THE EFFECT OF APPLICATION AND TILLAGE METHOD ON THE ACTIVITY OF BUTYLATE FOR CORN WEED CONTROL

R. W. Witmer, R. L. Ritter and T. C. Harris[1]

ABSTRACT

Herbicides can be impregnated on dry fertilizers allowing the herbicide and fertilizer to be applied at the same time. This is beneficial to farmers because it allows them to make fewer trips across the field thereby saving time and energy. An experiment was conducted at the University of Maryland Plant Research Farm in Silver Spring, MD, to determine whether applications of butylate impregnated on dry fertilizer were as effective as liquid applications for control of fall panicum in different tillage systems.

The experiment was arranged as a split split block design. Main plots consisted of primary tillage methods. These included moldboard plow, chisel plow, offset disc, tandem disc and no-tillage. The sub plots consisted of herbicide treatments which were stripped across the main plots. This included the use of butylate at 4 lb ai/A plus atrazine at 1.5 lb ai/A tank mixed and applied as a liquid spray, impregnated on dry fertilizer, or no herbicide applied at all. The sub sub plots consisted of incorporating the herbicide treatments 4 to 6 inches deep either once or twice with a tandem disc operating at 5 to 6 mph and run perpendicular to the main plots. The sub sub plots resulted in a plot 15 feet wide (6 corn rows on 30 inch centers) and 50 feet long. The sub sub plots were replicated three times.

The entire test was established on May 3, 1982. The soil was a Croom-Chillum gravelly loam (pH 6.3, O.M. 1.5). Pioneer 3184 was the hybrid used. The liquid spray applications were made with a pto driven tractor sprayer that delivered 30 gpa and 30 psi. The plots which had a liquid spray also received 1000 lb/A of a 16-8-8 fertilizer. This same fertilizer was used for the impregnated treatments by spinning it in a cement mixer and spraying in the proper amount of butylate plus atrazine. It was then applied to the field with a drop spreader. All herbicide treatments were incorporated within 6 hours of application. Visual ratings of weed control were made based on a scale of 0 to 100 with 0 equal to no control and 100 equal to total control. None of the plots were cultivated. Yields were obtained from all plots with a standard field combine.

When averaged across all other variables, there was no difference in weed control between liquid or impregnated applications. When the application methods are compared between the primary tillage systems, there was a trend for increased weed control with the liquid applications except under no-tillage conditions. Under no-tillage situations the impregnated fertilizer afforded better grass control. In general, better weed control was obtained where moldboard plowing or tandem discing were the primary tillage methods. Where the herbicide applications were disced in twice there was also a trend for better weed control.

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EFFECTS OF FALL PANICUM DENSITIES AND PLANTING DATES OF CORN ON BIOMASS YIELDS OF FALL PANICUM AND CORN 1/

M.W. Beale and R.D. Ilnicki 2/

ABSTRACT

This study was conducted to compare the competitive effects of fall panicum on corn biomass and corn on fall panicum at three planting dates and four harvest dates at different fall panicum densities. This study of field corn (var. Midstates 747) and fall panicum interactions was conducted during the 1982 season at the Adelphia Research Center, New Jersey Agricultural Experiment Station, Adelphia, N.J.

The experimental design was a split plot design replicated four times with planting dates comprising whole plots and corn with fall panicum competition or without fall panicum competition as split plots. A Freehold sandy loam soil was conventionally tilled and planted at 25,000 p/A in 30" rows on May 6, May 14, and May 27. Split plots measured 19' by 37.5' with corn planted in nine rows. Corn with or without fall panicum competition was evaluated at four weed infestations established by various levels of alachlor at 1.0 lb/A, 0.66 lb/A, 0.33 lb/A, and 0.00 lb/A representing check, low, medium, and high weed infestations, respectively.

Corn grain yields were greatest in the second planting date (May 14) at medium fall panicum densities. Corn silage yields were highest at lower fall panicum densities and greatest when planted May 6. Overall grain and silage yields were highest at lower fall panicum densities. Silage yields were highest when planted early while grain yields were highest at later planting dates.

1/ New Jersey Agricultural Experiment Station Publication No. J-15274-1-82

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Controlled Droplet Application (CDA) of Glyphosate for Quackgrass Control

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ABSTRACT

Field studies were conducted in 1982 to evaluate the activity of glyphosate for quackgrass control following low volume controlled droplet application (CDA) compared to similar volumes using conventional nozzles. Glyphosate was applied with CDA units at 9.34 l/ha (1 GPA), 18.67 l/ha (2 GPA), 37.35 l/ha (4 GPA), and 149.39 l/ha (16 GPA) or with conventional nozzles at 18.67, 37.35, and 149.39 l/ha. Glyphosate rates of 0.56 and 2.24 kg/ha were sprayed via each application procedure. The surfactant MON-0818 (the surfactant in the commercial glyphosate formulation) was used to obtain concentrations ranging from 0.12 to 7.51% (v/v) in the spray solutions. The 0.12% surfactant concentrations was that associated with a 0.56 kg/ha formulated glyphosate rate at the 149.39 l/ha spray volume. Other surfactant concentrations increased relative to either increased glyphosate rate or lower spray volume. When using the lowest spray volume of the CDA units, glpyphosate at 0.56 kg/ha was also applied using straight vegetable oil (93% soybean:7% emulsifier) instead of water as a carrier. This was accomplished by mixing the glyphosate with vegetable oil and spraying directly without adding water.

Visual ratings and quackgrass stand counts revealed that glyphosate was more effective applied with the CDA than with conventional nozzles. Early control ratings and stand counts also suggested better control of quackgrass with glyphosate when vegetable oil instead of water was used as a carrier.

