lawns and putting greens. One test studied the interaction of pre- and post-emergent herbicides and another investigated the tolerance of grass species to bromoxynil and DPX-4189.

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MATERIALS AND METHODS

Five spurge control studies were initiated from 1978 to 1980. Two tests were in lawn areas and three in putting green areas. A sixth study dealing with the tolerance of several grass species was in three separate lawn areas and a putting green area. Four of the studies used postemergent treatments, one used preemergent treatments and one combined pre and postemergent treatments. The herbicides, rates, dates of application, test locations and grass species are shown in Tables 1 to 5. Herbicides were applied to plots measuring 4 by 4 feet in size (putting green tolerance test, 3 by 4.5 feet) and replicated three to five times. In the combination pre- and post-study the design was split-plot with the main plots receiving the pre treatments (4 by 28 feet) and sub-plots the post treatments. Postemergent herbicides were applied as sprays at the rate of 50 gallons of water per acre (gpa). All preemergent herbicides were applied as granular materials except for sprays (86 gpa) of bensulide, DCPA, prosulfalin and siduron in the 1978 test. Spurge plants at the time of treatment in July and August measured more than 1.5 inches across while those treated in June were less than one inch in size. Spurge control in the 1978 pre and the 1980 combination pre- and post-emergent trial was determined by comparing percent spurge cover in treated plots to that of the untreated plots. In the other trials initial estimates of spurge cover in each plot were made at the time of treatment. Percent control was calculated by comparing the initial and final spurge cover adjusted to changes taking place in the untreated plots. Dates of control for each trial are shown in the tables. Turfgrass injury readings were taken periodically throughout all tests. The visual scale used was 0 to 10 with 10 being brown or dead turf. A reading of 2.0 could be considered objectionable.

RESULTS AND DISCUSSION

Preemergent control

Spurge control estimates from preemergent herbicides applied to lawn turf in 1978 are shown in Table 1. Turfgrass injury data was not recorded because the lawn contained mostly weeds. Of the seven materials tested, DCPA provided the most promising control. The treated plants were stunted and small in size. DCPA resulted in 72% control while the following provided control of 28% or less: benefin, bensulide, butralin, oxadiazon, prosulfalin and siduron.

Grass injury and spurge control from five preemergent herbicides applied in 1980 to a 'Kingstown' velvet bentgrass putting green are presented in Table 3. The data indicates that DCPA provided excellent control (90-100%) and siduron gave good control (80-89%) without objectionable bentgrass injury (2.0 or greater). Control was poor (60% or less) with benefin, bensulide and oxadiazon. The latter caused considerable bentgrass injury (4.0). Excellent results were obtained from the combinations of siduron as the preemergent material with either 2,4-D (.5 lb rate) or bromoxynil (.5 lb rate) as the postemergent material. Control was higher than that obtained with either material alone. The 2,4-D plus siduron combination did not cause objectionable grass injury, however, 2,4-D applied alone or with some of the other preemergent materials did cause objectionable bentgrass injury. The probability of grass injury with 2,4-D appears greater than that if bromoxynil is used. No

TABLE 1. Preemergent control of prostrate spurge in lawn turf treated with herbicides in 1978.

Preemergent June 1		Percent Spurge Control
Herbicide	lb ai/A	Aug 2
benefin	3	4
bensulide	12	10
butralin	4	10
DCPA	12	72
oxadiazon	4	0
prosulfalin	2	0
siduron	12	28

Spurge cover in untreated plots = 25 percent

TABLE 2. Control of prostrate spurge and injury to a Penncross creeping bentgrass putting green treated with postemergent herbicides in 1978.

Postemergent August 10		Percent Spurge Control Sept 11	Maximum[a] Bentgrass Injury
Herbicide	lb ai/A		
2,4-D + dicamba	.5 + .125	87	.7
2,4-D + dichlorprop	.5 + .5	98	2.3
2,4-D + mecoprop	.5 + .5	88	1.1
2,4-D + silvex	.5 + .25	97	1.0
2,4-D + DSMA	.5 + 1.8	70	.9
dicamba + mecoprop	.25 + .5	56	.8
2,4-D + dicamba + mecoprop	.5 + .063 + .25	76	1.3
2,4-D + dicamba + silvex	.5 + .063 + .25	98	1.7
picloram	.25	92	.8

Spurge cover in untreated plots = 18 percent

a Scale 0 to 10 (10 = brown) August through September

TABLE 3. Prostrate spurge control on July 23 in a Kingstown velvet bentgrass putting green treated with pre- and post-emergent herbicides in 1980.

		Percent Spurge Control						
		Postemergent Herbicide - lb ai/Acre - June 24						
Preemergent May 15		2,4-D	2,4-D + mecoprop	2,4-D + dicamba	2,4-D + dichlorprop	bromoxynil	bromoxynil	
Herbicide	lb ai/A	.5 lb	.5 + 1 lb	.5 + .25 lb	.5 + .5 lb	.5 lb	1.0 lb	none
benefin	2.1	61	87 **	82 **	87 **	74	94	58
bensulide	10.9	80 **	88 **	64 **	63 **	63	89	32
DCPA	12.3	99	100 **	99 **	96 **	99	99	98
oxadiazon	2.3	80 * **	87 * **	79 * **	94 * **	94 *	97 *	58 *
siduron	15.4	91	95 **	90 **	96 **	95	99	83
none	-	56 **	92 **	59 **	61 **	30	90	0

Spurge cover in untreated plots = 28 percent

* Objectionable grass injury after preemergent herbicide, 4.0 on scale 0 to 10, 10 = brown

** Objectionable grass injury after postemergent herbicide application, 2.0 to 4.5

antagonistic effects were observed from the pre- and post-emergent treatments.

Postemergent control

The results of postemergent herbicides applied in 1978 and 1980 in a bentgrass lawn and three bentgrass putting greens are shown in Tables 2, 3 and 4. The herbicide rates used in the putting green studies were about half those suggested for use in lawn areas or on other cool season grasses. This was an attempt to avoid grass injury with the hope that spurge control would be adequate. There was some variability in the results from one test to another. This was reflected in the degree of control and/or grass injury. Good to excellent spurge control was obtained with the combination of 2,4-D plus mecoprop (.5 + .5 or .5 + 1 lb rate). However, in one of the trials bentgrass injury was objectionable. Combinations of 2,4-D with either dicamba or dichlorprop did not provide consistent control and at times produced objectionable bentgrass injury. There appeared to be a greater potential for bentgrass injury with the dichlorprop combination. When these three combinations were used in the bentgrass lawn trial (Table 4) the 2,4-D plus dichlorprop combination was the most effective. None of the three combinations caused objectionable injury.

The most effective herbicide for postemergent spurge control with the least potential for causing bentgrass injury was bromoxynil. The .5 lb rate of bromoxynil was inadequate and the optimum rate appears to be 1 to 2 pounds. The addition of dicamba or mecoprop to the 1 lb rate of bromoxynil improved spurge control but in the lawn trial (Table 4) the 2 lb rate of bromoxynil was more effective than these combinations.

The experimental materials, DPX-4065 and DPX-4189, provided excellent spurge control in the bentgrass lawn area trial. The DPX-4189 material appears the most promising since DPX-4065 caused very severe bentgrass injury. The latter should be investigated at lower rates in an attempt to avoid grass injury.

Grass tolerance study

Since bromoxynil and DPX-4189 were found to be promising herbicides for the control of spurge studies were initiated to determine the tolerance of various grass species to these materials. The lawn grasses studied were 'Touchdown' Kentucky bluegrass, 'Jamestown' red fescue and 'Exeter' colonial bentgrass and the putting green bentgrasses studied were 'Kingstown' velvet, 'Penncross' creeping and 'Emerald' creeping. The results of these studies are presented in Table 5. All grass species were tolerant of bromoxynil at the 4 lb rate which could be considered as two to four times the rate required for spurge control. There appears to be a good margin of safety with bromoxynil. All grass species were tolerant of DPX-4189 at the .5 lb rate with the bentgrasses appearing the most tolerant. The 1 lb rate of DPX-4189 caused objectionable injury to red fescue. The combination of 2,4-D + mecoprop + dicamba was safe on Kentucky bluegrass and red fescue but caused objectionable injury to the bentgrasses.

TABLE 4. Postemergent control of prostrate spurge and injury to bentgrass in a putting green (Kingstown velvet) and lawn area (Exeter colonial) treated with herbicides in 1980.

Postemergent - Green July 24, Lawn Aug 6		Putting Green		Lawn Area	
Herbicide	lb ai/A	% Spurge Control Sept 10	Maximum* Bentgrass Injury	% Spurge Control Sept 18	Maximum* Bentgrass Injury
2,4-D	1	-	-	36	.3
bromoxynil	.5	67	.0	-	-
bromoxynil	1	92	.0	30	.2
bromoxynil	2	99	.3	99	.1
bromoxynil + dicamba	1 + .25	98	.0	69	.0
bromoxynil + mecoprop	1 + 1	99	.0	75	.7
2,4-D + dicamba	.5 + .25	65	1.2	32	.2
2,4-D + dicamba	1 + .25	-	-	47	.8
2,4-D + mecoprop	.5 + 1	80	.9	36	.9
2,4-D + mecoprop	1 + 1	-	-	45	1.0
2,4-D + dichlorprop	.5 + .5	72	.4	47	.1
2,4-D + dichlorprop	1 + 1	-	-	97	.2
2,4-D + dicamba + mecoprop	.25 + .1 + .75	76	.1	-	-
2,4-D + dicamba + mecoprop	1 + .125 + .5	-	-	48	.7
DPX-4065	.5	-	-	96	8.8
DPX-4189	.5	-	-	99	.7
Spurge cover in check plots -	at treatment	11	-	3	-
	at control	19	-	3	-

* Scale 0 to 10 (10 = brown) July through September

TABLE 5. Tolerance of various turfgrasses to herbicides applied on August 28, 1980.

Postemergent		Maximum Turfgrass Injury *			
Herbicide	lb ai/A	Kentucky bluegrass	Red fescue	Colonial bentgrass	Putting Green** bentgrasses
Bromoxynil	2	.1	1.1	.0	.5
Bromoxynil	4	.8	1.4	.7	1.1
DPX-4189	.5	1.5	1.8	.5	.5
DPX-4189	1	1.1	2.4	.7	.0
2,4-D + mecoprop + dicamba	1 + .5 + .125	.5	.5	2.0	3.2

* Scale 0 to 10 (10 = brown) August through October

** Kingstown velvet, Penncross and Emerald creeping bentgrass

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SINGLE VERSUS REPEAT APPLICATION OF VARIOUS PREEMERGENT HERBICIDES FOR CRABGRASS CONTROL[1/]

P.H. Dernoeden and J.K. Mathias[2/]

ABSTRACT

Efficacy of a single application of bensulide 4EC, benefin 2.5G, DCPA 5G and 75 WP, oxadiazon 2G and siduron 50 WP, at recommended rates was compared to reapplication of herbicides using half rate and recommended rate. Seedling counts showed that most crabgrass (Digitaria ischaemum (Schreb.)Muhl.) seed in the plots had germinated during April and May, but germination continued to a lesser extent throughout summer. All bensulide and oxadiazon treatments and reapplication treatments of DCPA had provided excellent, season-long crabgrass control. No benefit was achieved by reapplication of bensulide or oxadiazon. A single application of benefin and siduron exhibited deterioration of residual efficacy by late July. Retreated benefin (2+1 lb ai/A), and siduron (12+6 lb and 12+12 lb ai/A) plots exhibited unacceptable levels of control by mid-August. A single application of DCPA 5G and 75W maintained acceptable levels of control until early September. No discoloration or phytotoxicity was observed from any herbicide on perennial ryegrass.

INTRODUCTION

Maryland is located in the geographical region of the U.S. known as the transition zone (2). Although crabgrass, (Digitaria ischaemum (Schreb.) Muhl. and Digitaria sanguinalis (L.) Scop.) is widely distributed throughout the U.S. it is a more serious problem in the transition zone than elsewhere (2).

Research in the northeastern U.S. has shown that preemergence herbicides are very effective in controlling crabgrass (1,3,4,5). In the southeastern portion of Maryland, however, the growing season is longer and emergence of crabgrass is much earlier than in more northern regions. In Pennsylvania (5) and Rhode Island (1) crabgrass emergence was observed during mid to late May in 1979. In Maryland, emergence of crabgrass was first noted in late March, 1980. Crabgrass, therefore, is likely to emerge 4-6 weeks earlier in southern Maryland than in central Pennsylvania or Rhode Island.

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Despite previous testing, more information is needed to determine the season long efficacy of preemergence herbicides for crabgrass control in southern Maryland. In this investigation a single application of commercially available herbicides at recommended rates was compared to a reapplication of herbicides at half and full rates for crabgrass control.

MATERIALS AND METHODS

Herbicides were tested in 1980 at the University of Maryland Plant Research Farm on a three year old stand of 'Citation' perennial ryegrass, Lolium perenne L., exhibiting poor density. The statistical design was a completely randomized block with three replications and plot size was 5 ft x 5 ft.

The herbicides tested were: bensulide (S-(O,O-diisopropyl phosphorodithioate of N-(2-mercaptoethyl)benzenesulfonamide) 4EC, benefin (N-butylN-ethyl-a,a,a-trifloro-2,6-dinitro-p-toluidine 2.5G, DCPA (dimethyl tetrachloroterephthalate) 5G and 75 WP, oxadiazon ((2-tert-butyl-4-(2,4, dichloro-5-isopropoxyphenyl-Δ^2 -1,3,4-oxadiazolin-5-one)) 2G, and siduron ((1-(2-methylcyclohexyl) -3-phenylurea)) 50WP.

All herbicides were initially applied on April 4, 1980. Those plots receiving a second application were retreated on May 21,1980. Sprayable materials were applied with a CO_2 powered, single nozzle boom sprayer with 40 psi and a dilution rate of 100 gallons of water per acre. Granular materials were applied by hand. The plot area was irrigated with approximately one inch of water immediately following application of herbicides. Plots were irrigated on four occasions during July and August to prevent drought injury. Turf was maintained at a one inch cutting height until July at which time it was increased to 1.5 inches. Germination of crabgrass, (D. ischaemum) was first noted in the plot area on April 18.

Data appearing in Table 1 (number of seedlings per 4 square inches) were obtained by randomly dropping a 2 inch x 2 inch template three times into a thinned area of each plot and counting the number of seedlings within the grid. Once crabgrass plants had developed beyond the 3-4 leaf stage, the percent plot area colonized by crabgrass could be visually estimated (Table 2). All data were statistically analyzed using the analysis of variance and means were separated using the LSD multiple comparison test, 5% level. The acceptable level of control was considered to be 90% -100% (5).

RESULTS AND DISCUSSION

All herbicide treatments provided significantly lower crabgrass infestation when compared to the untreated check plots (Tables 1,2). There was, however, wide variation among treatments when the acceptable level of control parameter (90-100%) was taken into consideration.

Crabgrass seedling populations did not increase appreciably between June 11 and July 9 indicating that most germination of

crabgrass seeds had occurred during April and May, 1980 (Table 1). The data show, however, that some crabgrass seed germinated between July and September (Table 2). Few, if any, crabgrass seeds germinated in plots treated with bensulide, DCPA (5G and 75WP) or oxadiazon by July 9. At that time, the benefin 2 lb and 2 + 1 lb ai/A treatments had significantly more seedlings than bensulide, DCPA (5G and 75WP), and oxadiazon treatments, but did not significantly differ from benefin 2 + 2 lb ai/A and siduron treatments (Table 1).

On July 24 benefin 2 lb (84% control) and 2 + 1 lb ai/A (75% control), and siduron 12 lb ai/A (74% control) treated plots had significantly higher crabgrass infestations than all other herbicide treatments (Table 2). Furthermore, percent control of aforementioned treatments had fallen below an acceptable level. By August 15 siduron 12 + 6 lb (85% control) and 12 + 12 lb ai/A (86% control) treated plots had an unacceptable control level.

Data recorded on September 2 showed that benefin 2 + 2 lb ai/A (75% control), DCPA 5G 10 lb (79% control) and 10 + 5 lb ai/A (86% control), and DCPA 75 WP 10 lb ai/A (87% control) treated plots had entered the unacceptable range. These treatments did not, however, significantly differ in percent plot area colonized by crabgrass from other treatments within the acceptable level of control range (Table 2).

By September 29 it was observed that all bensulide and oxadiazon treatments and DCPA 5G (10 + 10 lb ai/A) and DCPA 75 WP (10.5 + 5.2 lb and 10.5 + 10.5 lb ai/A) treatments had provided outstanding, season long control of crabgrass. Benefin 2 + 2 lb ai/A (79% control), DCPA 5G 10 lb (80% control) and 10 + 5 lb ai/A (85% control), DCPA 75 WP 10.5 lb ai/A (81 % control) treatments did not significantly differ in percent plot area colonized by crabgrass from aforementioned outstanding treatments, but percent control data for these treatements were not within the acceptable range (Table 2).

Data showed that no benefit was achieved by a reapplication of bensulide or oxadiazon at either rate (Table 2). There were no significant differences observed between the granular and wettable powder formulations of DCPA; however, DCPA 75WP tended to provide better control. It was also shown that a reapplication of DCPA at 5 lb ai/A was needed to provide an acceptable level of season long control of crabgrass in Maryland during 1980. It is likely that a single application of DCPA 75WP or 5G, at the 10-10.5 lb ai/A rates, would have provided excellent season long control in more northern regions where crabgrass germinates 4-6 weeks earlier than in Maryland. It is also likely, however, that residual efficacy of bensulide, oxadiazon and DCPA was prolonged due to infrequent and low rainfall levels during the summer and fall of 1980 in Maryland. No discoloration or phytotoxicity was observed in perennial ryegrass plots treated with preemergent herbicides.