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Protection of Corn From Selected Herbicides with Naphthalic anhydride

Jean Buker and Scott Glenn[1/]

ABSTRACT

Field tests were conducted in Silver Spring, Maryland, on a Beltsville silt loam soil with pH of 7.0 and an organic matter content of 2.3%. The study was conducted as a completely randomized block design with three replications. Each plot consisted of three 7.6 m rows spaced 76 cm apart, of which two rows were treated. Pioneer 320 corn (Zea mays L.) was planted on May 18 with or without a seed treatment of 1% (w/w) naphthalic anhydride. MBR-20457 and MBR-23709 were applied preemergence at 2.24, 3.36 and 4.48 kg/ha to treated or untreated corn, while MBR-22359 was applied preemergence at 2.24 and 3.36 kg/ha to treated and untreated corn. The entire study was kept weed-free through-out the growing season. MBR-20457 showed the greatest crop damage 4 weeks after planting causing 80 to 90% crop injury without seed treatment, but only 5 to 7% crop injury when the corn seed was treated with naphthalic anhydride. Crop injury from MBR-23709 and MBR-22359 ranged from 3 to 13% and 17 to 25%, respectively. Seed treatment with naphthalic anhydride reduced crop injury only with MBR-22359. By the 6-week rating, damage on naphthalic anhydride treated plots was more visible. Seed treatment with naphthalic anhydride increased yields of plots treated with MBR-20457. Yields of plots treated with MBR-20457 ranged from 4040 kg/ha to 5250 kg/ha with untreated seed and 6425 kg/ha to 7305 kg/ha with the naphthalic anhydride seed treatment. There was no difference in yields due to seed treatment with naphthalic anhydride in plots treated with MBR-23709 and MBR-22359.

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DIFFERENTIAL RESPONSE OF CORN HYBRIDS TO SELECTED HERBICIDE APPLICATIONS

J. E. Zawierucha and N. L. Hartwig

ABSTRACT

Each season there are reports of corn injury from properly applied, labelled herbicides. A small percentage of this type of injury is not unusual due to the narrower safety margins of some herbicides, as well as, environmental interactions. However, the literature suggests that genetic lines of corn vary in tolerance to several herbicides. This study was initiated to evaluate suspected susceptible hybrids grown in Pennsylvania. Hybrids selected were based upon information gathered from the Extension Service and seed corn companies. These hybrids were suspected of being sensitive to either EPTC+R-25788, butylate+R-25788, alachlor, or metolachlor.

A field study was conducted at the Rock Springs Agronomy Farm in 1982 on a Hagerstown silt loam soil. Treatments consisted of four herbicides at the recommended rates, and six hybrids arranged in a split-split plot arrangement with four replications. Injury ratings (as a % of stand showing symptoms), stand counts, height, and yield were measured. Results presented in Table 1 indicate that the injury rating variation was significant among herbicides for each hybrid. Additionally, there were some significant reductions in plant height across herbicide for certain hybrids. These data suggest that hybrid tolerance to all herbicides was not the same. However, stand counts (from % germ) and resultant yield data suggests that the observed injury and stunting was not severe enough to cause a significant impact on yield.

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Table 1. Herbicide effects on injury and yield of selected corn hybrids.

Hybrid	Herbicide[1/]	% Germ	Height[2/]	% Injury[3/]	Bu/A
1	1	93a[4/]	154a	3.9a	113a
	2	94a	140b	3.3a	108a
	3	90a	138b	2.4b	108a
	4	93a	142b	1.9b	108a
2	1	96a	127a	0.8a	124a
	2	98a	127a	0.0c	117a
	3	96a	124a	0.7ab	122a
	4	96a	124a	0.2bc	122a
3	1	96a	134a	1.1c	135a
	2	94a	126b	0.0d	132a
	3	89a	118c	3.7a	106b
	4	93a	118c	2.4b	122a
4	1	94a	142a	3.0a	118ab
	2	96a	140ab	2.5a	123ab
	3	96a	136b	2.1a	118b
	4	96a	137b	0.4b	133a
5	1	94a	135a	2.1a	120ab
	2	91a	139a	0.0c	103c
	3	92a	132a	1.5b	110bc
	4	91a	133a	1.1b	129a
6	1	97a	140a	0.9b	131a
	2	99a	136ab	0.0c	124a
	3	96a	124c	1.9a	121a
	4	97a	130b	1.6a	125a

1/ Herbicide and Rate:

1 = EPTC+R25788 at 6 lb ai/A;
2 = Butylate+R25788 at 6 lb ai/A;
3 = Metolachlor at 2.5 lb ai/A;
4 = Alachlor at 2.5 lb ai/A.

2/ Ht in cm - just prior to tassel emergence.

3/ % Injury = % of stand exhibiting symptoms at the 4-6th leaf stage.

4/ Hybrid means followed by the same letter do not differ at the 5% level according to Duncan's multiple range test.

TOLERANCE OF CORN TO PENDIMETHALIN AS AFFECTED BY PLANTING DEPTH

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Abstract: The effect of pendimethalin was investigated on the viability of corn seedings (*Zea mays*, L.) at different planting depths. Pendimethalin was applied preemergence to corn sown in root boxes and grown in the greenhouse. No phytotoxic symptoms were observed with planting depths of 3.8 and 5.1 cm (1.5 and 2.0 in.) at any rate tested. Phytotoxic symptoms were observed in corn planted at the shallowest depth (1.3 cm or 0.5 in) and slight injury was observed at 2.5 cm (1.0 in). At the recommended rates of pendimethalin and seeding depths of corn, phytotoxicity did not occur.