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Table 1. The effect of preemergent herbicides on crabgrass seedling counts. Data were obtained on three dates.

	Rate	Application Date(s)	Mean Number of Crabgrass Seedlings Per Four Square Inches[1,2] 5/20	6/11	7/9
	(lbs ai/A)				
Bensulide 4EC	7.6	4/2	0.0c	0.0c	0.0d
Bensulide 4EC	7.6 + 3.8	4/2; 5/21	0.0c	0.0c	0.0d
Bensulide 4EC	7.6 + 7.6	4/2, 5/21	0.0c	0.0c	0.0d
Benefin 2.5G	2	4/2	0.6bc	0.3bc	1.1b
Benefin 2.5G	2 + 1	4/2, 5/21	0.1c	0.9b	1.0bc
Benefin 2.5G	2 + 2	4/2, 5/21	0.3bc	0.9b	0.7bcd
DCPA 5G	10	4/2	0.9b	0.2bc	0.2d
DCPA 5G	10 + 5	4/2, 5/21	0.2bc	0.1bc	0.1d
DCPA 5G	10 + 10	4/2, 5/21	0.2bc	0.1bc	0.0d
DCPA 75WP	10.5	4/2	0.0c	0.1bc	0.2d
DCPA 75WP	10.5 + 5.2	4/2, 5/21	0.0c	0.0c	0.0d
DCPA 75WP	10.5 + 10.5	4/2, 5/21	0.0c	0.0c	0.0d
Oxadiazon 2G	4	4/2	0.0c	0.0c	0.0d
Oxadiazon 2G	4 + 2	4/2, 5/21	0.0c	0.0c	0.0d
Oxadiazon 2G	4 + 4	4/2, 5/21	0.0c	0.0c	0.0d
Siduron 50WP	12	4/2	0.0c	0.0c	0.7bcd
Siduron 50WP	12 + 6	4/2, 5/21	0.0c	0.3b	0.3cd
Siduron 50WP	12 + 12	4/2, 5/21	0.0c	0.3b	0.3cd
Check	---	---	1.8a	2.6a	2.7a
LSD 5%	---	---	0.8	0.8	0.7

[1]Means followed by the same letter in the same column are not significantly different at the 5% level according to LSD multiple comparison test.
[2]Crabgrass seedling counts were determined by dropping a 2 inch x 2 inch template three times per plot at random and counting the number of seedlings within the grid.

Table 2. The effect of preemergent herbicides on the mean percent plot area covered by crabgrass and percent control of crabgrass determined by visual estimates on four dates.

	Rate	Application Date(s)	Percentage of Plot Area Covered by Crabgrass and Percent Control[1]							
			7/24		8/15		9/2		9/29	
			% Cover	% Control	% Cover	% Control	% Cover	% Control	% Cover	% Control
	(lb ai/A)									
Bensulide 4EC	7.6	4/2	0.0c	100	0.2c	99	1.4d	98	2.0cd	98
Bensulide 4EC	7.6 + 3.8	4/2, 5/21	0.0c	100	0.0c	100	0.4d	99	0.4cd	99
Bensulide 4EC	7.6 + 7.6	4/2, 5/21	0.2c	99	1.3c	98	2.9cd	97	2.9cd	97
Benefin 2.5G	2	4/2	3.3b	84	30.0b	64	55.0b	41	55.0b	43
Benefin 2.5G	2 + 1	4/2, 5/21	5.0b	75	41.7b	49	61.7b	33	63.3b	34
Benefin 2.5G	2 + 2	4/2, 5/21	0.8c	96	8.0c	90	22.3c	76	20.3c	79
DCPA 5G	10	4/2	0.8c	96	6.0c	93	19.3cd	79	19.3cd	80
DCPA 5G	10 + 5	4/2, 5/21	0.2c	99	4.3c	95	13.3cd	86	14.7cd	85
DCPA 5G	10 + 10	4/2, 5/21	0.0c	100	0.3c	99	1.7cd	98	3.3cd	97
DCPA 75WP	10.5	4/2	0.5c	98	2.4c	97	12.3cd	87	18.0cd	81
DCPA 75WP	10.5 + 5.2	4/2, 5/21	0.1c	99	1.7c	98	4.3cd	95	7.2cd	92
DCPA 75WP	10.5 + 10.5	4/2, 5/21	0.0c	100	0.7c	99	2.0cd	98	4.8cd	95
Oxadiazon 2G	4	4/2	0.0c	100	0.3c	99	1.2cd	99	0.5cd	99
Oxadiazon 2G	4 + 2	4/2, 5/21	0.0c	100	0.0c	100	0.0d	100	0.2cd	99
Oxadiazon 2G	4 + 4	4/2, 5/21	0.0c	100	0.0c	100	0.1d	99	0.1d	99
Siduron 50WP	12	4/2	5.3b	74	39.3b	53	63.3b	33	65.0b	32
Siduron 50WP	12 + 6	4/2, 5/21	1.5c	92	14.0b	83	46.7b	50	51.7b	46
Siduron 50WP	12 + 12	4/2, 5/21	1.0c	95	12.0b	86	31.7bc	66	31.7c	66
Check	---	---	20.0a	--	83.3a	--	93.3a	--	96.3a	--
LSD 5%	---	---	3.4		18.2		21.5		19.2	

[1]Means followed by the same letter in the same column are not significantly different at the 5% level according to LSD multiple comparison test.

PREEMERGENCE CONTROL OF CRABGRASS IN 1979 AND 1980

T. L. Watschke and M. S. Welterlen[1/]

ABSTRACT

Experiments were conducted on established turfgrasses to assess commercial and experimental herbicides for preemergence control of smooth crabgrass [Digitaria ischaemum (Schreb.) Muhl.]. In both 1979 and 1980, the efficacy of different rates and formulations were assessed by rating control and injury. In the 1979 experiment using 90% control as being acceptable, both rates of prosulfalin and pendimethalin, the high rate of siduron (13.44 kg/ha), both formulations of DCPA at 11.76 kg/ha, and one source of benefin at 2.24 kg/ha provided acceptable control in Kentucky bluegrass (Poa pratensis L.). None of the treatments caused significant injury to Kentucky bluegrass. All treatments except the 5.6 and 6.72 kg/ha rates of bensulide (4E) provided acceptable control of smooth crabgrass in creeping red fescue turf. Both formulations of DCPA and both sources of benefin caused 13-28% injury of creeping red fescue. In 1980 on Kentucky bluegrass, prosulfalin (2.24 kg/ha), DCPA (11.76 kg/ha), pendimethalin (2.24 and 3.36 kg/ha), and benefin (2.24 kg/ha) provided acceptable control. Alachlor, bensulide 4E, 3.6G, and in combination with napropamide or on a 10-6-4 fertilizer, and the 20/60 sieve size benefin did not provide greater than 90% control. As in 1979, none of the herbicide treatments caused injury to Kentucky bluegrass. Benefin, DCPA, prosulfalin, pendimethalin, and the bensulide plus napropamide combination (5.60 + 2.24 kg/ha) provided acceptable control in creeping red fescue. Both formulations of DCPA, benefin, and the high rate of alachlor (6.72 kg/ha) caused injury to the fine fescue. The severity caused by DCPA and benefin was not as great as in 1979. During both years, the wettable formulation of DCPA caused more injury than the granular. The granular formulation of bensulide provided less control at all rates in 1980 compared to 1979.

INTRODUCTION

Control of smooth crabgrass can be effectively achieved with commercially available preemergence herbicides. However, it is necessary to routinely compare these commercial materials with promising experimental compounds and new formulations of old materials (1, 2, 3, 4). The information gained from these comparisons provides industry with part of the efficacy data they need for the release of new materials and helps extension personnel develop recommendations for consumers.

The objective of this research was to assess different formulations and rates of commercial and experimental herbicides for the preemergence control of smooth crabgrass in Kentucky bluegrass and creeping red fescue.

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MATERIALS AND METHODS

This research was conducted at The Joseph Valentine Turfgrass Research Center, The Pennsylvania State University. In 1979, herbicides were applied on May 4 and supplemental irrigation was applied when needed during the season to relieve moisture stress. Germination was first noted on May 10, but significant germination did not occur until later in the month. In 1980, herbicides were applied on May 3 and the first irrigation was required five days later. Irrigation was required periodically throughout the season as rainfall was well below normal. On May 23, 22-12-12 fertilizer equivalent to 1.07 kg N/100 m^2 was applied. The turf was maintain at a 3.2 cm cutting height.

In both years, the crabgrass stand varied from 50 to nearly 100% across the site. Consequently, the experiment was designed with two replications of each herbicide treatment on each grass with an untreated control plot adjacent to each plot. This design facilitated rating by compensating for the varied crabgrass stand.

Sprayed materials were applied to 0.9 x 7.4 m plots with a hand held boom sprayer calibrated to deliver 425 L/ha. Granular formulations were applied to 0.9 x 1.8 m plots with a shaker bottle.

The materials used both years were; DCPA (dimethyl tetrachloroterephthalate) 5G and 75W, prosulfalain (N-[[4-(dipropylamino)-3,5-dinitrophenyl] sulfonyl]-S,S-dimethylsulfilimine) 50W, bensulide (0,0-diisopropyl phosphorodithioate S-ester with N-(2-mercaptoethyl)benzenesulfonamide 3.6G and 4E, benefin (N-butyl-N-ethyl-α,α,α-trifluoro-2,6-dinitro-p-toluidine) 2.5G, pendimethalin N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine. The only material applied in 1979 that was not applied in 1980 was siduron 1-(2-methylcyclohexyl)-3-phenylurea. In 1980, alachlor 2-chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide was added as a treatment and napropamide 2-(α-naphthoxy)-N,N-diethylpropionamide was used in combination with bensulide. Application rates and dates appear in Tables 1 and 2. In 1979, control and injury were rated on August 21 and in 1980 the ratings were made on August 5.

RESULTS AND DISCUSSION

1979 Experiment

Prosulfalin 50W provided excellent control of crabgrass at both rates (2.24 and 2.8 kg/ha) (Table 1). However, at the high rate Kentucky bluegrass was thinned. Injury to Kentucky bluegrass from prosulfalin applications has been previously reported (2).

DCPA control from both formulations was excellent, but creeping red fescue was thinned with the wettable formulation causing slightly more injury than the granular.

Good control of crabgrass occurred from siduron applications at the recommended rate (13.44 kg/ha). The lower rate (11.2 kg/ha) provided better control in creeping red fescue than in Kentucky bluegrass. Neither rate injured turf.

Both sources of benefin provided good to excellent control. The LC source had slightly better efficacy, but caused more injury to the creeping red fescue than the EL source.

The lower than recommended rates of bensulide (5.6 and 6.72 kg/ha) were more effective when applied in the liquid rather than granular form. However, regardless of formulation the 8.4 kg/ha rate appeared to be the minimum rate for acceptable efficacy. Injury to turf was insignificant from either formulation at any rate.

Pendimethalin provided excellent control from both rates on both turfgrass species without causing injury.

1980 Experiment

Prosulfalin provided excellent control of crabgrass in both turfgrass species and caused only slight injury to Kentucky bluegrass (Table 2). Although this material has provided excellent control in a number of experiments, the manufacturer has decided for other reasons to discontinue further testing.

Both formulations of DCPA provided excellent control with less injury on creeping red fescue than reported for the 1979 experiment. The season of 1980 was significantly drier than 1979 which undoubtedly had an effect on the release rate of DCPA.

Both sources of benefin provided good to excellent control with the LC source having slightly better efficacy as was also reported for 1979. Injury to creeping red fescue from benefin applications occurred but was less severe than in 1979. The 20/60 granule size of the EL source had slightly lower efficacy on Kentucky bluegrass than the commercial source but injury to creeping red fescue was reduced.

The 4E formulation of bensulide provided superior control of crabgrass compared to the 3.6G on both turfgrasses with only slight injury to the fescue. The granular formulation had much better efficacy at all rates in 1979 compared to 1980. Rainfall was much more abundant during 1979 than 1980. In most instances, however, wetter years usually result in reduced control. In 1980, sufficient moisture may have been present for early germination but the drier weather that followed may have slowed the release of less soluble materials. When bensulide was combined with napropamide, good to excellent control resulted at the higher rate of napropamide (2.24 kg/ha). This combination provided acceptable control at a bensulide rate (5.6kg/ha) that did not provide good efficacy when used alone.

Pendimethalin provided excellent control from both rates on both turfgrasses species without causing injury.

Alachlor did not provide acceptable control of crabgrass in either turfgrass. Control was considerably better when applied to creeping red fescue, but at the high rate (6.72 kg/ha) there was minor injury to the fescue.

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Table 1. Control and injury ratings for herbicides applied to Kentucky bluegrass and creeping red fescue for the preemergence control of smooth crabgrass. Herbicides were applied May 4 and rated for control on August 21, 1979.

Treatment	Formulation	Rate kg ai/ha	% Crabgrass Control		% Injury[a]	
			KBG	CRF	KBG	CRF
Prosulfalin	50W	2.24	95	99	SL	0
Prosulfalin	50W	2.80	93	98	8	0
DCPA	75W	11.76	98	99	0	18
DCPA	5G	11.76	97	99	0	15
Siduron	50W	11.20	83	93	0	0
Siduron	50W	13.44	90	90	0	0
Benefin (EL)[b]	2.5G	2.24	85	90	5	13
Benefin (LC)[c]	2.5G	2.24	90	99	SL	28
Bensulide	4E	5.60	80	90	0	SL
Bensulide	4E	6.72	80	90	0	SL
Bensulide	4E	8.40	84	94	0	SL
Bensulide	3.6G	5.60	78	55	0	0
Bensulide	3.6G	6.72	80	78	0	SL
Bensulide	3.6G	8.40	80	97	0	0
Pendimethalin	10G	2.24	97	97	0	0
Pendimethalin	10G	3.36	98	98	0	0

[a]Injury refers to discoloration and/or thinning

[b]EL refers to Eli Lilly Co., Inc., Elanco Division, Greenfield, Indiana

[c]LC refers to Lebanon Chemical Co., Lebanon, Pennsylvania

Table 2. Control and injury ratings for herbicides applied to Kentucky bluegrass and creeping red fescue for the preemergence control of smooth crabgrass. Herbicides were applied May 3 and rated for control on August 5, 1980.

Treatment	Rate kg ai/ha	% Crabgrass Control		% Injury[a]	
		KBG	CRF	KBG	CRF
Prosulfalin 50W	2.24	90	97	SL	0
DCPA 75W	11.76	95	99	0	18
Bensulide 4E	8.40	85	88	0	SL
Bensulide 4E + napropamide 50W	5.60+1.12	80	80	0	0
Bensulide 4E + napropamide 50W	5.60+2.24	85	93	0	0
DCPA 5G	11.76	98	99	0	10
Pendimethalin 10G	2.24	99	99	0	0
Pendimethalin 10G	3.36	99	99	0	0
Bensulide (10-6-4)(LS)[b]	8.40	73	70	0	0
Benefin 2.5G (EL)[c]	2.24	90	95	0	10
Benefin 2.5G (EL, 20/60)	2.24	83	97	0	SL
Benefin 2.5G (LC)[d]	2.24	98	98	0	10
Bensulide 3.6G	5.60	65	60	0	SL
Bensulide 3.6G	6.72	60	73	0	SL
Bensulide 3.6G	8.40	55	73	0	SL
Alachlor 15G	3.36	23	60	0	SL
Alachlor 15G	6.72	18	73	0	8

[a]Injury refers to discoloration and/or thinning

[b]LS refers to Lakeshore Turf Supply Co. Inc., Elyria, Ohio

[c]EL refers to Eli Lilly Co. Inc., Elanco Division, Greenfield, Indiana

[d]LC refers to Lebanon Chemical Company Co., Lebanon, Pennsylvania

THE EFFECT OF RATE ON GOOSEGRASS CONTROL IN FAIRWAY TURF USING PREEMERGENCE HERBICIDES[1/]

J.K. Mathias and P.H. Dernoeden[2/]

ABSTRACT

Oxadiazon (2G), DCPA (75W and 5G), bensulide (4EC), and benefin (2.5G) were applied to a fairway turfgrass for goosegrass (Eleusine indica (L.) Gaertn) control in 1980. The efficiacy of a single application of these herbicides was compared to reapplication using various rates. Oxadiazon at 4.48 + 4.48 and 1.79 + 1.79 kg ai/ha provided greater than 90% goosegrass control. Oxadiazon 4.48 + 2.24, 1.79 + 0.89, 4.48 + 0, and 1.79 + 0 kg ai/ha and benefin 2.24 + 2.24 kg ai/ha did not significantly differ from the best treatments; however, percent goosegrass control was below an acceptable level. Poor goosegrass control was noted for lower rates of benefin, and all rates of bensulide and DCPA.

INTRODUCTION

Effective goosegrass control in turf has been reported for field trials in various sections of the country (1,2,3,). Goosegrass is considered to be the most difficult summer annual to control on golf course fairways in Maryland. Existing preemergent herbicides are either very expensive or do not provide an acceptable level of control. This study was initiated to evaluate goosegrass control efficacy of various preemergence herbicides using single applications at recommended rates versus repeat applications at various rates. An important parameter of the study was to determine the lowest rate at which effective goosegrass control could be achieved.

MATERIALS AND METHODS

The location of this study was the first fairway at Twin Shields Golf Club in Dunkirk, Maryland. The fairway turfgrass consisted of a perennial ryegrass (Lolium perenne L.), Kentucky bluegrass (Poa pratensis L.), and annual bluegrass (Poa annua L.) mixture with species composition being 60%, 30% and 10%, respectively. The fairway was maintained at a 2.5 cm mowing height and irrigation was applied as needed. The site was selected due to a heavy goosegrass infestation from the previous year. Soil pH was 6.6 with high phosphate and

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potash levels. A negligible thatch layer (0.6 cm) was observed.

The herbicides tested were: bensulide (0,0-disopropyl phospho rodithioate S-ester with N-(2mercaptoethyl) benzenesulfonamide 4EC, benefin (N butyl- N-ethyl-a,a,a-trifluro-2,6-dinitro-p-toluidine) 2.5G, DCPA (dimethyl tetrachloroterephthalate) 5G and 75W, and oxadiazon-(2-tert-butyl-4-(2,4-dichloro-5-isopropoxy phenyl)-Δ^2-1,3,4,-oxadiazol-5-one) 2G. Treatments rates and timing of application are shown in Table 1.

Granular herbicides were applied by hand and the liquid herbicides were applied using a CO_2 pressurized back pack sprayer at 40 psi and 942 L/ha. The initial application of all herbicides was on April 24, 1980. Those plots receiving a second application of herbicides were retreated on June 19, 1980. The plot area was irrigated within 12 hours after application of herbicides.

The experimental design was a randomized complete block with three replications. Individual plot size was 1.5 m x 1.5 m. Goosegrass control ratings were visual estimates expressed as percent goosegrass coverage and converted to percent goosegrass control.

RESULTS AND DISCUSSION

The reapplication treatments of oxadiazon performed consistently better than the other herbicide combinations (Table 1). The reapplication treatments of oxadiazon, 4.48 + 4.48 and 1.79 + 1.79 kg ai/ha provided excellent goosegrass control (96 and 94%, respectively). Oxadiazon at 1.79 + 0.89 kg ai/ha also gave good control (82%). These data show that double application rates of oxadiazon could be more than halved, from 4.48 + 4.48 to 1.79 + 1.79 kg ai/ha without a significant reduction in goosegrass control.

The best benefin treatment (70% control) was the 2.24 + 2.24 kg ai/ha rate. When the second application of benefin was reduced or omitted, percent goosegrass control dropped dramatically (Table 1).

The bensulide and DCPA treatments gave very poor goosegrass control (Table 1). Repeat applications with recommended rates and half rates did not significantly improve the performance of these herbicides.

CONCLUSION

Data showed that the most effective and efficient goosegrass control treatment was oxadiazon 1.79 + 1.79 kg ai/ha. Although not quantified, turf quality was below an acceptable level due to environmental stress. More information is needed to determine what effects these herbicides have on turf quality in stress situations.

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Table 1. The effects of various rates of several preemergence herbicides upon percent goosegrass cover, and percent goosegrass control on a perennial ryegrass-Kentucky bluegrass fairway.

Treatment	Application Dates and Rates April 24	June 19	Goosegrass[1,2] Cover	Goosegrass Control
	(kg ai/ha)	(kg ai/ha)	---------%----------	
Oxadiazon 2G	4.48	4.48	3a[3]	96
Oxadiazon 2G	1.79	1.79	5a	94
Oxadiazon 2G	4.48	2.24	12ab	86
Oxadiazon 2G	1.79	.89	15ab	82
Oxadiazon 2G	4.48	0	10abc	76
Benefin 2.5G	2.24	2.24	25abcd	70
Oxadiazon 2G	1.79	0	33abcde	61
Benefin 2.5G	2.24	1.12	43bcdef	49
Benefin 2.5G	2.24	0	45bcdefg	47
Bensulide 4EC	8.40	0	50cdefgh	41
DCPA 5G	11.20	0	62defghi	27
Bensulide 4EC	8.40	4.2	65edghi	24
Bensulide 4Ec	8.40	8.40	68fghi	20
DCPA 5G	11.2	5.6	70fghi	18
DCPA 5G	11.2	11.2	73fghi	14
DCPA 75W	11.2	0	77ghi	9
DCPA 75W	11.2	5.6	78ghi	8
DCPA 75W	11.2	11.2	80hi	6
Control	0	0	85i	0
LSD			33.3	

[1]Means with the same letter or letters are not significantly different at the 5% level according to the LSD multiple comparison test.
[2]Percent goosegrass cover data were visual estimates recorded on September 10, 1980.

ANNUAL BLUEGRASS ENCROACHMENT AFFECTED BY KENTUCKY BLUEGRASS SEEDING RATE

A. D. Brede and J. M. Duich[1/]

ABSTRACT

Kentucky bluegrass cultivars 'A-34,''Baron,''Bonnieblue,' 'Newport,' and 'Pennstar' were each seeded at 65, 194, 388, and 1033 pure-live-seed count per dm^2 on May 12, 1977. A cutting height factor (1.3 and 2.5 cm) and fungicide factor (preventive fungicide-applied and check) were superimposed over the experimental area. A visual estimate of the area per plot occupied by annual bluegrass was taken five times over a 3½ year period. We found less annual bluegrass at the 2.5-cm cutting height than at the 1.3-cm height. There were significant seeding rate and cultivar effects on annual bluegrass encroachment which lasted for the 3½ years of observation. In general, a cultivar or seeding rate that allowed annual bluegrass encroachment in the first two months, retained that proportion for the entire test. The fungicide-applied and check plots had equal quantities of annual bluegrass at the beginning of the test but these amounts diverged until the check plots had significantly more annual bluegrass after 3½ years.

INTRODUCTION

It is an established principle that a dense Kentucky bluegrass (*Poa pratensis* L.) stand is a deterrent to annual bluegrass (*Poa annua* L.) encroachment (2). Can we, however, extrapolate this fact and say that a heavy seeding rate will similarly deter *P. annua* in a seedling stand? Almost 40 years ago, Longley (4) suggested that heavy seeding rates would limit annual grassy weed invasion -- a hypothesis which, to this day, remains unconfirmed.

The trouble in making this extrapolation lies in the many other effects of seeding rate. For example, a heavy seeding rate produces highly disease-susceptible turf which subsequently thins (5). Then *P. annua*, as well as other weeds, takes the opportunity to colonize the thin stand. Thus, the effect of Kentucky bluegrass seeding rate on *P. annua* encroachment is unclear.

The purpose of this study was to observe the encroachment of *P. annua* into a stand of Kentucky bluegrass over time, in hopes of understanding the impact and interactions of several management practices: seeding rate, cultivar, fungicide application, and cutting height.

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MATERIALS AND METHODS

The experimental area was established on Hagerstown silt loam at the Joseph Valentine Turfgrass Research Center, University Park, PA on May 12, 1977. The site had been fallow for several years and no pre-plant herbicides or soil-sterilization treatments were used. The experimental design was a split-split plot, comprised of whole plots (cutting height, 1.3 and 2.5 cm, two replicates), sub-plots (preventive fungicide-treated[2/] and check, four replicates), and sub-sub-plots (20 seeding rate/cultivar combinations, eight replicates). Five Kentucky bluegrass cultivars ('A-34,''Baron,''Bonnieblue,' 'Newport,''Pennstar') were each seeded at four rates (65, 194, 388, 1033 pure-live-seed count (PLSC) per dm^2) in 122 by 183 cm plots. The PLSC was based upon laboratory germination and purity percentages and seed counts per gram. No *P. annua* seed was detected in any of the seedlots in the laboratory tests; all *P. annua* in the experiment originated from seed indigenous to the site.

Mowing commenced one month after planting. Irrigation and fertilization were only applied when mild stress was noted. The area received minimal traffic.

The percent *P. annua* per plot on an area basis was visually estimated using two methods of species differentiation: (i) On July 20, 1977 and May 12, 1980, the *P. annua* was in bloom, making species differentiation possible. (ii) On July 5, 1978, June 29, 1979, and October 22, 1980, the plots were evaluated early in the morning when a dew-retention differential between species was prominent. With the latter method, the *P. annua* appeared most iridescent when the sun was less then 20° above the horizon and the angle of observation was roughly 10° above ground level, with the evaluator directly facing the sun.

RESULTS AND DISCUSSION

In accordance with the findings of other researchers (1,2), less *P. annua* was present at the higher height of cut. Similar trends existed for all cultivars and dates and the significant differences are summarized in Table 1.

With increasing seeding rate, the two cutting heights had different effects on *P. annua* encroachment (Fig. 1). The 1.3-cm height had a minimum of *P. annua* at the 388 PLSC/dm^2 rate, while this dip was absent at the 2.5-cm height. Similar patterns were evident at all dates of observation after the first year.

None of the Kentucky bluegrass cultivars tested by Kemmerer and Butler (3) were significantly superior in preventing encroachment of grassy annuals. Table 2, however, shows several cultivar differences in the suppression of *P. annua*. In general, a cultivar that allowed *P. annua* encroachment in the first two months, retained that proportion over the 3½ year period. In other

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[2/] Six to nine preventive treatments were applied per year using the following fungicides: anilazine, benomyl, chloroneb, chlorothalonil, cycloheximide + thiram, maneb, and thiram.

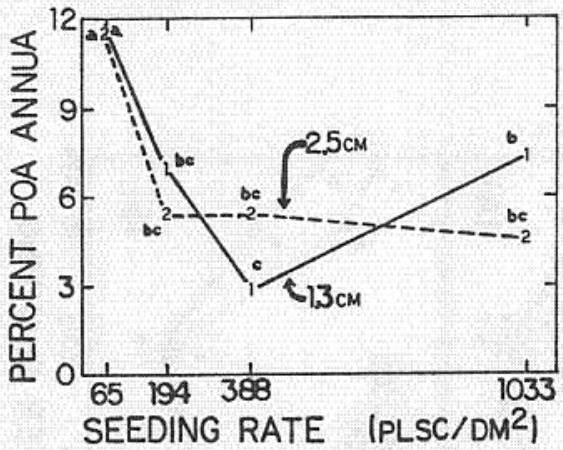

Figure 1. Cutting height differences in the effect of seeding rate on P. annua encroachment at 14 months after planting, summed over cultivars and fungicide treatments.

Table 1. Significant (ρ=0.05) P. annua differences between the two heights of cut, summed over seeding rates and fungicide treatments.

	Cutting Height (cm)	
Cultivar @ date	1.3	2.5
	% P. annua	
Bonnieblue @ 25 mo.	6†	3
Newport @ 2 mo.	15	8
Newport @ 36 mo.	38	22

†All differences within rows are significant.

words, the five cultivars maintained similar rankings throughout the entire test.

At two months (Fig. 2A), all cultivars were similar in their response to seeding rate: the least amount of P. annua was present at the two highest rates. Three years later (Fig. 2B), A-34 and Baron retained this response. With Newport, however, the amount of P. annua was independent of seeding rate. The other cultivars were intermediate between the two patterns.

The effect of seeding rate (summed over cultivars) on P. annua encroachment lasted for the entire 3½ years of observation (Fig. 3A).

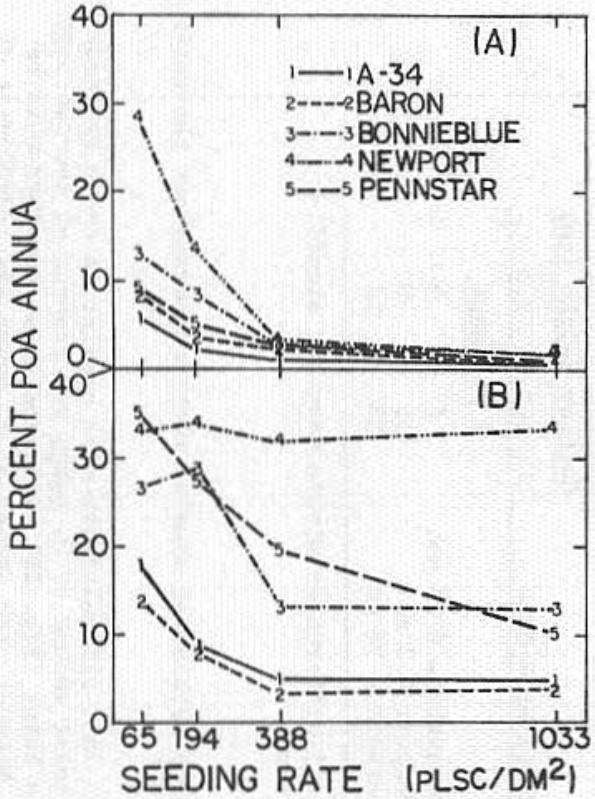

Figure 2. Cultivar differences in the effect of seeding rate on P. annua encroachment at (A) 2 and (B) 41 months after planting, summed over cutting heights and fungicide treatments.

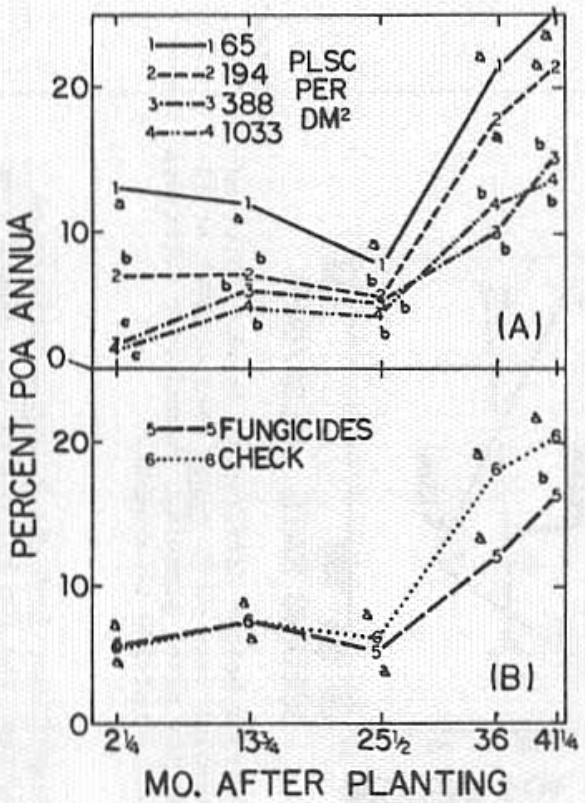

Figure 3. Effects of (A) seeding rate (summed over cultivars, cutting heights, and fungicide treatments) and (B) preventive fungicide treatment (summed over cultivars, cutting heights, and seeding rates) on P. annua encroachment over time. Statistical comparisons are only possible within dates and graphs.

Table 2. Cultivar differences in P. annua encroachment over time, summed over seeding rates, cutting heights, and fungicide treatments.

Cultivar	Months after Planting 2	14	25	36	41
	---- % P. annua ----				
A-34	3 c†	4 c	3 b	7 c	9 c
Baron	3 c	4 c	3 b	6 c	7 c
Bonnieblue	6 b	7 b	5 b	18 b	20 b
Newport	11 a	15 a	14 a	30 a	34 a
Pennstar	4 c	4 c	4 b	16 b	23 b

†Statistical comparisons may only be made within columns (Duncan's multiple range test, $\rho=0.05$).

Concurrent studies on these experimental plots[3/] revealed that the 16:1 range of seeding-rate treatments converged to a 1.6:1 tiller density range after only one year. Therefore, density differences in the first year were probably responsible for allowing P. annua to move into the thinner stands. Thereafter, even though the absolute amounts of P. annua changed over time due to weather, the relative rankings of the four rates stayed very consistent.

At the beginning of the test (Fig. 3B), the fungicide-applied plots had as much P. annua as the check. Over time, however, the percentage of P. annua in the sprayed and unsprayed plots diverged until a significant difference occurred at 41 months. This divergence suggested that the fungicides enabled the Kentucky bluegrass to more effectively compete against the encroaching P. annua.

These results reflect the behavior of only one experiment at one site. Therefore, care should be taked when applying these data to different climatic regions. The many interactions of management factors on P. annua encroachment found by this study call for the need for similar experiments in a variety of locations.

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EFFECTS OF A REAPPLICATION OF GROWTH RETARDANTS IN A TWO YEAR STUDY ON KENTUCKY BLUEGRASS[1]/

P.H. Dernoeden and D.J. Wehner[2]/

ABSTRACT

Growth retardants; mefluidide 2S, MBR 18337 2EC, ethephon 2S, and EL 72500 50WP and 1G; were applied to a Kentucky bluegrass turf to evaluate growth suppression and turf quality during the second year of application under low management conditions. EL 72500 50WP at 2.0 and 3.0 lb ai/A rate provided the best season-long combination of growth retardation and turf quality. Data indicated that mefluidide and MBR 18337 treated plots sustained loss of density in 1979 as corroborated by high weed infestation percentages in 1980. A mid-July trim mowing and application of fertilizer improved turf quality in EL 72500 WP and 1G and ethephon treatments. Poor turf quality ratings in mefluidide and MBR 18337 plots primarily reflect heavy crabgrass (Digitaria sp.) infestations. By October all plots displayed improved turf quality. Mefluidide and MBR 18337 treated plants exhibited highest percentages of leaves bearing Helminthosporium vagans leaf spot lesions. EL 72500 1G and 50WP had no deleterious effects upon rooting when applied twice yearly during two successive years to a Kentucky bluegrass turf.

INTRODUCTION

Growth regulators provide the potential for reducing expenditures allocated toward costly mowing practices along highways, parks, cemeteries, home lawns and golf courses (1,2). Perhaps of even greater significance is that these compounds offer another means through which fossil fuels may be conserved.

The objective of this study was to evaluate growth inhibition and turf quality of Kentucky bluegrass treated with growth regulators during two successive years. An important parameter of this investigation was to appraise retreatment effects on a turf subjected to a very low level of management.

MATERIALS AND METHODS

The growth regulators used in this study were mefluidide 2S (N-(2,4-dimethyl-5-(((trifluoromethyl)sulfonyl)amino)phenyl)acetamide) ethephon 2S (2-chloroethyl-phosphoric acid), MBR 18337 2EC (undisclosed), and EL 72500 50WP and 1G (undisclosed). Rates of application are in Table 1. There were two untreated controls: the unmowed check and the mowed check.