INTRODUCTION

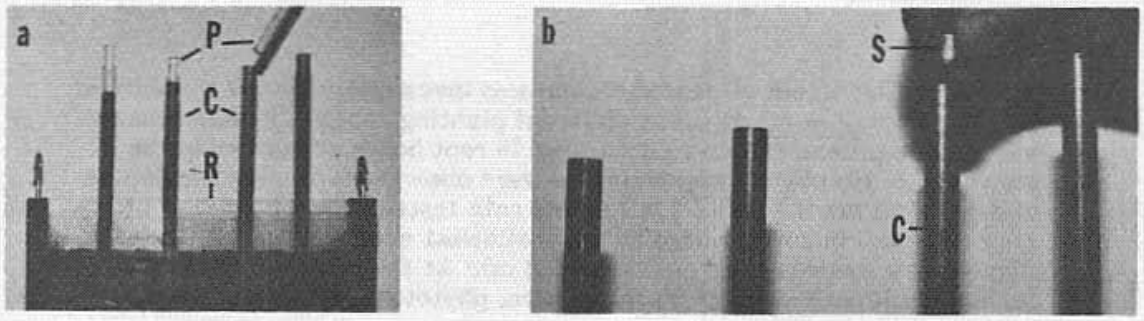
Dinitroaniline herbicides are known to cause injury to corn seedlings (1.3). The phytotoxic effects include stunting and twisting of plants, leaf malformation, purple discoloring and root inhibition. Of the dinitroanilines, pendimethalin (N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine) does not cause damage to crops when properly used (e.g. 4). Pendimethalin is used preemergence, early postemergence and lay-by for the control of grass weeds in corn. The effect of preemergence-applied pendimethalin on corn seedlings planted at different depths was the subject of this study. The results are discussed with reference to label recommendations.

MATERIALS AND METHODS

Corn (*Zea mays* L. 'Pioneer 3780') seeds were planted in a Georgia loamy sand soil (organic matter was 0.5%). The soil was placed in root boxes with clear plastic fronts (4). Seeds were planted 1.3, 2.5, 3.8 and 5.1 cm (0.5, 1.0, 1.5 and 2.0 in.) using a calibrated cylinder with a plunger (Figure 1). A cylinder (calibrated) with a plunger was placed into soil to desired depth. The plunger was removed and the seed was added, embryo downward. The cylinder was removed and the seed was covered with soil.

The soil was brought to field capacity with tap water. On the following day, pendimethalin was applied preemergence at rates of 1.5, 1.0, 0.75 and 0.5 a.i. kg/ha using a laboratory sprayer. The solutions were made from a commercial 4EC formulation and sprayed at 190 L/ha (20 gpa). Root boxes were kept in the greenhouse where temperatures ranged between 20 to 40°C. At 4 or 5 day intervals, 0.5 cm of tap water was added to each root box for 2 weeks. Phytotoxicity was determined 3 weeks after treatment.

Figure 1: Cylinder-Plunger technique used to plant corn seeds at specific depth in root boxes. a. Cylinder insertion; b. Seed planting. C = cylinder (graduated by 0.5 inch increments to 2 inches), P = plunger (keeps clinder clear of soil), R = root box, S = corn seed (dropped through cylinder).



RESULTS

Corn seedlings exposed to 0.5 kg/ha pendimethalin had no visible signs of phytotoxicity regardless of the planting depth (Table I). Phytotoxicity was not evident in any seedling planted at 3.8 or 5.1 cm (1.5 or 2 in.) depths. After a 1.0 kg/ha pendimethalin treatment, phytotoxic symptoms appeared in approximately 60% and 10% of seedlings planted at 1.3 cm and 2.5 cm (0.5 and 1.0 in.) depths (Figure 2). Phytotoxicity was not evident in corn planted 3.8 and 5.1 cm (1.5 and 2.0 in.) deep. The symptoms of phytotoxicity observed were little or no root growth, severely inhibited stem growth, twisting of plants and leaves, and purpling of leaf sheaths and blades.

Table I: Percent of corn seedlings showing phytotoxic symptoms after preemergence application of pendimethalin.