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The experimental design was a randomized complete block with three replications. Chemicals were applied to 3 ft x 10 ft plots of a Kentucky bluegrass (Poa pratensis L.) turf. The bluegrass stand was comprised of three cultivars, 'Merion', 'Adelphi', and 'South Dakota Certified' with a small percentage of 'Penniawn'red fesuce (Festuca rubra L.) also present. The stand was grown on a Chillum silt loam at the University of Maryland Plant Research Farm.

Spray materials were applied on April 21 and June 9, 1980 with a CO_2 pressurized sprayer at 40 psi and a dilution rate of 100 gallons per acre. Granular formulation, EL 72500 1G, was applied by hand on May 12 and June 27, 1980. All plots were trim mowed one week following the initial growth retardant application.

Four height measurements were made in each plot (by standing a ruler onto the soil surface and dropping a cardboard disc mounted on the ruler onto the turfgrass leaves) on the recording dates noted in Tables 1,2,3. Turfgrass quality was visually estimated using a rating scale of 0 to 10 where 10 equals optimum denisty, color and uniformity. The rates of application and the method of data collection were similar to that method used in 1979 (2). Percentage of leaves bearing Helminthosporium vagans leaf spot lesions (Table 5) and percentage of plots colonized by weeds, (Table 4) were visual estimates.

On July 15 plots were split in half. One half was mown to a height of 2.5 inches and fertilized with 1.0 lb nitrogen per 1000 square feet from Milorganite. The other half of the plot was not mown or fertilized. The entire plot area was then irrigated. Height measurements and turf quality ratings were obtained from both halves of the plots (Table 3).

To obtain dry root weight measurements, 3 inch diameter plugs about 1 inch deep were removed from the plots (unmowed and unfertilized halves) with a cup cutter on September 11. Three plugs were taken from each plot and individually potted in a standard 5 inch plastic pot containing a coarse sand growing medium. The pots were randomly arranged on a greenhouse bench. Leaves were lightly trimmed weekly and pots were watered daily. On October 31 the plugs were removed from their pots and the coarse sand was gently washed from the roots. The roots were severed from the plugs at the soil-sand interface, oven dried at 150°F for 72 hours, and weighed.

Prior to the application of growth regulators, the plot area was treated with herbicides (2,4-dichlorophenoxy acetic acid, and 3,6-dichloro-o-anisic acid) to eliminate dandelions (Taraxacum officinale Weber) and other broadleaf weeds, and fertilized with one pound of nitrogen per 1000 square feet from ammonium nitrate. Plots were irrigated on three occasions during July and August to prevent drought injury.

All data were analyzed using the analysis of variance and means were separated using the Duncan's multiple range test.

RESULTS AND DISCUSSION

Growth retardation. All treatments resulted in significantly lower height measurements through August 6 when compared to the unmowed check (Table 1). EL 72500 1G and 50WP, and ethephon treatments maintained significantly lower heights, compared to the unmown check, until September 3 at which time the acquisition of height measurements was suspended. Mefluidide and MBR 18337 treated plots could not be evaluated September 3 due to heavy crabgrass (*Digitaria ischaemum* (Schreb). Muhl), infestations. On the final rating date, turf treated with EL 72500 50 WP (2.0 and 3.0 lb ai/A) and EL 72500 1G (1.0, 2.0 and 3.0 lb ai/A) exhibited best growth retardation.

On the initial rating date, May 28 turf treated with EL 72500 1G (1.0, 2.0 and 3.0 lb ai/A), mefluidide (0.5 lb ai/A) and MBR 18337 (0.5 lb ai/A) treatments had the highest percentages of height reduction (Table 1). Throughout June, mefluidide (0.5 lb ai/A) and MBR 18337 (0.5 lb ai/A) treatments continued to provide good growth suppression (Table 1). By August 6, however, the percentage height reduction of all mefluidide and MBR 18337 treated plots was significantly below all EL 72500 1G and WP, except EL 72500 WP 1.0 lb ai/A treatment, but remained comparable to both ethephon treatments.

Turf Quality. On May 28 turf quality ratings were similar among treatments with the exception of EL 72500 1G plots (Table 2). The significantly low quality ratings of the EL 72500 1G plots were attributed to discoloration of the turf which was exacerbated by some scalping incurred by trim mowing. The quality ratings for the EL 72500 1G treatments deteriorated dramatically by June 24 , but showed some recovery by August 6. Quality ratings for EL 72500 1G and 50 WP treated turf were also adversely affected by the presence of senescent, brown-colored foliage. The senescent foliage became less conspicuous by August 6 and was no longer evident by September 3. Ethephon (4.0 and 6.0 lb ai/A) consistently maintained better quality turf than most other treatments throughout the test period (Table 2).

Turf treated with mefluidide and MBR 18337 displayed quality comparable to other treatments through June 24, except all EL 72500 1G which had poor quality ratings (Table 2). By August 6 turf quality in mefluidide and MBR 18337 treated plots had sharply declined. All plots treated with mefluidide and MBR 18337 treatment rates, except MBR 18337 at .25 lb ai/A, had exhibited significantly lower quality ratings when compared to check plots. These low ratings were attributed to the colonization of plots by crabgrass (Table 4). This crabgrass infestation was related to poor density of the turf in mefluidide and MBR 18337 treatments as corroborated by the large percentages of broadleaf weeds observed in those plots during spring (Table 4). Elimination of the broadleaf weeds with herbicides in April undoubtedly favored the development of crabgrass in those plots. Conversely, all other treatments, including control plots, had significantly lower percentages of broadleaf weeds than mefluidide and MBR 18337 treated plots (Table 4). Similarly, crabgrass infestations in August were significantly highest in both mefluidide treatments and MBR 18337

treated (0.5 lb ai/A) plots. Crabgrass infestations were lowest in EL 72500 WP treated plots. These data indicate that the application of mefluidide and MBR 18337 in 1979 had caused deterioration in sward density whereas EL 72500 WP and 1G and ethephone had not.

On September 15 the plants in the entire plot area were gradually reduced in height to 2.5 inches. On October 7 the plots were again evaluated for overall turf quality (Table 2). At that time the EL 72500 WP and 1G plots exhibited color, density and uniformity comparable to the mowed check. MBR 18337 and mefluidide plots had improved greatly due to the elimination of most of the crabgrass by mowing and normal senescence of crabgrass tissues. Ethephon plots had also improved but not as dramatically as other treatments. All treatments received quality ratings on October 7 superior to those obtained on April 11. Data collected on April 11 were obtained prior to the application of the growth regulators in 1980 (Table 2).

Split Plot Treatment. The split plot treatment was implemented on July 15 and the first height measurements were recorded 21 days later on August 6. The August 6 data showed that mefluidide and MBR 18337 no longer had any significant effect upon retarding vertical shoot growth (Table 3). This may be attributed, in part, to the effect of the fertilizer. This conclusion is supported by data in Table 1 which show some percent height reduction on the half plots not receiving any fertilizer on August 6. Heavy crabgrass infestations by August 22 prevented data acquisition in all mefluidide and MBR 18337 plots except MBR 18337 at .25 lb ai/A. In the latter treatment, vertical shoot growth had significantly exceeded the unmowed control suggesting a post inhibition stimulation effect.

Data collection on September 3 revealed that EL 72500 50WP and 1G, and ethephon continued to provide good growth suppression. The 3.0 lb ai/A rate of EL 72500 50WP and 1G exhibited the greatest percent height reduction, i.e. 36 and 49 percent height reduction, respectively (Table 3).

Turf quality ratings were appreciably higher in EL 72500 50WP and 1G, and ethephon plots which had been mown and fertilized versus the unmowed and unfertilized half of the split plot (Table 1,2). The desireable effect of improving quality by a mid-season trim mowing and fertilizer application, without loss of suppression, illustrate the promising potential of EL 72500 use on swards other than low quality or minimum use turfs.

Disease Ratings. Growth regulators have been reported to render turf more susceptible to several fungal diseases (1,2). This phenomenon may be ascribed, in part, to the reduced recuperative potential of plants treated with growth regulators and to a reduced capacity of older, senescent tissue to actively resist infection.

Only trace levels of stripe smut, (*Ustilago striiformis* (Westend. Niessl) infection were observed in plots during mid-May. There were,

however, high percentages of Kentucky bluegrass leaves showing Helminthosporium vagans Drechsler (Synomyn=Drechslera poae (Baudys) Shoemaker) leaf spot lesions in specific treatments (Table 5). Data recorded on May 16 showed that plants in mefluidide and MBR 18337 treated plots had significantly higher leaf infection percentages than all other treatments. On June 24 the percentage of leaves bearing leaf spots in mefluidide and MBR 18337 treated plots decreased; however, these percentages significantly exceeded those in the mowed check, but not the unmowed check. Plants in the EL 72500 50W and 1G treated plots possessed the lowest percentage of leaves bearing leaf spot lesions.

Dry Root Weights. The mowed check dry root weight yields were significantly larger than dry root weight yields of the unmowed check. This anomaly makes interpretation of data difficult. Lowest dry root weights were incurred in ethephon treated plugs, especially the 6.0 lb ai/A rate, but data were not significantly different from the unmowed check. EL 72500 WP (2.0 and 3.0 lb ai/A) treatments yielded significantly higher dry root weights versus most of other growth retardant treatments and the mowed check. For reasons not understood, dry root weight yields increased with increasing rates of EL 72500 1G and 50WP. Data indicate that EL 72500 1G or 50WP had no deleterious effects upon rooting when applied twice yearly during two successive years to a Kentucky bluegrass turf.

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Table 1. Height measurements (cm) and percent height reduction (%) from Kentucky bluegrass turf treated with growth retardants.

Treatment	Rate	Height (cm) and Percent Height Reduction (%)[1]									
		5/28		6/24		7/25		8/6		9/3	
	(lb ai/A)	(cm)	(%)	(cm)	(%)	(cm)	(%)	(cm)	(%)	(cm)	(%)
EL 72500 50WP	1.0	9.7c	28	8.6de	37	9.1cd	40	11.0d	35	14.1b	33
EL 72500 50WP	2.0	9.0c	33	7.6e	45	7.0ef	54	7.6e	55	10.1c	52
EL 72500 50WP	3.0	8.2c	39	6.1g	55	6.3fg	59	6.5ef	62	8.1de	61
EL 72500 1G	1.0	6.4ef	51	6.2fg	55	7.4ef	51	8.3e	51	10.3c	51
EL 72500 1G	2.0	6.2ef	54	5.6g	59	5.5g	64	6.4ef	62	12.0cd	43
EL 72500 1G	3.0	5.9f	56	5.5g	60	5.3g	65	5.4f	68	7.9de	62
Mefluidide 2S	0.25	8.9cd	34	9.1cd	34	10.3bc	32	14.1b	17	*	*
Mefluidide 2S	0.50	7.0e	48	6.0g	46	9.1cd	40	11.6d	31	*	*
MBR 18337 2EC	0.125	8.7d	35	8.2de	40	10.7b	30	15.0b	11	*	*
MBR 18337 2EC	0.25	9.1cd	32	7.9de	42	9.0cd	41	13.8bc	18	*	*
MBR 18337 2EC	0.50	6.3ef	53	7.4ef	53	7.8de	49	12.2cd	28	*	*
ETHEPHON 2S	4.0	10.6b	21	10.4b	24	9.9bc	35	12.1cd	28	13.3b	36
ETHEPHON 2S	6.0	10.7b	20	9.6bc	30	10.3bc	32	12.1cd	28	12.9b	38
Mowed Check	---	4.9g	--	5.8g	--	7.1ef	--	8.0e	--	6.8e	--
Unmowed Check	---	13.4a	--	13.7a	--	15.2a	--	16.9a	--	20.9a	--

[1]Means followed by the same letter in the same column are not significantly different at the 5% level according to Duncan's multiple range test.
*Crabgrass infestation prevented acquisition of accurate height measurements.

Table 2. Overall turfgrass quality ratings of Kentucky bluegrass turf sprayed with growth retardants.

Treatment	Rate	OVERALL TURFGRASS QUALITY[1,2]					
		4/11[3]	5/28	6/24	8/6	9/3	10/7[4]
	(lb ai/A)						
EL 72500 50W	1.0	6.0a	6.5abc	6.1bc	4.8cde	5.7a	7.7abc
EL 72500 50W	2.0	6.2a	5.7abcdef	4.9cd	4.3cde	4.3abcd	8.4ab
EL 72500 50W	3.0	6.2a	5.0cdef	3.3de	5.3bcd	4.5abcd	8.7a
EL 72500 1G	1.0	5.5ab	4.3ef	3.0ef	5.7bc	5.9a	7.9abc
EL 72500 1G	2.0	6.2a	4.0f	1.7ef	4.3de	4.3abcd	7.8abc
EL 72500 1G	3.0	5.8a	4.5def	1.3f	4.3de	5.3abcd	8.4ab
Mefluidide 2S	0.25	2.2e	6.0abcde	6.1bc	2.0fg	1.0e	5.5fg
Mefluidide 2S	0.50	2.0e	5.3bcdef	6.0bc	1.0g	1.0e	4.3g
MBR 18337 2EC	0.125	3.8cd	6.2abcd	5.7bc	2.3f	2.6cde	6.7cdef
MBR 18337 2EC	0.25	3.5cde	6.0abcde	6.6bc	3.8e	2.8bcde	7.0bcde
MBR 18337 2EC	0.50	2.7de	5.8abcde	5.7bc	1.7fg	1.8de	6.0ef
ETHEPHON 2S	4.0	5.0abc	7.3a	6.4bc	5.2bcd	5.0abc	6.8cdef
ETHEPHON 2S	6.0	4.2bcd	7.2a	7.1ab	6.1ab	4.8abc	6.3def
Mowed check	--	5.7ab	6.8ab	7.9a	6.8a	5.3abc	8.2ab
Unmowed check	--	5.7ab	6.9ab	5.4bc	4.5de	5.5ab	7.4abcd

[1]Means followed by the same letter in the same column are not significantly different at the 5% level according to Duncan's multiple range test.
[2]Rating values are visual estimates based on a 0-10 scale where 0=dead turf and 10= optimum greeness, density and uniformity.
[3]Data were obtained before application of growth retardants in 1980.
[4]Data were obtained 21 days following termination of experiment.

Table 3. Height (cm) and percent height reduction (%), and overall turfgrass quality of the Kentucky bluegrass split plot treatment where half of the plots were mown at 2.5 inches and fertilized with one pound of nitrogen per 1000 square feet from Milorganite on July 15.

		Height (cm) and Percent Height Reduction (%)[1]						Overall Turf Quality[1,2]	
Treatment	Rate	8/6		8/22		9/13		8/6	9/3
	(lbs ai/A)	(cm)	(%)	(cm)	(%)	(cm)	(%)		
EL 72500 50WP	1.0	8.5cd	13	8.5cd	13	11.5b	15	6.7ab	6.7ab
EL 72500 50WP	2.0	7.4de	24	7.4ef	24	10.6bc	22	6.2ab	6.0a
EL 72500 50WP	3.0	6.7ef	32	6.7f	32	8.7d	36	6.5ab	5.1ab
EL 72500 1G	1.0	7.6de	23	10.6b	0	11.0b	20	6.5ab	6.8a
EL 72500 1G	2.0	6.7ef	32	7.5ef	23	9.4cd	31	4.3bcde	5.0ab
EL 72500 1G	3.0	5.9f	40	6.8f	31	6.9e	49	5.3abcd	5.9a
Mefluidide 2S	0.25	9.9a	0	*	*	*	*	2.7ef	1.0c
Mefluidide 2S	0.50	9.7ab	1	*	*	*	*	1.0f	1.0c
MBR 18337 2EC	0.125	9.9a	0	*	*	*	*	3.5de	2.6bc
MBR 18337 2EC	0.25	10.3a	0	12.8a	0	*	*	3.8cde	2.6bc
MBR 18337 2EC	0.50	9.2abc	6	*	*	*	*	2.3ef	2.0c
ETHEPHON 2S	4.0	8.7bc	11	10.8	0	10.4bc	24	6.0abc	5.2ab
EPHEPHON 2S	6.0	8.5cd	13	9.7	1	10.1bc	26	6.0abc	5.3a
Mowed Check	--	6.7ef	--	9.1	--	6.8e	--	7.0a	5.3a
Unmowed check	--	9.8ab	--	9.8	--	13.6a	--	6.5ab	6.5a

[1]Means followed by the same letter in the same column are not significantly different at the 5% level according to Duncan's multiple range test.
[2]Rating values are visual estimates based on a 0-10 scale where 0=dead turf and 10=optimum greeness, density and uniformity.
*Crabgrass infestation prevented acquisition of accurate height measurements.

Table 4. Percentage of plot area colonized by broadleaf weeds and crabgrass, and dry root weights of plugs removed from treated plots on September 11.

Treatment	Rate	Plot Area Colonized by Weeds[1]		
		4/11 Broadleaf Weeds	8/6 Crabgrass	Dry Root Weights[1,2]
	(lb ai/A)	(%)	(%)	(mg)
EL 72500 50WP	1.0	2.0d+	0.1d	155fg
EL 72500 50WP	2.0	1.7d	0.7d	482ab
EL 72500 50WP	3.0	2.7d	1.0d	612a
EL 72500 1G	1.0	4.7d	2.0d	255def
EL 72500 1G	2.0	2.7d	2.7d	308cde
EL 72500 1G	3.0	2.7d	1.5d	446bc
Mefluidide 2S	0.25	45.0a	38.3bc	*
Mefluidide 2S	0.50	45.0a	86.7a	*
MBR 18337 2EC	0.125	26.7abc	19.0cd	*
MBR 18337 2EC	0.25	28.3ab	15.7d	*
MBR 18337 2EC	0.50	38.3a	42.0b	*
Ethephon 2S	4.0	9.0bcd	2.7d	164fg
Ethephon 2S	6.0	7.3cd	1.8d	75g
Mowed Check	--	6.3cd	10.3d	328cd
Unmowed check	--	4.0d	0.1d	180efg

[1]Means followed by the same letter in the same column are not significantly different at the 5% level according to Duncan's multiple range test.
[2]Plugs were grown in coarse sand for 50 days in a greenhouse.
*Not observed.