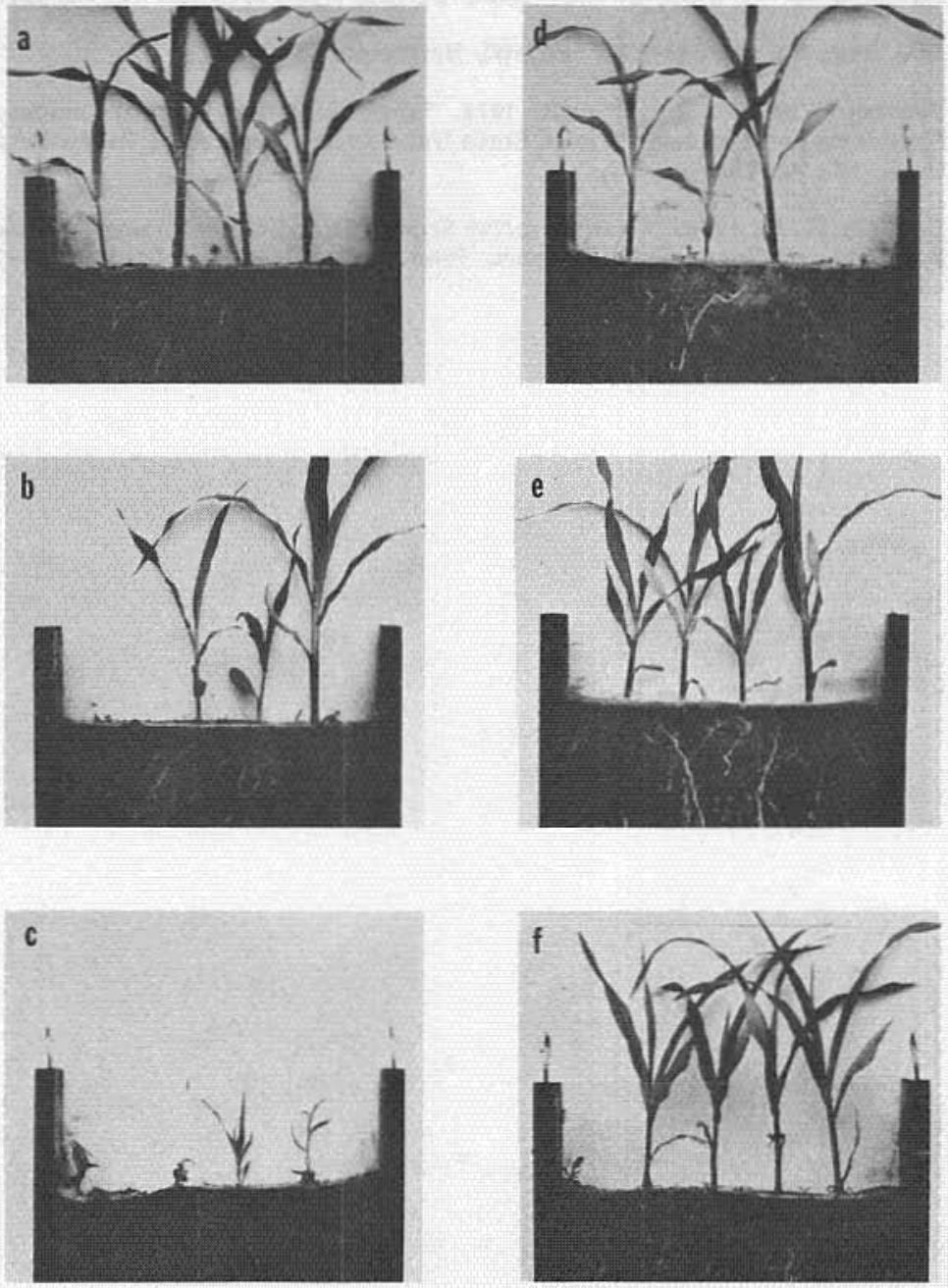
Pendimethalin Rate (kg/ha)	Planting Depth (cm)			
	1.3	2.5	3.8	5.1
0	0	0	0	0
0.50	0	0	0	0
0.75	10	10	0	0
1.0	60	10	0	0
1.5	60	10	0	0

DISCUSSION

The registration (2) of pendimethalin for preemergence application in field corn stipulates: 1) "Plant corn at least 1-1/2 inches (3.8 cm) deep.", 2) For loamy sands with less than 1.5% organic matter, pendimethalin is to be applied at 0.75 to 1.0 lb/acre (0.84 to 1.12 kg/ha). The results in this test agree with the label.
Injury due to pendimethalin was not oberved on corn seedlings planted 1.5 or 2 inches (3.8 or 5.1 cm) deep. Even 1.5 kg/ha (50% above the recommended rate) did not adversely effect the seedlings. Therefore, planting depths of corn must be considered when using pendimethalin for preemergence weed control.

Figure 2: Corn seedlings planted at different depth and treated preemergence with 1.0 kg/ha pendimethalin.

Treatment: a. 1.5 in (3.8 cm), b. 1.0 in (2.5 cm), c. 0.5 in (1.3 cm) planting depths.
Check: d. 1.5 in (3.8 cm), e. 1.0 in (2.5 cm), f. 0.5 in (1.3 cm) planting depths.



LITERATURE CITED

1. Blair, B. D., R. I. Abrams, M. J. Anderson, C. D. Bremer, W. S. Craig, J. P. Downs, C. R. Edwards, J. B. Eisley, C. W. Ellett, J. M. Ferris, J. M. Good, D. L. Keith, E. L. Knake, D. E. Kuhlman, and H. J. Stockdale. "Corn Pest Management for the Midwest." North Central Regional Publ. No. 98, pp. 119.

2. EPA Reg. No. 241-243-AA. "PROWL Herbicide." pp. 5-7.

3. Jennings, V.M. and R. F. Nyvall. 1978. "Misapplied Row Crop Herbicides: Symptoms and Problems." Iowa State University, Cooperative Extension Service Publ. No. Pm 738, pp. 6-7.

4. Pavlista, A. D. 1980. A Comparative Study of Pendimethalin and Trifluralin on Soybeans and Cotton Root Systems. Proc. South. Weed Sci. Soc. 33:257-267.

THE EFFECTIVENESS OF A SEED TREATMENT ANTIDOTE IN SOYBEANS [1/]

I.M. Detlefsen and R.D. Ilnicki [2/]

ABSTRACT

The objective of this study was to determine whether an experimental antidote applied as a seed treatment could be effectively used in reducing the injury symptoms experienced by soybeans to vernolate.

Soybean seeds were treated with five concentrations of SC1030, an experimental antidote for vernolate, formulated as a liquid and a solid, approximately three weeks prior to planting. The rates of the antidote used were 0.0, 0.0025, 0.005, 0.01, and 0.015 percent by weight. The seed was then planted to plots treated with preplant soil-incorporated vernolate at 0, 3, 4, 6, and 8 lb/A. The experimental design was a completely randomized split plot with vernolate rates as whole plots and antidote formulation and rates as subplots. The antidotal effects were measured in terms of emergence, seedling vigor, plant height, and fresh and dry weights of soybean seedlings.

It was observed that the solid formulation of SC1030 was somewhat safer than the liquid formulation in reducing the stunting effects of high rates of vernolate. Furthermore, it was noted that high rates of the liquid formulation had a detrimental effect on seedling emergence and vigor in the no vernolate check plots. These reductions in seedling emergence and vigor were not as obvious as the rate of vernolate was increased.

That the antidote could possibly have some growth regulating effects was exemplified by high fresh and dry weights of seedlings, in the no vernolate plots, treated with the lowest concentration of the liquid antidote, along with the lowest fresh and dry weights of seedlings treated with the highest rate of the liquid antidote. The superiority of the solid formulation was further exemplified by the high fresh weight yields of soybean seedlings harvested from plots treated with vernolate at 4 lb/A and higher, where the seeds were treated with the highest rate of the solid formulation. On the other hand, the lowest fresh weights of seedlings were recorded at low rates of vernolate and the highest level of the liquid antidote.

From this preliminary study, the data indicate that the solid formulation of the seed treatment antidote may be better than the liquid formulation, but additional studies are needed before this can be said with confidence.

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THE HERBICIDAL ACTIVITY OF DICAMBA SALTS IN CORN WEED CONTROL SYSTEMS

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ABSTRACT

Six experiments were conducted in 1982 at the Wye Research Center in Queenstown, MD, to examine the herbicidal activity of a number of dicamba salts on broadleaf weed control in field corn. The dicamba salts used in these studies included the following: CN-10-4359T (1), (2), (3) and (1) (W) (alumninum salts), CN-10-6471 (potassium salt), CN-10-2913 (calcium salt), and CN-10-1504 (sodium salt), dicamba (sodium salt), and dicamba (dimethylamine salt or DMA).

The soil was a Matapeake silt loam (pH 6.5, O.M. 1.5). Corn (Pioneer 3320, 3184 or 3182) was conventionally planted between May 13 and 17 in 30 inch rows. Individual plots were 4 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 backpack sprayer that delivered 20 gpa at 20 psi utilizing SS-8003 flat fan nozzles. Visual ratings of weed control and crop injury were made based on a scale of 0 to 100 with 0 equal to no control or injury and 100 equal to total control or crop dessication. None of the plots were cultivated. Yields were taken from all plots with a standard field combine.

When the dicamba salts were tank mixed with butylate and applied preplant incorporated, broadleaf weed control was minimal. No corn injury was observed from any of the preplant incorporated treatments. Corn yields were not different from the weedy check due to the lack of weed control.

When applied preemergence as an overlay to butylate, dicamba DMA and high rates of the aluminum salts resulted in poor to fair broadleaf weed control with some crop injury. When tank mixed with alachor or metolachlor and applied preemergence, an increase in broadleaf weed control was obtained with all of the salts in comparison to the butylate overlay. Initially, these preemergence combinations resulted in fair to good control of lambsquarters and velvetleaf. By mid to late season only the high rates of dicamba DMA and the high rates of the aluminum salts showed any degree of broadleaf weed control. These same high rates also resulted in some crop injury but no yield reductions.

When applied postemergence or post-directed, both as an overlay to butylate, few differences were found in broadleaf weed control between the various salts. One of the aluminum salts, CN-10-4359T (1), gave good broadleaf weed control at high rates when applied overtop postemergence, but corn injury also occurred resulting in decreased yields. The potassium salt also resulted in good broadleaf weed control when applied overtop postemergence with minimal crop injury. Postemergence tank mix combinations with alachlor or metolachlor also resulted in few differences between the salts in broadleaf weed control. As in the preemergence study, the higher rates of the salts tested in the postemergence tank mix combinations seemed to provide better weed control. No differences occurred when the salts were compared as post-directed applications to hairy galinsoga. This may have been different if the weed spectrum varied.

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COMBINATIONS OF CHLORAMBEN WITH TRIFLURALIN, PENDIMETHALIN, AND UBI-S734 FOR WEED CONTROL IN SUNFLOWERS[1/]

D. Vitolo, R.D. Ilnicki, and L.C. Horng[2/]

ABSTRACT

Chloramben, trifluralin, pendimethalin, and UBI-S734 alone and in combination, and oxyfluorfen alone and in combination with sethoxydim, were evaluated for their effects on weed control and yields in sunflowers in 1982. None of the herbicides applied caused injury to the crop. Excellent weed control was obtained with pendimethalin and trifluralin alone, and with all combinations of the herbicides studied. No significant differences in yield were found between sequential and tank mix combinations of the herbicides, with the exception of trifluralin + chloramben 0.75 + 2.0 lb/A ppi over trifluralin (ppi) + chloramben (pre) 0.75 + 2.0 lb/A.

Significant yield differences between individual treatments could not be attributed to crop injury or weed control.

INTRODUCTION

Sunflower (*Helianthus Annuus* L. cv Interstate 924) are being considered as a cash crop in New Jersey. As a result there is a need to evaluate established and new herbicides for weed control in this crop. The objective of this study was to compare rates, combinations and sequence of applications of chloramben (3-amino-2,5-dichlorobenzoic acid), with trifluralin (α,α,α-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine), pendimethalin [N-(1-ethylpropyl)-3,4 dimethyl-2,6 dinitrobenzeneamine], and UBI-S734 (2-[1-(2,5-dimethyl phenyl) ethyl sulfonyl]pyridoxine-N-oxide. Oxyfluorfen [2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene), a selective broadleaf herbicide, was evaluated alone and in combination with sethoxydim (2-[1-(ethoxyimino)-butyl]-5-[2-(ethylthio)-propyl]-3-hydroxy-2-cyclohexene-1-one), a herbicide which controls a wide range of grass weeds in braodleaf crops.

MATERIALS AND METHODS

This study was conducted at the Adelphia Research Center, New Jersey Agricultural Experiment Station, Adelphia, New Jersey, in 1982. Treatments were applied to a Freehold sandy loam soil (organic matter 1.5%). Plots size was 18' by 7.5', with 3-rows per plot. The study was conducted utilizing a randomized complete block design with three replications. All herbicide treatments were applied at 40 gpa, using a backpack CO_2-propelled sprayer with water as a carrier. Nozzles were Unijet flat spray tips, number 730616. The dominant weed species growing in the experimental area

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1/New Jersey Agricultural Experiment Station, Publication No. J-15472-3-82.
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were common lambsquarters (*Chenopodium album* L.), redroot pigweed (*Amaranthus retroflexus* L.), and fall panicum (*Panicum dichotomiflorum* Michx.).