Table 5. Percentage of Kentucky bluegrass leaves bearing *Helminthosporium vagans* leaf spot lesions.

Treatment	Rate	Percentage of leaves bearing leaf spot lesions[1,2] 5/16	6/24
	(lb ai/A)	----------(%)----------	
EL 72500 50WP	1.0	0.3c	4.0c
EL 72500 50WP	2.0	0.0c	7.7bc
EL 72500 50WP	3.0	0.7c	7.0c
EL 72500 1G	1.0	0.0c	5.7c
EL 72500 1G	2.0	0.0c	5.7c
EL 72500 1G	3.0	0.0c	2.3c
Mefluidide 2S	0.25	30.0a	15.0a
Mefluidide 2S	0.50	31.7a	16.0a
MBR 18337 2EC	0.125	16.7b	15.0ab
MBR 18337 2EC	0.25	26.7a	15.0ab
MBR 18337 2EC	0.50	23.3ab	15.0ab
Ethephon 2S	4.0	0.0c	7.0c
Ethephon 2S	6.0	0.0c	10.0abc
Mowed check	--	0.7c	4.0c
Unmowed check	--	0.0c	10.0abc

[1]Means followed by the same letter in the same column are not significantly different at the 5% level according to Duncan's multiple range test.
[2]Percentages are visual estimates.

EFFECT OF FOUR GROWTH RETARDANTS ON TWO KENTUCKY BLUEGRASSES (*Poa pratensis* L.)

T. L. Watschke[1/]

ABSTRACT

Four growth retardants (mefluidide, MBR 18337, EL 500, and PP 333) were applied to Merion and Pennstar Kentucky bluegrasses to assess the growth retarding capability and phytotoxicity. Color, height, weight, seed inhibition, density, and soil moisture levels were measured. PP 333 and EL 500 were slower acting, but were ultimately more effective in reducing growth of both bluegrasses. All treatments that caused significant growth suppression also caused some discoloration. MBR 18377 and mefluidide were significantly more effective in inhibiting seedheads than either PP 333 and EL 500, but the latter two reduced culm length. Density, assessed approximately one year after treatment, was not reduced by any of the treatments. Some increase in density was found for turf treated with the 3.36 kg/ha rate of EL 500 (both formulations) and the 4.48 kg/ha rate of PP 333. The soil moisture percentage was also highest for these treatments.

INTRODUCTION

Research on growth retardants for turf has significantly increased in recent years (1, 2, 3, 4, 5). This increase has come about because of the need to evaluate new compounds from industry and to find ways of reducing fuel consumption associated with mowing. The purpose of this research was to compare three experimental growth retardants to mefluidide [N-[2,4-dimethyl-5-[[(trifluoromethyl)sulfonyl]amino]phenyl]acetamide for growth retardation and phytotoxicity to 'Merion' and 'Pennstar' Kentucky bluegrasses (*Poa pratensis* L.). Mefluidide was used as standard as it has been shown to suppress growth more than other commercially available materials (3).

MATERIALS AND METHODS

The materials used in this research were; mefluidide 2S, MBR 18337 (undisclosed) 2EC, EL 500 (undisclosed) 50W and 1G, and PP 333 (undisclosed) 50W and 2G.

On April 26, 1979, the materials were applied to 12-year-old stands of Merion and Pennstar Kentucky bluegrass maintained at a height of 4 cm at the

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Joseph Valentine Turfgrass Research Center, The Pennsylvania State University. The treatments were applied in two replications to 0.9 x 1.8 m plots. Spray materials were applied with a hand held boom-type sprayer and granular materials were applied with a shaker bottle. One week after treatment the test area was mowed at a height of 5 cm.

Color was rated 10 times during the season and height was measured eight times. Three height measurements per plot were made with the average being presented in Table 2.

On June 7, 1979, one half of each plot was mowed to height of 7 cm. Subsequent color and height measurements were taken on the mowed half. On July 26 (50 days after mowing) a 157 x 51 cm swath was harvested using a rotary mower and the clippings were weighed.

On May 25, 1979, a visual estimate of seedhead inhibition was made and on July 23, 1979, the culm lengths of Merion treated with EL 500 were compared to the check.

On June 26, 1979, three samples 7.5 cm deep using a soil sampling tube were taken from the non-mowed half of the Merion plots. Percent moisture was calculated after the soil was dried at 105 C for 15 hours.

On June 2, 1980, a 13 x 76 m sampling tool was used to take three samples per plot for density counts. The average number of tillers per 988 m^2 sample was the measurement used for density.

RESULTS AND DISCUSSION

Color ratings were taken 10 times from May 11 to August 28 (Table 1). On May 11, the high rate (0.56 kg/ha) of MBR 18377 and mefluidide had discolored both grasses more than any other treatment. Similar activity and intensity for these two chemicals has been previously shown on a mixed bluegrass-fine fescue turf (5). By June 8, the discoloration caused by mefluidide and MBR 18337 had disappeared. By this time, however, the higher rates of PP 333 and EL 500 were beginning to injure both bluegrasses. Injury started sooner on Merion than Pennstar. The nature of the discoloration caused by EL 500 and PP 333 was very similar. A leaf tip yellowing followed by a tip die back occurred on all treatments greater than 2.24 kg/ha. This injury has been previously described (5). However, by mowing at 7 cm on June 7, much of the yellowing was removed and plot appearance improved. The 4.48 kg/ha rate of PP 333 caused significant discoloration throughout the month of June. By July 26, both bluegrasses showed very little injury from any of the treatments. Later in the season, most treatments enhanced color compared to the check.

Height was measured eight times during the season beginning May 11 and ending on August 28 (Table 2). Both grasses were mowed at 4 cm prior to treatment and were then mowed one week after treatment at 5 cm. Therefore, the height measurements represent growth that had occurred after May 3. Mefluidide and MBR 18337 caused a more immediate growth suppression (particularly the 0.56 kg/ha rate of 18337) than PP 333 and EL 500 (Table 2). However, by June 15 the growth rate of turf treated with mefluidide and MBR

18337 was equal to that of the check. And, by the end of August, growth of turf treated with these two materials had gotten taller than the check. The 3.36 and 4.48 kg/ha rates of PP 333 reduced growth more and for a longer time than any other treatments as on August 28 (over four months after treatment) very little growth had occurred on either bluegrass. Growth of turf treated at 1.68 kg/ha of PP 333 began to resume in early August. The 0.56 and 1.12 kg/ha rates of EL 500 suppressed growth to approximately the same degree as the 0.14 kg/ha rate of MBR 18337. The 2.24 and 3.36 kg/ha rates of EL 500 suppressed growth similar to the 3.36 kg/ha rate of PP 333. Height measured on August 28 indicated that growth suppression from PP 333 was longer lasting than from equivalent rates of EL 500.

Fresh weight yields were taken from both grasses after 50 days of growth (Table 3). Half of each treatment was mowed at 7 cm on June 7, and weights were taken from the mowed portion on July 26. Growth suppression for mefluidide and MBR 18337 had significantly diminished by early June. Consequently the increase in growth over the check during the 50 days described here supports earlier work that showed an increased growth rate following a period of retardation (3). The 2.24 and 3.36 kg/ha rates of EL 500 and all rates of PP 333 maintained a significant growth suppression of both grasses throughout the 50 day period.

On May 25 visual estimates of seedhead suppression showed that mefluidide and MBR 18337 were superior to EL 500 and PP 333 in seedhead inhibition (Table 4). Both mefluidide and MBR 18337 inhibited seedheads nearly 100 percent. Although EL 500 and PP 333 were not nearly as effective in reducing seedhead formation, they both shortened the culm length (Table 5). The 3.36 kg/ha rate of PP 333 reduced culm length by 67%, while the same rate of granular EL 500 reduced culm length by 56%. Shortening the culm without adversely affecting seed set would be a significant advantage as a treatment to small grain varieties that are prone to lodging. These applications undoubtedly have value in rice production and the grass seed industry as well. However, from just a retardation standpoint (for example along highways), not being able to inhibit seedhead formation would be a drawback compared to materials that suppress seedheads.

On June 26, soil moisture measurements showed that soil under Merion sod that was treated with the high rates of PP 333 and EL 500 had a better moisture status than soil under untreated Merion sod (Table 6). This measurement was made only once because late June was the only time during the season that the turf showed signs of moisture stress. Observation of growth retardation tests in previous years indicated that turf treated with growth retardants was more resistant to wilting than nontreated turf. Presumably, reduced foliar growth created a lower transpirational demand and water was conserved.

Since the high rates of EL 500 and PP 333 were still affecting turf growth at the time of winter dormancy, density measurements were made on the following June 2 to assess stand thinning. No treatment caused significant thinning of either of the grasses (Table 7). Pennstar showed more of a density response than Merion, with all treatments causing minor to significant increases in density. The EL 500 and PP 333 treatments tended to

increase density more than mefluidide and MBR 18337. More work is needed in documenting the morphological changes that occur in the sward and in individual tillers in response to treatment with these materials.

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Table 1. The effect of four growth retardants applied April 26, 1979, on the color of Merion (MKB) and Pennstar (PKB) Kentucky bluegrasses.

Treatment	Rate kg ai/A	Color Rating[a]																			
		5/11		5/18		5/25		6/1		6/8[b]		6/15		6/25		7/11		7/26		8/26	
		MKB	PKB	MKB	PKB	MKB	PKB	MKB	PKB	MKB	PKB	MKB	PKB	MKB	PKB	MKB	PKB	MKB	PKB	MKB	PKB
Mefluidide 2S	0.42	7.0	7.5	7.0	7.0	7.0	7.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	8.5	9.0	9.0	9.0	8.0	8.0
MBR 18337 2E	0.14	8.0	9.0	8.0	8.5	8.5	9.0	8.5	9.0	8.0	8.0	9.0	9.0	8.5	8.5	9.0	9.0	9.0	9.0	8.0	8.0
MBR 18337 2E	0.28	7.5	8.0	7.5	7.5	7.5	8.0	8.0	8.0	9.0	8.5	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0
MBR 18337 2E	0.56	7.0	7.5	7.0	7.0	7.0	7.0	7.0	7.0	8.5	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0
PP 333 2G	1.68	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.5	9.0	8.0	9.0	7.0	8.5	8.5	9.0	8.0	8.5	8.0	8.0
PP 333 2G	3.36	8.5	9.0	8.5	9.0	8.0	9.0	8.5	9.0	7.5	9.0	7.0	9.0	7.0	9.0	7.0	8.0	7.5	8.5	8.0	8.0
PP 333 50W	4.48	9.0	9.0	9.0	9.0	8.0	8.5	8.5	9.0	7.5	9.0	7.0	9.0	6.5	8.5	7.5	7.5	7.5	8.0	8.0	8.0
EL 500 50W	0.56	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0	8.5	8.0	9.0	8.5	9.0	9.0	8.5	9.0	8.0	8.0
EL 500 50W	1.12	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.5	8.5	9.0	8.5	8.0	8.0
EL 500 50W	2.24	8.5	9.0	8.0	9.0	9.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.5	9.0	8.5	8.5	9.0	8.5	8.5	9.0
EL 500 50W	3.36	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	8.5	8.5	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
EL 500 1G	0.56	9.0	9.0	8.5	8.5	9.0	9.0	9.0	9.0	8.0	8.0	8.5	8.5	8.5	8.5	8.0	8.5	9.0	9.0	8.0	8.0
EL 500 1G	1.12	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0	9.0	9.0	9.0	9.0	8.0	8.5	9.0	9.0	8.0	8.0
EL 500 1G	2.24	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.5	8.5	9.0	9.0	8.5	9.0	9.0	9.0	9.0	9.0	9.0
EL 500 1G	3.36	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	8.0	9.0	8.5	9.0	8.5	8.5	9.0	9.0	8.5	9.0	9.0	9.0
Check	0.00	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	7.0	8.0	8.0	8.0	8.0	8.5	8.5	8.0	8.0	8.0	8.0

[a]Color rating; 0 = yellow, 10 = dark green

[b]Color rated on turf mowed to 7 cm on June 7, 1979

Table 2. The effect of four growth retardants applied April 26, 1979, on the height of Merion (MKB) and Pennstar (PKB) Kentucky bluegrasses.

Treatment	Rate kg ai/A	Height															
		5/11		5/18		5/25		6/2		6/15[a]		6/25		7/11		8/28[b]	
		MKB	PKB	MKB	PKB	MKB	PKB	MKB	PKB	MKB	PKB	MKB	PKB	MKB	PKB	MKB	PKB
		cm															
Mefluidide 2S	0.42	5.2	4.6	5.0	4.5	5.5	5.0	8.4	7.3	12.5	11.8	14.0	14.2	15.8	18.6	19.7	22.2
MBR 18337 2E	0.14	6.0	6.4	6.0	6.2	6.8	6.3	8.5	7.7	14.5	12.6	14.8	14.8	16.6	17.5	19.5	20.3
MBR 18337 2E	0.28	5.5	5.0	5.5	4.6	5.4	5.0	7.6	7.2	12.2	12.4	14.2	14.5	18.3	18.8	19.6	22.0
MBR 18337 2E	0.56	4.8	4.5	4.5	4.3	4.8	4.5	5.7	5.6	12.4	12.0	14.0	13.8	18.0	20.0	20.5	22.2
PP 333 2G	1.68	6.2	6.4	7.2	7.2	8.0	7.5	7.8	7.6	8.2	8.0	8.0	8.0	9.0	9.6	12.5	13.0
PP 333 2G	3.36	6.0	6.4	6.4	6.2	6.5	6.2	7.0	6.3	7.6	7.0	7.5	7.4	7.6	7.3	8.2	7.6
PP 333 50W	4.48	6.4	6.5	6.4	6.4	6.5	6.3	6.2	6.0	7.0	6.6	6.7	7.0	7.0	7.0	7.3	8.2
EL 500 50W	0.56	6.8	7.3	8.6	8.5	9.5	9.4	9.2	9.8	10.8	10.8	12.0	11.8	14.7	14.5	17.7	18.8
EL 500 50W	1.12	6.0	6.0	7.3	7.0	8.0	8.4	8.2	8.5	8.5	9.0	9.0	9.4	12.8	14.5	18.6	20.2
EL 500 50W	2.24	6.4	6.5	6.6	6.5	6.8	6.8	6.7	6.8	7.6	7.2	7.8	8.0	9.4	9.7	16.0	17.4
EL 500 50W	3.36	6.0	6.4	7.5	6.7	6.8	6.2	6.5	6.8	7.2	6.7	7.6	7.8	9.0	9.4	14.8	15.2
EL 500 1G	0.56	6.3	6.7	8.5	8.0	10.4	8.6	9.8	10.0	11.6	11.3	11.7	11.5	14.5	15.2	17.4	17.7
EL 500 1G	1.12	7.0	7.3	7.8	8.0	8.4	7.8	9.2	9.3	9.8	9.2	9.8	8.8	12.0	11.7	16.2	18.3
EL 500 1G	2.24	6.7	6.6	7.2	6.6	7.5	7.0	7.2	7.2	8.0	7.5	9.2	7.8	10.5	10.4	15.6	16.6
EL 500 1G	3.36	6.5	6.6	6.8	6.8	7.2	7.0	7.2	6.6	8.0	7.4	8.0	8.2	8.7	8.5	13.7	15.8
Check	0.00	8.0	8.2	9.8	9.8	12.4	10.8	13.5	12.6	14.2	14.0	14.4	14.5	16.8	17.6	17.8	16.5

[a]Height of turf that had been mowed at 7 cm on June 7, 1979.

[b]Height of turf that had been mowed at 7 cm on July 26, 1979.

Table 3. The effect of four growth retardants applied April 26, 1979, on the fresh weight of Merion and Pennstar Kentucky bluegrasses harvested on July 26, 1979.

Treatment	kg/ai/A	Weight[a]	
		Merion	Pennstar
		g	
Mefluidide 2S	0.42	360	506
MBR 18337 2E	0.14	452	451
MBR 18337 2E	0.28	474	541
MBR 18337 2E	0.56	610	500
PP 333 2G	1.68	43	79
PP 333 2G	3.36	7	11
PP 333 50W	4.48	3	11
EL 500 50W	0.56	340	353
EL 500 50W	1.12	170	235
EL 500 50W	2.24	47	111
EL 500 50W	3.36	31	69
EL 500 1G	0.56	295	288
EL 500 1G	1.12	276	251
EL 500 1G	2.24	94	71
EL 500 1G	3.36	52	53
Check	0.00	331	351

[a]Area of plot harvested had been mown at 7 cm on June 7, 1979. Weight represents growth for 50 days.

Table 4. The effect of four growth retardants applied April 28, 1979, on the seedhead inhibition of Merion and Pennstar Kentucky bluegrasses.

Treatment	Rate (kg ai/A)	Seedhead Inhibition	
		Merion	Pennstar
		%	
Mefluidide 2S	0.42	96	99
MBR 18337 2E	0.14	95	97
MBR 18337 2E	0.28	99	99
MBR 18337 2E	0.56	99	99
PP 333 2G	1.68	8	38
PP 333 2G	3.36	50	63
PP 333 50W	4.48	60	75
EL 500 50W	0.56	5	8
EL 500 50W	1.12	10	45
EL 500 50W	2.24	10	68
EL 500 50W	3.36	13	48
EL 500 1G	0.56	3	3
EL 500 1G	1.12	3	3
EL 500 1G	2.24	8	28
EL 500 1G	3.36	50	45
Check	0.00	0	0

Table 5. The effect of EL 500 and PP 333 applied April 26, 1979 on the culm length of Merion Kentucky bluegrass measured July 23, 1979.