Preplant incorporated and preemergence treatments were applied on June 9, 1982. Sunflowers were planted in 30-inch rows at a population rate of 20,000 plants per acre on June 9, 1982. Postemergence treatments were applied on July 1, 1982, at which time sunflower height was 6-8", with 4-6 leaves, fall panicum was 3-6", with 4-5 leaves. Plots were rated for weed control and crop injury on July 23, 1982, using a scale of 0 to 10, where 0 is no effect on weed or crop and 10 is complete control (Table 1). The center row was harvested on September 24, 1982. All yields were converted to pounds per acre (Table 1).

RESULTS AND DISCUSSION

No significant crop injury was observed with any of the treatments investigated alone, UBI-S734, an experimental grass herbicide, did not adequately control broadleaf weeds at 0.5 and 0.75 lb/A. Chloramben and oxyfluorfen alone did not control fall panicum. All other treatments provided excellent broad spectrum weed control (Table 1).

Yields were not significantly different between treatments of chloramben trifluralin, pendimethalin and UBI-S734 alone, with the exception of pendimethalin at 1.0 lb/A ppi. Sunflower yields with pendimethalin applied preemergence at 1.0 lb/A were significantly greater than with pendimethalin at 1.0 lb/A ppi.

There were no significant differences in yield between sequential and tank mix combinations of UBI-S734 or pendimethalin plus chloramben. When trifluralin and chloramben were combined, the only significant difference in yield was between trifluralin + chloramben 0.75 + 2.0 lb/A (ppi) over trifluralin 0.75 lb/A (ppi) plus chloramben 2.0 lb/A (pre).

Significant yield differences between individual treatments could not be attributed to crop injury or weed control.

Table 1. Weed control ratings and yields for preplant incorporated, preemergence and postemergence treatments in sunflowers, Adelphia, N.J., 1982.

Herbicide	Rate, lb.a.i./A	Weed Control[a] Common Lambsquarters	Ragweed	Fall Panicum	Yield[b] lb/A
chloramben 2S	2.0 (pre)	8.1	9.0	1.3	2860
	3.0 (pre)	9.0	10.0	4.0	3132
trifluralin 4L	0.75 (ppi)	9.9	10.0	9.6	3128
	1.00 (ppi)	9.8	10.0	9.6	3111
pendimethalin 4E	1.00 (ppi)	10.0	10.0	9.8	2482
	1.50 (ppi)	9.9	10.0	9.8	3072
	1.00 (pre)	10.0	9.9	8.1	3281
	1.50 (pre)	10.0	9.3	8.8	3181
UBI-S734 4L	0.75 (ppi)	5.0	6.3	10.0	3114
	1.00 (ppi)	7.8	6.5	10.0	2785
	1.50 (ppi)	8.9	8.3	10.0	2871
trifluralin + chloramben	0.75 + 2.0 (ppi)	9.6	10.0	9.8	3280
	0.75 + 3.0 (ppi)	10.0	10.0	9.3	3145
	0.75 (ppi) + 2.0 (pre)	10.0	10.0	10.0	2608
	0.75 (ppi) + 3.0 (pre)	10.0	10.0	9.6	2997
pendimethalin + chloramben	1.0 + 2.0 (pre)	10.0	10.0	8.8	2851
	1.0 + 3.0 (pre)	9.6	10.0	8.1	2844
	1.0 (ppi) + 2.0 (pre)	10.0	10.0	9.6	2837
	1.0 (ppi) + 3.0 (pre)	10.0	10.0	9.6	3119
UBI-S734 + chloramben	0.75 + 2.0 (ppi)	9.8	10.0	10.0	3144
	1.00 + 2.0 (ppi)	10.0	9.6	9.0	2951
	1.50 + 2.0 (ppi)	9.0	10.0	10.0	3116
	0.75 (ppi) + 2.0 (pre)	8.9	10.0	10.0	2827
	1.00 (ppi) + 2.0 (pre)	9.8	10.0	10.0	2701
	1.50 (ppi) + 2.0 (pre)	9.5	9.8	9.0	3028

Table 1 (Cont'd)

Herbicide	Rate, lb.a.i./A	Weed Control[a] Common Lambsquarters	Ragweed	Fall Panicum	Yield[b] Lb/A
oxyfluorfen 2E	.125	10.0	9.8	5.0	2957
	.25	6.5	9.8	3.6	2692
	.38	10.0	10.0	8.3	3102
oxyfluorfen	.125 pre + 0.38 post	9.3	9.3	10.0	3549
foll. by	.25 pre + 0.38 post	10.0	10.0	10.0	3022
sethoxydim 1.53 lb/gal.	.38 pre + 0.38 post	10.0	10.0	10.0	2866
Uncultivated Check		0.0	0.0	0.0	
LSD 0.05					617

(a) Weed Control Rating (0 = No Control; 10.0 = Complete Control) made July 23, six weeks after planting.

(b) Harvest September 24.

Wounded Johnsongrass Response to Glyphosate

J.T. Kirkby and S. Glenn[1/]

ABSTRACT

Field studies were conducted in Washington county, Calvert county, and Wicomico county, Maryland to evaluate the effects of glyphosate on wounded johnsongrass (Sorghum halepense L.). At each location the plot size was 1.2 m by 1.8 m and each treatment was replicated four times and organized as a completely randomized design. A hand-held wick-bar was used to apply glyphosate at 0,11, 22, and 33% to johnsongrass in early bloom. Wounding treatments made on johnsongrass were: uncut, cut immediately before treatment (cut), and cut five days before treatment (precut). Johnsongrass control was greatest for glyphosate treatments made to uncut johnsongrass. This may be due to an increase in surface area exposed to the wick-bar. Control obtained with cut johnsongrass averaged 67% over all glyphosate rates, while johnsongrass control obtained with precut plants averaged 45%.