Treatment	Rate (kg ai/A)	Culm Length (cm)
PP 333 2G	1.68	12.4
PP 333 2G	3.36	9.4
PP 333 50W	4.48	9.3
EL 500 50W	2.24	14.8
EL 500 50W	3.36	13.2
EL 500 1G	2.24	15.6
EL 500 1G	3.36	12.4
Check	0.00	28.3

Table 6. The moisture level of soil under Merion Kentucky bluegrass that was treated with four growth retardants on April 26, 1979. Soil moisture was measured on June 26, 1979.

Treatment	Rate (kg ai/A)	Soil Moisture (%)
Mefluidide 2S	0.42	10.0
MBR 18337 2E	0.14	12.1
MBR 18337 2E	0.28	10.1
MBR 18337 2E	0.56	10.4
PP 333 2G	1.68	11.7
PP 333 2G	3.36	13.2
PP 333 50W	4.48	11.6
EL 500 50W	0.56	10.8
EL 500 50W	1.12	11.4
EL 500 50W	2.24	11.1
EL 500 50W	3.36	12.3
EL 500 1G	0.56	11.3
EL 500 1G	1.12	10.9
EL 500 1G	2.24	10.7
EL 500 1G	3.36	13.7
Check	0.00	10.0

Table 7. The effect of four growth retardants applied April 26, 1979, on the density of Merion and Pennstar Kentucky bluegrasses. Density counts were made June 2, 1980.

Treatment	Rate (kg ai/A)	Density Counts[a]	
		Merion	Pennstar
Mefluidide 2S	0.42	11.0	16.0
MBR 18337 2E	0.14	17.8	16.3
MBR 18337 2E	0.28	17.3	12.5
MBR 18337 2E	0.56	15.8	19.3
PP 333 2G	1.68	14.3	19.0
PP 333 2G	3.36	11.8	22.5
PP 333 50W	4.48	17.0	26.3
EL 500 50W	0.56	11.8	14.5
EL 500 50W	1.12	16.3	22.0
EL 500 50W	2.24	9.5	15.3
EL 500 50W	3.36	14.5	22.0
EL 500 1G	0.56	12.0	24.8
EL 500 1G	1.12	14.8	20.0
EL 500 1G	2.24	15.0	16.0
EL 500 1G	3.36	16.0	22.5
Check	0.00	10.5	13.8

[a]Number of tillers in a 988 m^2 sample.

Effects of EL-500 on a Kentucky Bluegrass:Red Fescue Turf

K.A. Hurto [1/]

ABSTRACT

EL-500 and mefluidide were applied to a Kentucky bluegrass:red fescue turf to evaluate growth retardation and turfgrass injury. All treatments suppressed shoot growth but differed in extent of injury. Under mid-summer stress conditions, high rates of EL-500 caused unacceptable turfgrass injury. EL-500 provided longer periods of growth suppression than mefluidide. Mefluidide was more effective than EL-500 in seedhead suppression. Combinations of EL-500 plus mefluidide improved seedhead control but reduced quality at rates evaluated. Mowing treated plots 2 weeks after growth regulator applications reduced seedhead appearance and improved turfgrass quality.

INTRODUCTION

Chemical agents for reducing turfgrass mowing requirements have been investigated over the years; yet chemical growth retardants are not used extensively on fine turfs because of phytotoxic effects to the turf or because they have been ineffective in reducing vertical shoot growth, or both. The objective of this research was to compare the phytotoxic effects and growth retardation of EL-500 with mefluidide (N-[2,4-dimethyl-5-[[(trifluormethyl) sulfoyl]amino]phenyl]acetamide) on a Kentucky bluegrass (*Poa pratensis* L.):red fescue (*Festuca rubra* L.) turf.

MATERIALS AND METHODS

Separate experiments were conducted in 1979 and 1980 on a mature 'Baron' Kentucky bluegrass:'Pennlawn' red fescue polystand growing on a Typic Udifluvent (Hadley silt loam) at the South Deerfield Turfgrass Research Center in South Deerfield, Massachusetts. The turf had been maintained at 3.8 cm cutting height, fertilized twice annually to supply 0.8 kg N/are/yr, and irrigated to prevent wilt.

1979 experiment. Treatments were applied April 20, 1979 to plots measuring 1.8 by 3.0 m that were replicated three times in a randomized complete block design. At the time of treatment, Kentucky bluegrass had initiated shoot growth, but the red fescue was still dormant. Growth regulator treatments included EL-500 at (1.1, 1.6, 2.2 and 3.4 kg/ha as 50% wettable powder (50W) and 1% granular (1G) formulations; mefluidide at 0.4 kg/ha as a 240g/ℓ salt formulation; and an untreated check. On June 12, half of each plot was cut with a rotary mower to 5 cm, the clippings harvested, and retreated. Granular formulations were applied by hand and sprayable formulations were applied in 106ℓ/ha water. Vertical shoot growth, seedhead development, and turfgrass injury were recorded.

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1980 experiment. Treatments were applied May 12, 1980 to plots measuring 1.5 by 4.5 m that were replicated three times in a split-plot, randomized complete block design. The plots were actively growing when treated and had been cut to 5 cm on May 5, 1980. Growth regulator treatments were EL-500 50W at 0.8, 1.6, and 3.4 kg/ha; mefluidide 2S at 0.4 kg/ha; EL-500 plus mefluidide at 1.6 plus 0.3 kg/ha; and an untreated check. Sub-plot treatments were initiated to determine the effects of mowing on seedhead development and turfgrass appearance. Mowing treatments included: no mowing, mowing 2 weeks after treatment, mowing 2 weeks after treatment and then monthly. Vertical shoot growth, seedhead development, and turfgrass injury were recorded.

RESULTS AND DISCUSSION

1979 experiment. April 20 applications of EL-500 were effective in suppressing vertical shoot growth, but were ineffective in suppressing seedhead development (Table 1). Granular formulations gave better shoot growth suppression but resulted in more injury than spray treatments, particularly on red fescue. This may be due to the application of EL-500 prior to spring-green-up of red fescue. Mefluidide was ineffective in reducing shoot development when applied this early.

Retreating plots extend growth suppression beyond that of single applications. Higher rates resulted in severe injury, however. Granular applications were more effective than spray treatments this may be due to the low spray volume and lack of rainfall immediately after treatment. Mefluidide provided good growth suppression with minimal turfgrass injury.

1980 experiment. Turfgrass response to mefluidide was apparent within a week of application. Shoot growth suppression was good, but injury was noticeable as a dull, blue-green discoloration of the leaves. EL-500 growth suppression lagged behind mefluidide but provides longer periods of growth control (Table 2). However, injury from EL-500 was more pronounced and increased under mid-summer stress. Turfgrass injury symptoms included a yellow-cast to the turf with some tip - die back. Upon closer examination of individual plants it became apparent that most injury was associated with older, elongated tissue. Younger tissue and basal tiller development had good color with no tissue necrosis, but since this tissue was located in the lower regions of the plant canopy they did not contribute to quality ratings. Combination treatments increased turfgrass injury and vertical growth suppression.

Seedhead control was ineffective with EL-500. Mowing treated plots 2 weeks after growth regulator application improved turfgrass appearance by removing elongated flowering culms and leaf growth (Table 3). Subsequent seedhead development occurred after initial mowing on Kentucky bluegrass plants, but these seedheads were not removed by mowing, reflecting the reduction in flowering stem elongation by EL-500 treatments.

EL-500 shows strong potential as a growth regulator in fine turf providing summer stress is not too severe. Seedhead development was not inhibited by EL-500. This study demonstrates that mowing 2 weeks after treatment improves turfgrass quality by removing flowering stems in EL-500 treatment plots. Alternatively, combinations of lower rates of EL-500 plus mefluidide may increase seedhead control and vertical shoot growth suppression, and reduce potential turfgrass injury associated with high rates of EL-500.

Table 1. Effects of chemical growth retardants on growth of a Kentucky bluegrass:red fescue turf in 1979.

Treatment	Form[a]	Rate[b] kg/ha	Turfgrass Injury[c] 5/29	6/12	7/3	8/1	9/5	Seedheads 6/12	Shoot Growth[d] 6/12 ht	wt	Shoot Growth[d] 9/12 ht	wt
								(#1.7 ft^2)	(cm)	(g)	(cm)	(g)
EL-500	1G	1.1	6.7	7.0	7.3	7.0	9.0	34	10.6	24.7	11.0	34.2
"		1.0 + 1.0			6.3	5.3	6.3				7.8	15.7
"		1.6	6.7	6.7	6.3	6.0	6.7	33	8.4	21.2	9.4	19.3
"		1.6 + 1.6			6.3	5.3	6.3				6.7	7.7
"		2.2	6.0	6.3	6.3	6.0	6.3	52	8.2	17.1	9.8	33.4
"		2.2 + 2.2			6.3	4.3	6.0				5.9	5.8
"		3.4	5.3	6.3	5.3	6.0	6.0	35	8.4	9.2	9.0	19.4
"		3.4 + 3.4			5.3	4.3	4.7				5.2	5.3
EL-500	50W	1.1	8.7	9.0	8.7	9.0	9.0	65	12.3	38.5	14.0	69.0
"		1.1 + 1.1			8.7	9.0	9.0				9.7	35.4
"		1.6	8.7	9.0	8.0	8.7	9.0	51	10.3	32.8	11.4	40.8
"		1.6 + 1.6			8.0	7.7	8.3				9.5	16.7
"		2.2	8.0	8.3	8.0	8.3	8.7	41	8.2	20.1	11.8	50.8
"		2.2 + 2.2			8.0	7.0	8.3				9.1	21.3
"		3.4	7.0	7.7	7.0	7.3	8.0	38	7.7	16.4	12.3	41.8
"		3.4 + 3.4			6.7	5.0	6.3				8.3	12.1
Mefluidide	2S	0.4	9.0	9.0	9.0	8.7	8.3	50	22.6	80.9	17.7	69.8
"		0.4 + 0.4			8.3	8.7	8.0				7.6	16.9
Untreated, unmowed			9.0	9.0	9.0	9.0	9.0	59	22.1	76.6	15.9	64.2
Untreated, mowed 6/13					8.0	8.3	8.7				9.7	27.9

[a] Formulations include: granules (G), wettable powders (W), and salts (S).

[b] Treatments were applied on April 20, 1979 and again on June 13 to plots mowed the day before.

[c] Turfgrass injury was visually estimated on a scale of 9 through 1, with 9 representing no injury and 1 complete necrosis. Ratings below 7 indicate unacceptable turfgrass injury.

[d] Vertical shoot height was measured as height of sward excluding seedheads. Shoot dry weights were for an area 2.4 ft^2.

Table 2. Effects of chemical growth retardants on growth of a Kentucky bluegrass:red fescue turf in 1980.

Treatment[a]	Rate	Turfgrass Injury[b]				Shoot Dry Weight			Seedheads
	kg/ha	5/28	6/11	7/1	7/14	5/28	6/23	7/14	7/14
						(% untreated)			(#/ft^2)
EL-500	0.8	8.5	7.3	7.2	5.8	50	33	52	71
"	1.6	8.0	6.5	5.8	3.8	36	13	22	46
"	3.4	7.7	4.7	4.6	2.1	32	13	9	31
mefluidide	0.4	5.0	4.7	7.2	8.1	17	22	54	2
EL-500 + mefluidide	1.6 + 0.3	5.3	4.8	3.3	4.2	15	1	11	12
untreated	-	9.0	9.0	9.0	7.3	100	100	100	77

[a]Treatments were applied May 12, 1980.

[b]Turfgrass injury was visually estimated on a scale of 9 through 1, with 9 representing no injury and 1 complete necrosis. Ratings below 6 indicate unacceptable turfgrass injury.

Table 3. Effects of mowing frequency on turfgrass quality and seedheads in a Kentucky bluegrass:red fescue turf.

Treatment	Rate kg/ha	Turfgrass Quality[a] 6/11	7/1	7/14	Seedheads[b] 7/14
unmowed					
EL-500	0.8	6.8	6.5	5.0	6.1
"	1.6	5.9	5.1	3.2	5.4
"	3.4	6.0	4.3	2.0	4.7
mefluidide	0.4	4.7	7.0	8.0	1.7
EL-500 + mefluidide	1.6 + 0.3	4.7	3.3	4.0	1.3
untreated	-	9.0	9.0	6.0	6.3
mowed 2 weeks					
EL-500	0.8	7.8	7.3	6.2	2.7
"	1.6	7.1	5.9	4.0	2.9
"	3.4	7.0	4.3	2.3	2.7
mefluidide	0.4	5.0	7.7	8.0	1.0
EL-500 + mefluidide	1.6 + 0.3	4.7	3.3	4.0	1.3
untreated	-	9.0	9.0	7.7	1.7
mowed 2 weeks and 4 weeks					
EL-500	0.8	7.8	7.8	6.2	1.0
"	1.6	7.1	6.3	4.3	1.0
"	3.4	7.0	5.0	2.0	1.0
mefluidide	0.4	3.0	7.0	8.3	1.0
EL-500 + mefluidide	1.6 + 0.3	4.7	3.3	4.7	1.0
untreated	-	9.0	9.0	8.3	1.0

[a] Turfgrass quality was visually estimated on a scale of 9 through 1, with 9 representing ideal quality. Ratings below 6 were unacceptable.

[b] Seedhead appearance was visually rated on a scale of 1 through 9, with 1 representing no adverse affect of seedheads on turfgrass appearance. Ratings greater than 4 indicate that seedheads were above the turf canopy.

POSTEMERGENCE CRABGRASS CONTROL IN A MIXED TURFGRASS SWARD

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ABSTRACT

Experiments were conducted at Rutgers University Turfgrass Research Center, North Brunswick, N. J. Experiments were run during August and September in mixed turfgrass swards containing perennial ryegrass, fine fescue, crabgrass, and creeping bentgrass.

Creeping bentgrass was killed by 0.25 lb/A BAS 9052 OH. A non-ionic spreader and an oil concentrate were used as adjuvants. There were no differences in activity due to adjuvants. BAS 9052 OH was used alone and in combination with conventional postemergence crabgrass herbicides. Fine fescue and perennial ryegrass recovered from 1.0 lb/A BAS 9052 OH. Good crabgrass control was obtained in fine fescue and perennial ryegrass at 0.25 lb/A.

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EFFECTS OF EXCESSIVE LEVELS OF SOME POSTEMERGENT CRABGRASS HERBICIDES ON TUFCOTE BERMUDAGRASS AND PENNCROSS CREEPING BENTGRASS[1/]

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ABSTRACT

Postemergent crabgrass herbicides; DSMA, MSMA, PMA and siduron, were applied at excessive rates onto 'Tufcote' bermudagrass to evaluate phytotoxicity, recuperative time and rooting effects. Severe phytotoxicity was incurred by MSMA (4.0, 6.0 lb ai/A), DSMA (7.4, 11.1 lb ai/A) and PMA (13.2 oz ai/A). Phytotoxicity was much more severe when applications were made at 95°F than at 85°F or 88°F. Turf recovered from injury induced by MSMA, DSMA and PMA within 2 weeks, conversely, phytotoxicity caused by siduron progressed over time. Herbicides did not appear to cause any significant, deleterious effects upon rooting. 'Penncross' bentgrass was more prone to phytotoxicity and recuperated more slowly than bermudagrass. Excellent control of mature crabgrass (*Digitaria ischaemum* (Schreb.) Muhl.) plants was achieved with DSMA (3.7 lb ai/A) and MSMA (2.0 lb ai/A), but not with PMA (4.4 oz ai/A) or siduron (8.0 lb ai/A).

INTRODUCTION

Bermudagrass (*Cynodon dactylon* L. Pers) is becoming a widely used sports turf in southern Maryland. Crabgrass (*Digitaria ischaemum* (Schreb.) Muhl. and *D. sanguinalis* (L) Scop), becomes a weed problem in bermudagrass turf when density deteriorates due to wear injury from late fall and spring sporting events on dormant turf. Preemergent herbicides are often ineffective because herbicide barriers are disrupted by spring time sporting activities. These herbicides may also retard rooting at nodes of bermudagrass stolons during the summer. For these reasons, postemergent herbicides are generally used to control annual grassy weeds during summer in bermudagrass turf.

The methanearsonates and PMA can be phytotoxic and are particularly injurious when applied during hot weather (1). Phytotoxicity, exacerbated by high summertime temperatures and misuse such as improper overlapping has led to the reluctance on the part of turfgrass managers to utilize these herbicides. The objectives of this investigation were to evaluate the extent of phytotoxicity, the amount of time needed for recovery, and the effects of rooting from over application of postemergent crabgrass herbicides on 'Tufcote'

1/Scientific article No.A2895and Contribution No. 5949 of the Maryland Agriculture Experiment Station, Dept. Agron., Univ. of Maryland, College Park.

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bermudagrass. Also studies were the phytotoxic effects of postemergent herbicides and crabgrass control efficacy using recommended rates on a 'Penncross' creeping bentgrass turf.

MATERIALS AND METHODS

These investigations were conducted in 1980 at the University of Maryland Plant Research Farm on a 'Tufcote' bermudagrass turf. The statistical design was a randomized complete block with three replications and plot size was 5 ft x 5 ft. Herbicides were applied with a CO_2 powered, single nozzle boom sprayer at 40 psi. The rates, (Table 1) were the recommended rate, twice recommended rate and three times recommended rate using a dilution of 100, 200 and 300 gallons per acre, respectively. The herbicides were applied to the same plots on 3 occasions: July 7 (sunny, 85°F), July 15 (sunny, 95°F) and July 22 (sunny, 88°F). Plots were irrigated on July 17.

Herbicides applied were: MSMA (monosodium acid methanearsonate), DSMA (disodium methanearsonate), PMA (phenylmercuric acetate) and siduron ((1-(2-methylcyclohexyl)-3-phenylurea)). Rates used appear in Tables 1,2. The bermudagrass was weed free, therefore, herbicides were also applied at recommended rates to a 'Penncross' bentgrass turf, Agrostis palustris Huds., infested with mature (tillering) crabgrass, D. ischaemum, to evaluate efficacy of control. Herbicides were applied as previously described.

To obtain dry root weight measurements, 3 inch diameter plugs about 1" deep were removed from the plots with a cup cutter 2 weeks after the final application of herbicides. Three plugs were taken from each plot and individually potted in a standard 5 inch plastic pot containing a coarse sand growing medium. The pots were arranged randomly on a greenhouse bench. Leaves were trimmed weekly and pots were watered daily. On September 4 the plugs were removed from their pots and the sand was gently washed from the roots. The roots were severed from the plugs at the soil-sand interface, oven dried at 150°F for 72 hours, and weighed.

Phytotoxicity was visually estimated using a 0-5 scale where 0=green turf, with no discoloration and 5=brown turf. All data were analyzed using the analysis of variance and means separated using the Least Significant Difference multiple comparison test.

RESULTS AND DISCUSSION

Data were not collected following the initial application because no significant discoloration was observed.

On July 17, two days following the second application, notable differences were evident. MSMA (4.0, 6.0 lb ai/A) and DSMA (7.4, 11.1 lb ai/A) treated plots had highest injury ratings (Table 1). The aforementioned MSMA levels caused significantly more injury than any other treatment. MSMA (2.0 lb ai/A), and PMA (13.2 oz ai/A), had also caused appreciable discoloration. PMA (4.4, 8.8 oz ai/A) and DSMA (3.7 lb ai/A) plots exhibited some minor yellowing. No discoloration was observed on plots treated with siduron. However, thirteen days

following the second application (July 28), all MSMA, DSMA and PMA treated plots had either partially or totally recovered from injury (Table 1). Conversely, siduron treatments, particularly the two highest rates, were showing significant levels of discoloration. Rather than brown or yellow, discolored turf in siduron plots was blue-gray in color and plants appeared stunted.

Seven days following the third application of herbicides (August 6), it was noted that DSMA, MSMA and PMA plots had sustained only slight discoloration. Plants and seed heads in siduron plots, especially at 16 and 24 lb ai/A rate, were stunted, and leaves were a purple-blue color. Plants treated with siduron at 16 and 24 lb ai/A rate maintained a purple-blue color for about four weeks. By mid-September the purple-blue leaf color had dissipated, and plots appeared dark green in color. The dark green color remained conspicuous until turf became dormant in early November. Although not quantified, there was a low to moderate reduction in turf density at the two higher siduron rates.

Dry root weight data indicate that no significant reduction in root recuperative potential had been incurred as a result of herbicide use (Table 1). Plugs taken from MSMA (6.0 lb ai/A) and siduron (24 lb ai/A) treated plots had produced the lowest dry root weight yields, but data did not significantly vary from the check. Plugs treated with the lowest siduron rate, had produced significantly higher root weight yields than all other treatments.

Results showed that degree of severity was affected more by temperature than by rate. Discoloration was most severe following application when air temperature was 95°F. Only moderate, short-lived yellowing of the turf had occurred when chemicals were applied at 85 °F and 88°F. Despite extensive injury to bermudagrass turf by high rates of MSMA and DSMA, applied on a sunny, hot day, turf had dramatically recuperated within 2 weeks. This was attributed to the aggressive nature and rapid growth rate of 'Tufcote' bermudagrass.

Unlike 'Tufcote' bermudagrass, 'Penncross' creeping bentgrass was seriously injured by MSMA (2.0 lb ai/A) and DSMA (3.7 lb ai/A) (Table 2). PMA (4.4 oz ai/A) caused some yellowing, and siduron (8.0 lb ai/A) was non-injurious. Although not quantified, the methanearsonates, under the test conditions imposed, caused an unacceptable level of phytotoxicity and loss of density. The arsonates did, however, provide an excellent level of crabgrass control (Table 2).

LITERATURE CITED

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Table 1. Turfgrass injury from postemergent herbicides on Tufcote bermudagrass evaluated on three occasions and dry root weights of plugs removed from treated plots 14 days after third application of herbicides.

Treatment	Rate	INJURY RATING[1,2,3] 7/17	7/28	8/6	Dry Root Weights[4]
	(ai/A)				(mg)
MSMA 6L	2.0 lb	1.8	0.0 d	0.0 e	117 bc
MSMA 6L	4.0 lb	3.7a	0.0 d	0.5 d	130 bc
MSMA 6L	6.0 lb	4.0a	0.2 d	0.5 d	105 c
DSMA 3.6L	3.7 lb	1.2 d	0.2 d	0.0 c	134 bc
DSMA 3.6L	7.4 lb	2.2 bc	0.2 d	0.5 d	138 bc
DSMA 3.6L	11.1 lb	2.7 b	0.3 cd	0.5 d	131 bc
Siduron 50WP	8.0 lb	0.0 f	0.7 c	1.0 c	200a
Siduron 50WP	16.0 lb	0.0 f	1.6 b	3.0 b	153 b
Siduron 50WP	24.0 lb	0.0	3.0a	4.0a	104 c
PMA (10% ai)	4.4 oz.	0.7 e	0.4 d	0.5 d	150 bc
PMA (10% ai)	8.8 oz.	0.8 de	0.5 d	0.5 d	135 bc
PMA (10% ai)	13.2 oz	1.4 cd	0.5 d	0.6 d	112 bc
Check	---	0.0 f	0.0 d	0.0 e	137 bc
LSD 5%	---	0.6	0.4	0.2	46.7

[1]Means followed by the same letter in the same column are not significantly different at the 5% level according to LSD multiple comparison test.
[2]Mean visual estimates based on a 0-5 scale where 0=green turf and 5=brown turf.
[3]Herbicides applied July 7, July 15 and July 22, 1980.
[4]Plugs were grown in coarse sand for 23 days in a greenhouse.

Table 2. Turfgrass injury from postemergent herbicides on 'Penncross' creeping bentgrass evaluated on two occassions and percent plot area colonized by crabgrass, and percent crabgrass control.

	Rate	INJURY RATING[1,3] 7/17	8/6	Plot Area[2] Colonized by Crabgrass	Crabgrass Control[4]
	(ai/A)			----------%----------	
MSMA 6L	2.0 lb	2.5a+	2.7a	0.2 c	99
DSMA 3.6L	3.7 lb	2.7a	2.0 b	0.1 c	99
Siduron 50WP	8.0 lb	0.0 c	0.0 c	5.8 bc	63
PMA (10 % ai)	4.4 oz	1.0 b	0.5 c	9.0 b	43
Check	---	0.0 c	0.0 c	15.7a	--
LSD 5%	---	0.5	0.6	6.6	--

[1]Means followed by the same letter in the same column are not significantly different at the 5% level according to LSD multiple comparison test.
[2]Percent plot area colonized data are visual estimates.
[3]Herbicides applied on July 7, July 15 and July 22, 1980.
[4]Data were recorded 7 days following termination of experiment.

CONTROL OF *ARISTIDA* SPP. IN THE RENOVATION OF ROADSIDE TURFGRASSES

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ABSTRACT

Attempts to renovate deteriorating stands of roadside turfgrasses by overseeding and fertilization have been unsuccessful in areas where prairie three-awn (*Aristida oligantha* Michx.) and churchmouse three-awn (*Aristida dichotoma* Michx.) have become the dominant species. Field trials and review of literature suggested that allelopathy as well as competition played a significant role in inhibiting germination and growth of newly-seeded perennial grasses such as red fescue.

In a field experiment red fescue was seeded in rows by itself or adjacent to rows of *A. oligantha* or red fescue. Plots were irrigated and fertilized to minimize competition for water and nutrients. Germination and growth of red fescue growing next to the *Aristida* was significantly reduced. In bioassay experiments, aqueous extracts of *A. oligantha* shoot tissue inhibited germination and growth of red fescue as well as several other perennial grasses which are components of Rhode Island's highway seed mix. Aqueous extracts of root tissue were less inhibitory than shoot extracts. Germination of red fescue was inhibited when seeded in pots containing soil amended with ground *Aristida* shoot tissue. However, germination was not affected when red fescue was seeded in the pots one month after the ground tissue was incorporated into the soil, suggesting that the phytotoxin may be rapidly deactivated in the soil.

Main plots on a highway median covered almost exclusively by *A. dichotoma* and occasional plants of *A. oligantha* were overseeded (Jacobsen disc seeder) in the fall and following spring with red fescue. Subplots were treated with siduron or bensulide in the spring, or left untreated. Siduron resulted in complete control of both species of *Aristida*. Bensulide was less effective, providing approximately 75 percent control. At the end of the first growing season, percent cover by red fescue plants was significantly greater in plots treated with siduron (42% cover) or bensulide (24%) than in control plots (6%).

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RECENT INNOVATIONS IN HERBICIDE APPLICATION EQUIPMENT

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ABSTRACT

A tractor mounted sprayer unit containing several Micromax controlled droplet applicators was compared with a conventional sprayer using flat fan nozzle tips. Efficacy of several chemicals including glyphosate for quackgrass control and 2,4-D, dinoseb, and paraquat on various annual weed species was evaluated. No differences could be detected between sprayer units.

A drift comparison between sprayers was also obtained by spraying 2,4-D perpendicular to the wind direction. Tomato plants were set downwind at various distances from the spray swath. Two wind velocities were obtained. Visual injury ratings were taken two weeks after treatment.

A 5.4 to 8.1 km/hr wind resulted in significant injury up to 9M with the conventional sprayer, while no injury was observed from the Micromax (see Figure 1). A 16.1 to 24.2 km/hr wind resulted in significant injury up to 18.5 M with the conventional sprayer, and 1.5 M with the Micromax (see Figure 2).

Comparison of Conventional and Micromax Applications of Glyphosate and Surfactant to Quackgrass.

Applicator	Glyphosate Rate (kg/ha)	Total % Surf.	Treatment Mean[2/]	
Micromax	1.11	0.84	2.36	b*
"	1.11	1.67	1.74	b
"	2.22	1.67	1.87	b
8002 nozzle tips	1.11	0.125	5.71	b
"	1.11	0.84	6.54	b
"	1.11	1.67	0.77	b
"	2.22	0.25	2.98	b
"	2.22	1.67	1.56	b
Untreated	0	0	47.96	a

[2/] Dry wt. in gms. Harvested Sept. 30, 1980.
* Treatment means with different letters are significantly different at the 0.05 probability level.

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Figure 1. Comparison of 2,4-D Drift between Conventional and Micromax Sprayers. (Wind velocity = 5.4 to 8.1 km/hr).

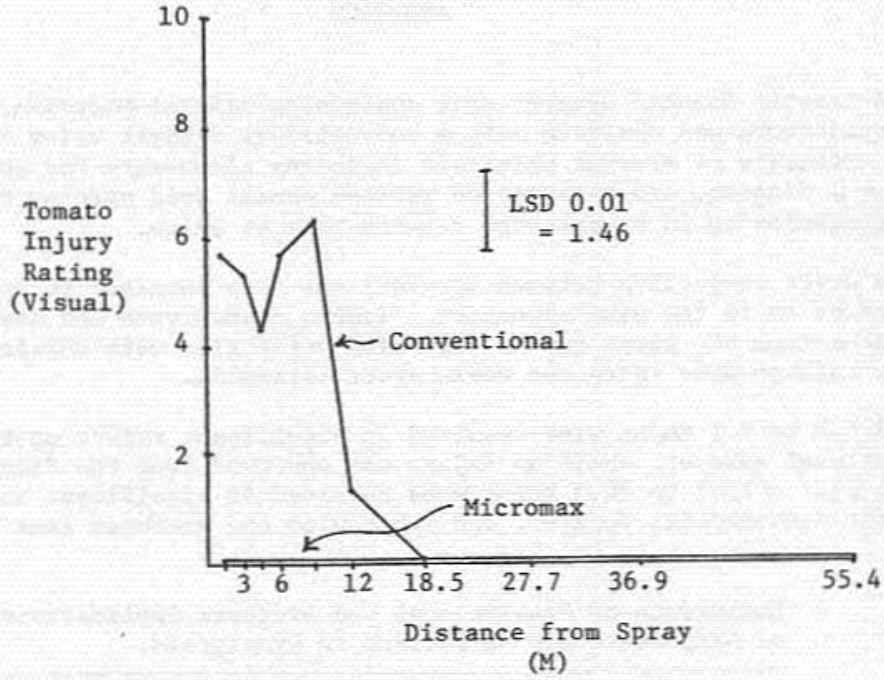
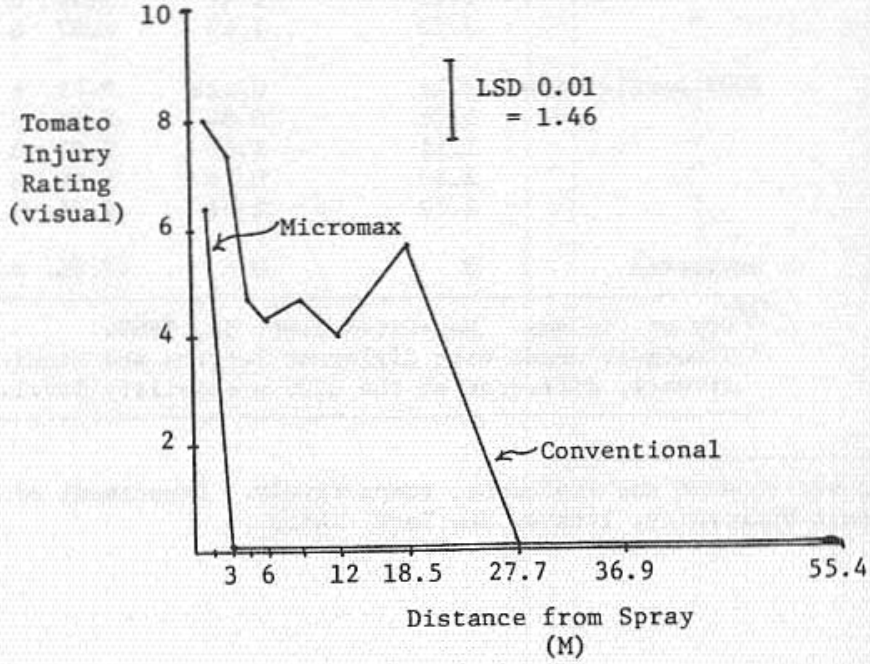


Figure 2. Comparison of 2,4-D Drift between Conventional and Micromax Sprayers. (Wind velocity = 16.1 to 24.2 km/hr).



A SELF-FEEDING, HAND-HELD HERBICIDE WIPER

W. V. Welker[1/]

ABSTRACT

Many methods have been used to improve herbicide selectivity, including directed sprays, foams, and granular formulations. More recently, a number of devices which apply contact herbicides such as the recirculating sprayer, the roller applicator, the ropewick applicator, and the endless belt wiper, have been employed to selectively control weeds that are taller than the crop. Their greatest usefulness has been for large scale applications. These are all major pieces of equipment that require the use of a tractor or similar device to transport them.

I will describe a simple wiping device that is easily carried by an individual and effective in controlling weeds. Its greatest usefulness is in spot-treating, scattered weed stands. Details depicting its construction are shown in Figure 1. The device consists of a hockey stick that has been fitted with a self-feeding herbicide reservoir. A plastic tube is attached to the top surface of the hockey stick. Several small holes are placed in the tubing along the blade. The blade of the hockey stick is enclosed in sponge that is covered with a protective cloth. A reservoir containing the herbicide is carried on a backpack. The reservoir is connected to the hockey stick by means of a quick coupler attached to a plastic hose. An air valve in the top of the reservoir provides an open gravity fed system which avoids the need for pressurization. A trigger from a handsprayer is attached to the tubing at the top of the hockey stick and is used to control the flow of herbicide solution into the sponge on the blade of the hockey stick. When more herbicide solution is needed the operator squeezes the trigger and the solution flows by gravity down the tube and wets the sponge. The supply can likewise be restricted when not needed to avoid over supply and prevent dripping. Sufficient quantity of herbicide solution can be carried in the reservoir to wipe a considerable area.

The hockey stick applicator has been used in cranberry bogs to apply herbicide to weeds that are taller than the cranberry vines. It also has been successfully used in orchards to spot-treat weeds, particularly perennials, that have not been controlled with a standard weed control program. Perennial weeds growing beneath blueberry bushes have been effectively controlled. This was done without contacting the stems of the blueberry bush, thus avoiding injury. By adding a shield over the top of the blade, the same wiper can be used to wipe weeds beneath ornamental plantings. The shield lifts and protects the ornamental from contact with the wiper.

Applying herbicides using a wiping technique such as this affords selectivity otherwise unobtainable. Greater safety to the operator is also achieved by avoiding the use of sprays.