A greenhouse study was conducted using a randomized complete block design with 4 replications. Glyphosate was applied at 5,10, and 15% to johnsongrass at a locus 10 cm above the soil line using a 1-cm wide sponge-forceps applicator. The treatments and percent control as averaged over all glyphosate treatments were as follows: uncut, 46%; cut and treated on the wound, 58%; cut and treated 1 cm below the wound, 39; precut 24 h prior to treatment 1 cm below the wound, 37%. This study suggests that glyphosate applied directly on a wound is more efficacious than glyphosate applied to non-wounded tissue.

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HERBICIDE PROGRAMS FOR CORN (*ZEA MAYS*)

H. P. Wilson and T. E. Hines[1/]

ABSTRACT

Studies to investigate the activities of several herbicides and herbicide programs for weed and grass control in corn have been conducted at the Virginia Truck and Ornamentals Research Station, Painter. Preemergence and postemergence herbicides were applied to a State sandy loam soil (Typic Hapludult) having a pH of approximately 6.0 and O.M. content of 1.5%. Postemergence incorporated applications of pendimethalin provided late season control of annual grasses with no apparent crop response. Early postemergence applications of pendimethalin with atrazine, and especially with cyanazine, caused visual injury to corn. Treatments of dicamba (CN 10-4359T) were active against common lambsquarters (*Chenopodium album* L.) in all methods applied but preplant incorporated applications were less effective than preemergence and postemergence applications. Large common lambsquarters were slow to respond but final control was good. In other studies, a corn seed treatment of 1,8-naphthallic anhydride failed to prevent early injury from MBR 23709, MBR 20457, and MBR 22359. All three herbicides provided control of annual grasses and permitted yields comparable to those of corn treated with alachlor.

[1/] Plant Physiologist and Agricultural Research Supervisor, respectively, Virginia Truck and Ornamentals Research Station, Painter, VA 23420

SOME PRELIMINARY STUDIES ON THE BIOLOGY AND CONTROL OF BLACK NIGHTSHADE 1/

Trang K. Le and R.D. Ilnicki 2/

ABSTRACT

Since black nightshade (*Solanum ptycanthum* Dunn) infestations are on the increase in New Jersey and the Northeast, it was felt that information on the biology and control of this species was needed.

Germination studies indicated that black nightshade seeds need light to germinate. Seeds stored at room temperature do not germinate in the dark but will germinate when exposed to light for as little as 15 minutes. Imbibed seeds stored at 4 C for two months germinated without a light treatment although the germination was slow.

The effects of pH on germination was also studied. Ranges in pH from 3 to 10 in the germination medium had no effect on germination provided light was available.

Studies on emergence, in the greenhouse, indicated that seeds stored at room temperature did not emerge from depths more than 10 mm; however, cold-treated seeds emerged from depths of 40 mm.

Seeds required alternating temperatures to germinate and they do not germinate well if daytime temperatures are lower than 25 C.

In emergence studies it was observed that seeds began to germinate near the end of May when air temperature reached 25 C and most of the emergence was complete prior to July 15 if the soil was not disturbed. Shading reduced emergence.

In a black nightshade/soybean field competition study with weed densities of 18, 33, and 74 plants/m^2 it was shown that soybean yield was reduced only at the highest weed density and yield was not seriously affected if the competition period was six weeks or less. Yield components affected were number of pods/plant and numbers of branches bearing pods.

From control studies, both in the greenhouse and field, it was found that the dinitroaniline herbicides trifluralin, profluralin, oryzalin, and fluchloralin were not effective in controlling this species up to 2 lb/A; the phenylurea herbicides linuron and chlorbromuron and the acetanilide herbicides alachlor and propachlor were effective for control. Bifenox, oxyfluorfen, and acifluorfen were also effective.

1/ New Jersey Agricultural Experiment Station Publication No. J-15274-2-82.

2/ Graduate Student and Research Professor of Weed Science, respectively, Dept. of Soils and Crops, N.J. Agr. Exp. Sta., Cook College-Rutgers University, New Brunswick, N.J. 08903.

COMPARISON OF SEVERAL NON-SELECTIVE HERBICIDES IN REDUCED TILLAGE SYSTEMS

Robin R. Bellinder and Henry P. Wilson[1/]

ABSTRACT

Two experimental herbicides, AM HOE 00661 (ammonium [3-amino-3-carboxylpropyl]-methylphosphinate) and SC 0224 (chemistry not disclosed), along with glyphosate (N-[phosphonomethyl] glycine) and, in some instances, paraquat (1,1'-dimethyl-4-4'bipyridinium ion) were compared for control of existing weeds in eight field studies conducted from April to September, 1982. AM HOE 00661 exhibited superior control of horseweed (Conyza canadensis (L.) Cronq.), common ragweed (Ambrosia artemisifolia L.), and Pennsylvania smartweed (Polygonum pensylvanicum L.) when compared to glyphosate or SC 0224. Control of common lambsquarters (Chenopodium album L.), large crabgrass (Digitaria sanguinalis (L.) Scop.) and redroot pigweed (Amaranthus retroflexus L.) was better with SC 0224 and glyphosate than with AM HOE 00661. Control of weeds treated with AM HOE 00661 and paraquat frequently diminished with time, while similar plots treated with SC 0224 and glyphosate generally improved when compared over the same period. Mowing prior to application reduced the effectiveness of SC 0224 and glyphosate but had little influence on AM HOE 00661.