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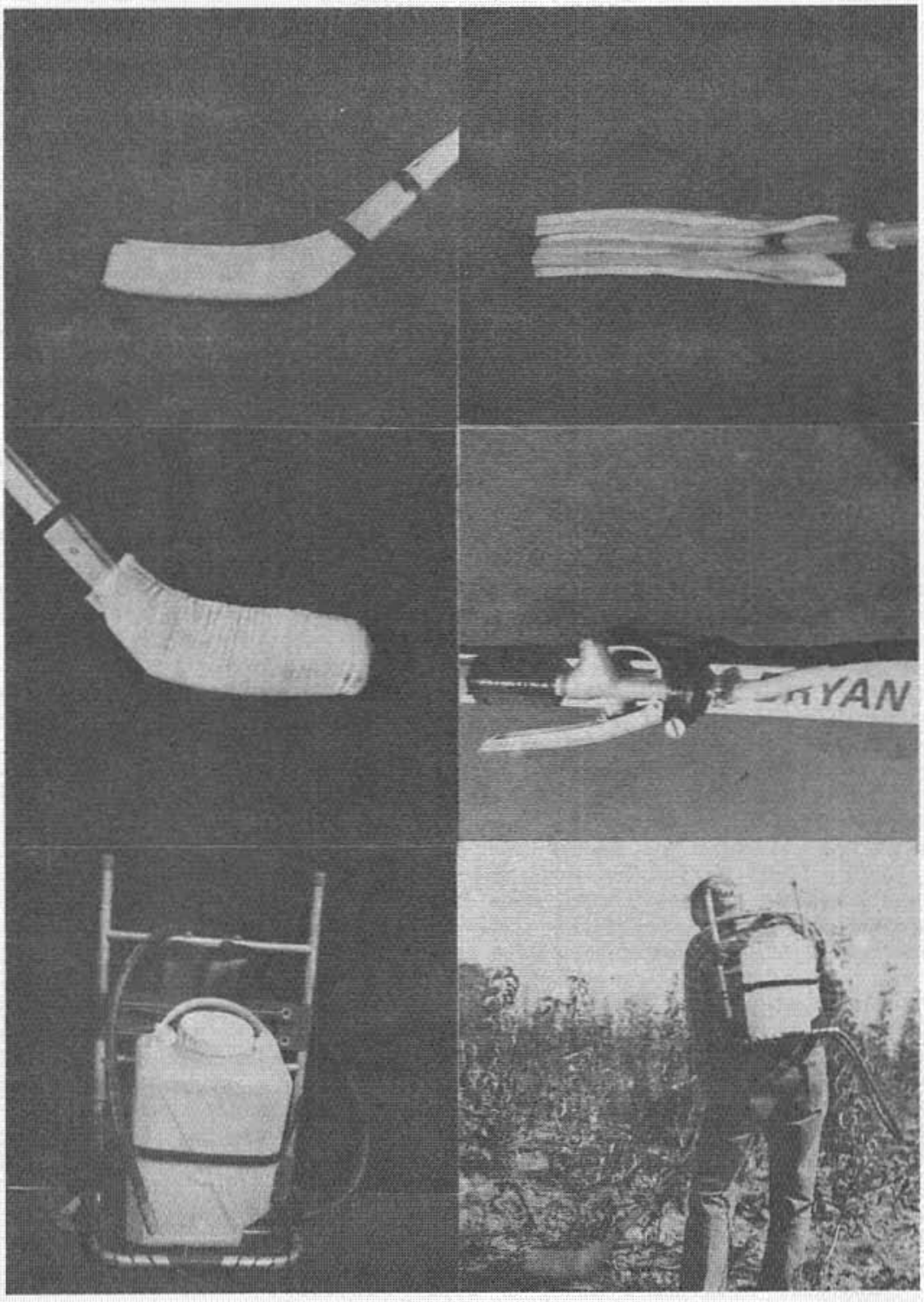

Figure 1. Construction of self-feeding herbicide wiper: (top left) plastic tube attached to blade of hockey stick; (top right) blade of hockey stick inserted in sponge; (center left) protective cloth enclosing sponge; (center right) trigger attached to feeder tube; (lower left) reservoir and feeder line on backpack; (lower right) wiper in use.

TRICKLE IRRIGATION AS A RESEARCH TOOL

W. H. Mitchell[1/]

ABSTRACT

Trickle irrigation has been used successfully in field research plots for over six years. Although used primarily for the distribution of water, the emitter lines have functioned well as a carrier system for nitrogen solutions and herbicides. Emitter lines can be placed on the soil surface for flexibility and ease of installation or below the plow sole for improved water distribution and reduced cost. Soil texture, topography, and water quality must be considered when designing a system. Lateral length and spacing and operating pressures are other important considerations when striving for uniform application of water. Trickle irrigation systems make possible efficient use of land since only a 3 m distance between irrigated and non-irrigated plots is required to eliminate border effects. Irrigation of row crops can be achieved with relatively small amounts of water because of reduced evaporation and band placement of water.

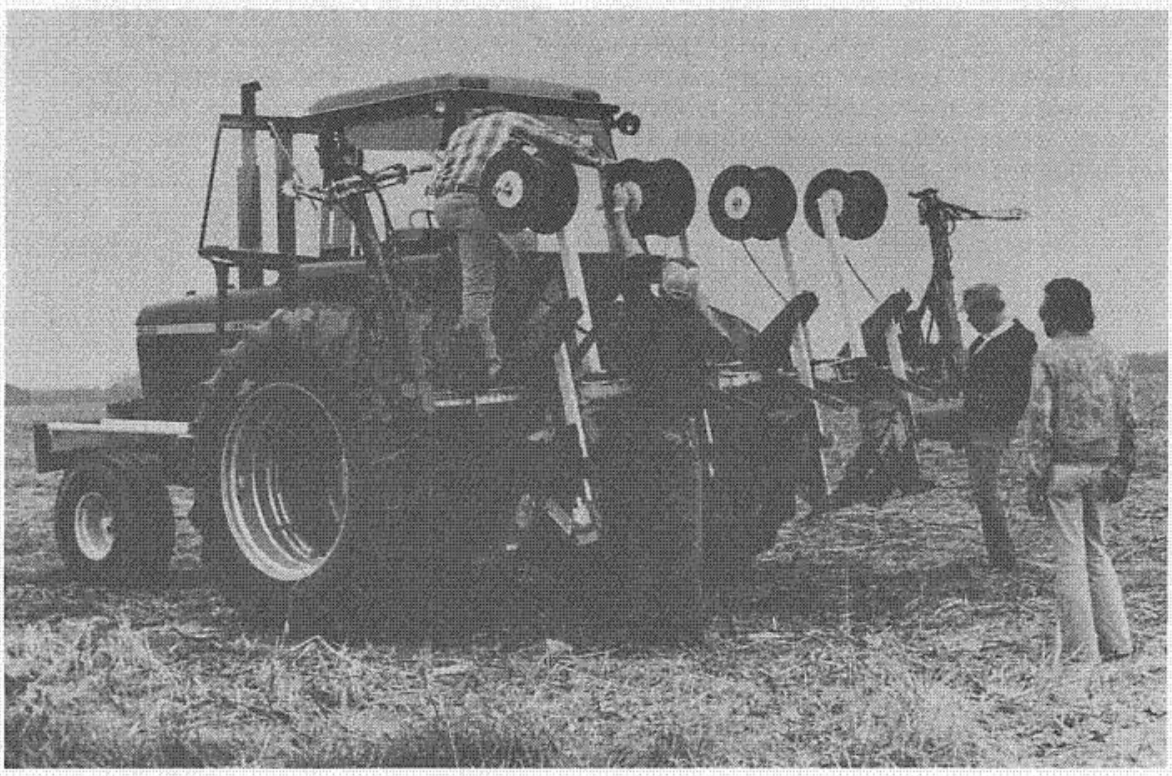

Fig. 1. Subsoiling machine modified for the installation of subsurface irrigation tubing at the University of Delaware.

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SPRAYER CANOPIES FOR DIRECTED APPLICATION OF HERBICIDES

D. L. Regehr[1/]

ABSTRACT

Two types of sprayer canopies were constructed for trial use in 1980. The first was a plywood box measuring 30 cm x 30 cm x 150 cm, open on the bottom, with 7 sprayer tips spaced 20 cm apart. This canopy, mounted underneath an IH Cub, is used to cut and maintain alleys in experimental plots through application of knockdown herbicides. Plot markers are placed in the center of an alley and the canopy application is centered over the row of markers. This procedure reduces plot layout time and also leaves markers more visible. Weed regrowth in alleyways is reduced since the soil is not tilled. Application of preemergence residual herbicide could further reduce weed recovery.

The second sprayer canopy was used to apply selective postemergence herbicides in a band over soybean rows. These sprayer "tunnels" measured 25 cm x 25 cm x 76 cm and were constructed of galvanized sheet metal. Each row had 3 sprayer nozzles with hollow cone tips. The advantage of the tunnel is that wind drift is much reduced. The disadvantage is that sprayer dimensions and angles are set, and soybeans beyond the first trifoliate size are too large to be treated with the tunnel.

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WILD BEAN CONTROL ON CRANBERRY BOGS WITH MALEIC HYDRAZIDE 1/

Robert M. Devlin and I.E. Demoranville 2/

ABSTRACT

The growth regulator herbicide maleic hydrazide (MH) will give commercially acceptable control of wild bean, an important weed found in the cranberry bogs of southeastern Massachusetts. Berry size and yield are adversely affected by MH and vine damage can be observed when high rates are used (33.6 and 67.2 kg/ha). Treated cranberries and water adjacent to treated areas were analyzed for MH residue.

INTRODUCTION

Wild bean (Apios americana Medic.) is a major weed problem in the cranberry growing regions of Massachusetts. At the present time there is no reliable control for this weed other than hand-weeding, a method hardly adequate considering the vigorous growing habits of wild bean on cranberry (Vaccinium macrocarpon Ait.) bogs.

Heavy infestation of wild bean presents the cranberry grower with a major economic problem. The bog must be scraped off and rebuilt, a very costly process when you consider the grower will not be able to harvest a crop until three years after planting. In Massachusetts the total cost of rebuilding

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a bog, including two non-productive years, is approximately $10,000/A.

In the present study the growth regulator herbicide, MH (1,2-dihydro-3,6-pyridazinedione), was tested on infested cranberry bog and the data collected indicate that MH gives commercially acceptable control of wild bean

MATERIALS AND METHODS

Control of wild bean by MH was tested at two separate locations of the State Bog that were heavily infested with the weed. At both locations MH was applied July 1, 1977 at 0, 5.6, 11.2, 16.8, and 33.6 kg/ha. At each location there were 4 replicates and plots ($6.4m^2$) were randomized within replicates. Application was made with a hand compressed air knapsack with an adjustable cone nozzle at a rate equivalent to 2260 l/ha. Wild bean control was evaluated September 8. Another set of plots was established to evaluate the tolerance of cranberry growth and development to MH. The section chosen was relatively free of weeds and possessed a consistent stand of vines. There were 4 replicates and plots ($6.4m^2$) were randomized within replicates. MH was applied June 28 at 16.8, 33.6, and 67.2 kg/ha. On September 8 the plots were hand scooped, the berries immediately weighed, and size determined by the number of berries required to fill a standard 250 cc cranberry measuring cup. Subsamples were taken from each sample at harvest and immediately frozen for later analysis for MH residue (2).

Water samples for residue analysis were collected upstream and downstream of the treated areas, 2 and 72 days after MH application (1). Also, water samples were collected directly from the treated areas when those areas were flooded 72 days after application.

RESULTS AND DISCUSSION

Application of 5.6 and 11.2 kg/ha MH gave unsatisfactory control of wild bean. To obtain commercially acceptable control 16.8 kg/ha of the herbicide had to be applied (Table 1). Doubling that rate to 33.6 kg/ha gave only a small improvement in wild bean control and caused slight vine damage (Table 1).

Berry size and yield were adversely affected by MH. Although berries treated with 16.8 and 33.6 kg/ha MH were

considerably smaller than untreared berries, there was little difference in berry size between the two treatments (Table 1). Berry size was even further reduced by treating the plots with 67.2 kg/ha MH (Table 1).

Table 1. Effect of MH on wild bean control, cranberry vine damage, berry size, and yield.

Rate (kg/ha)	Wild Bean Control[a] Location #1	Location #2	Vine Damage[a]	Berry Size	Yield (kg/ha)
0	0	0	0	84.8	13,755
5.6	4.8	5.5	-	-	-
11.2	6.5	7.5	-	-	-
16.8	8.0	9.5	0	117.3	2,301
33.6	9.5	10.0	2.8	116.0	2,229
67.2	-	-	4.5	132.0	668

[a] Weed control and vine injury rated on a scale of 1-10; 1 represents no effect and 10 complete control.

It is obvious from Table 1 that MH dramatically reduces yield. Plots treated with 16.8 or 33.6 kg/ha MH had an 83% drop in yield while plots treated with 67.2 kg/ha showed a drop in yield of 95% (Table 1).

The average amount of MH residue found in berries treated with 16.8 kg/ha MH was 10.7 ppm and in those treated with 33.6 kg/ha, 21.8 ppm. No MH was found in water samples collected upstream and down stream from treated areas. This was also true for samples taken directly from treated areas when those areas were flooded.

When a cranberry bog has a serious infestation of wild bean the grower must consider rebuilding his bog. This costly process can be avoided by treating the bog with MH. The penalty to the grower would be a very large drop in yield in the year that the bog is treated. However, with a heavy infestation of wild bean even less yield is expected and, of course, low yield situation can be expected every year until control is established. The results of this study suggest that 16.8 kg/ha MH would be the best rate to use for the control of wild bean on cranberry bogs.

ACKNOWLEDGEMENTS

We express our gratitude to Uniroyal, Inc., Bethany, CT for the residue analyses on the berry and water samples from this study.

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ASULAM FOR BRAKEN CONTROL IN LOWBUSH BLUEBERRY FIELDS

D. E. Yarborough and A. A. Ismail[1]

ABSTRACT

No chemical is currently registered to selectively control braken fern {Pteridium aquilinum (L.) Kuhn} in lowbush blueberry (Vaccinium angustifolium Ait.) fields. A mid-summer application of asulam significantly reduced the number of braken fronds emerging the year after application. A linear decline of 27% to 95% reduction in braken fronds corresponded to the 0 to 7.5 kg/ha rates of asulam applied.

INTRODUCTION

Braken fern {Pteridium aquilinum (L.) Kuhn} has been identified as a problem weed in lowbusn blueberry {Vaccinium angustifolium Ait.} fields (3). It is usually associated with post-logging sites (4) and has not been considered a severe weed problem in most fields. However, sporadic patches of the fern shade blueberries and hinder harvesting. Trevett (7) reported braken fern to be very resistant to 2,4-D. No other herbicide is currently registered for the control of braken fern in lowbush blueberry fields in Maine. Mechanical methods of control are not considered practical.

Asulam {methyl(4-aminobensulphonyl)carbarmate} is reported to reduce braken frond density by 97% at 4.4 kg/ha in forage applications (8). Ericaceous shrubs, including V. myrtillus (like V. myrtilloides Michx.), when mature are not affected by asulam (2). Canadian researchers (5) have reported asulam at 2.5 and 5.0 kg/ha has satisfactorily controlled braken fern without injury to lowbush blueberry bushes and is currently registered for braken control in Canada (1).

The objective of the experiment was to compare the efficacy of several rates of asulam to control braken fern in lowbush blueberry fields.

MATERIALS AND METHODS

Plots 1.5 by 6.1 m were established on a first year growth commercial lowbush blueberry field in Columbia Falls, Maine. Experimental design was in randomized complete block with five treatments and six replications. On 6, July, 1979, when the braken fern were at full frond, asulam at 0, 0.9, 1.9, 3.7 or 7.5 kg/ha was applied with a pneumatic boom sprayer at 276 kPa pressure in 190 L/ha water carrier.

Ferns were counted before treatment and one year later. Data were analyzed with regression analysis with an F test, at a single degree of freedom, used to determine significance (6).

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RESULTS AND DISCUSSION

Pretreatment braken fern stand ranged from 30 to 47 fronds per 9.2 m^2 plot with no significant variation in the population. One year after treatment, a highly significant linear decline associated with an increase in asulam rate was evident (Table 1). The fern population was reduced by 27% for the control to a 94% for the 7.5 kg/ha asulam treatment. The decline for the control may have been due to competition from increases in other weeds such as sweet fern {Comptonia peregrina (L.) Coult.}, bush honeysuckle (Diverilla lonicera Mill.) and dogbane (Apocynum androsaemifolium L.), which appeared to increase the second year.

Visually, little evidence of control the first year due to the treatments. Some chlorosis on the blueberries and some necrosis on the braken ferns was observed at the 3.7 and 7.5 kg/ha rates of asulam. However, asulam application resulted in an 80% decrease in braken population with as little as 0.9 kg/ha asulam. A more in-depth study is needed for labeling this material. Asulam registration would allow blueberry growers to selectively control braken fern in lowbush blueberry fields.

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Table 1. Effect of Asulam on Braken Fern

Application rate (kg/ha)	Pre-treatment (1979) braken population ($9.2m^2$ plot)	Post-treatment (1980) braken population ($9.2m^2$ plot)	Change in braken population (%)
0	30	20	-27
0.9	44	9	-80
1.9	47	7	-81
3.7	46	1	-98
7.5	46	2	-94
F test	ns[a]	L**	L**

[a] F test was non-significant (ns), significant at the 1% level (**), (L) indicates linear trend from regression analysis.

INHIBITION OF ROUGH CINQUEFOIL SEED GERMINATION BY ETHYLENE

R. B. Taylorson and S. Suzuki[1/]

ABSTRACT

Light stimulated germination of rough cinquefoil (*Potentilla norvegica* L.) seeds is greatly inhibited by less than 1 μl/L ethylene. Seeds may escape from the ethylene inhibition by delaying ethylene treatment until 24 hours after the irradiation, similar to an escape from phytochrome control. The inhibition may be reversed by simply releasing the gas and providing a brief irradiation with red light. Alternating temperature or gibberellic acid overcomes the inhibitory action of ethylene. We interpret these findings as indicating the ethylene is loosely held on a site(s) that interferes with phytochrome action and that alternating temperature might displace the ethylene from the site.

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