INTRODUCTION

The success or failure of reduced or zero tillage crop production models depends upon the control of existing cover crop or weed vegetation at the time of planting. Glyphosate and paraquat, although differing in modes of action, rate of activity, and, to some extent, species controlled, are widely used for this purpose. AM HOE 00661 and SC 0224 both exhibit non-selective properties which would make them useful in reduced tillage systems.

In 1980 and 1981, Kapusta (1) obtained control of ten weed species with AM HOE 00661 that was comparable to that achieved with glyphosate and paraquat. Wilson and Hines (3) reported that AM HOE 00661 provided control of rye (Secale cereale L.) and common vetch (Vicia sativa L.) that equalled or was superior to control provided by glyphosate and paraquat. They also observed that the rate of plant response to AM HOE 00661 was intermediate when compared to paraquat and glyphosate. In other studies, (2) good initial control of fall panicum (Panicum dichotomiflorum Michx.) and field sandbur (Cenchrus pauciflorus Benth.) occurred with AM HOE 00661, but 25 days after treatment (DAT) weed recovery was observed at rates below 1.5 lb/A.

In the spring of 1982, field studies were initiated to compare glyphosate, paraquat, AM HOE 00661, and SC 0224 with regard to response rates, influence of environmental conditions, and weed species controlled.

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MATERIALS AND METHODS

Eight studies were conducted on State sandy loam soils (Typic Hapludult) at the Virginia Truck and Ornamentals Research Station, Painter, from April to September of 1982. Plot size varied between studies and ranged from 20 to 135 $ft.^2$ Consequently, herbicides were applied with one-, three-, or four-nozzle booms as required. In all instances, flat fan tips[2/] were used, delivering at a rate of 25 gpa at 30 psi using propane as the source of pressure.

All studies, with one exception, were conducted on sites selected for uniformity of mixed weed populations or for the presence of specific weed species. In the one study noted as an exception, herbicides were applied to a weedy soybean field mowed to a height of 8 to 10 in to simulate conditions found following small grain harvest.

It was elected to present the comparative effects of the herbicides over a range of weed species and environmental conditions rather than concentrate on any study in its entirety. As a result, the data presented here have been drawn from larger studies in which separate statistical analyses were performed. All studies were randomized complete block designs with four replications. Control plots, rated as 0.0% control, were included in the statistical analyses but are not graphically represented.

Herbicide rates of 1.0 or 1.5 lb ai/A are presented from these studies for AM HOE 00661, glyphosate, and SC 0224. Paraquat was applied at either 0.25 or 0.5 lb ai/A.

Visual ratings, expressed as percent of the control, were made periodically. Environmental conditions and timing of herbicide applications for each species are presented in Table 1.

RESULTS

Control of horseweed was initially good with all herbicides when applied in late April, but at 34 DAT control from paraquat had decreased to less than 20% while control with the other herbicides was 80% or better (Figure 1). In studies initiated in June and July, control of horseweed was significantly greater with AM HOE 00661 than with glyphosate and SC 0224 (Figure 2). With both glyphosate and SC 0224, considerable regrowth of horseweed occurred at the 1 lb/A rate in the June study.

Initial control of common ragweed was greater with AM HOE 00661 than with glyphosate or SC 0224 (Figure 3). By 40 DAT, control with SC 0224 and glyphosate had improved to better than 75%.

Control of common lambsquarters decreased from 91% at 21 DAT to 63% at 40 DAT with AM HOE 00661 (Table 2). Maximum control of common lambsquarters was obtained 28 DAT with SC 0224 and glyphosate and, because of less regrowth, did not decrease to the levels observed with AM HOE 00661 at 40 DAT. Mowing

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2/ TeeJet 8003 from Spraying Systems Company, Chicago IL 60187

of common lambsquarters prior to herbicide application, resulted in erratic responses to glyphosate, SC 0224 and paraquat, while having little effect on the control achieved with AM HOE 00661 (Figure 4).

No differences could be observed 38 DAT from applications of AM HOE 00661, glyphosate or SC 0224 when applied to Pennsylvania smartweed following mowing (Figure 5). Paraquat activity in the same study provided excellent early control of Pennsylvania smartweed, but decreased rapidly, and at 38 DAT was providing significantly less control than other treatments. Both SC 0224 and glyphosate exhibited poor initial control of the Pennsylvania smartweed but improved over time to provide better than 80% control when evaluated 38 DAT. AM HOE 00661 at 1.0 and 1.5 lb/A and glyphosate and SC 0224 at 1.5 lb/A each applied to unmowed Pennsylvania smartweed provided excellent control 41 DAT when compared to paraquat at the 0.5 lb/A rate (Table 3).

Control of large crabgrass is reported as a statistically analyzed composite of two separate studies (Figure 6). Both glyphosate and SC 0224 provided excellent control with no regrowth through 37 DAT. AM HOE 00661 provided control comparable to glyphosate and SC 0224 at 13 DAT but some regrowth of large crabgrass was observed as the study progressed. Paraquat activity declined with time and was significantly less effective against large crabgrass than the other herbicides at all dates.

AM HOE 00661 provided better initial control of redroot pigweed than either glyphosate or SC 0224 when evaluated 29 DAT; however, at 40 DAT both glyphosate and SC 0224 were providing significantly better control than AM HOE 00661 (Figure 7).

When the herbicides (including paraquat) were applied to mowed redroot pigweed, effectiveness was initially high when measured at 13 DAT but declined rapidly when evaluated at three subsequent dates (Figure 8). Observations made 35 DAT indicated that AM HOE 00661, while providing less than 70% control of redroot pigweed was significantly better than the other treatments.

DISCUSSION

In large part the results obtained in these studies agree with earlier reports on efficacy observed with AM HOE 00661. Control of several difficult weed species was equal or superior to control with glyphosate and paraquat as was observed by Kapusta (1). Similarly, our study in many ways substantiates an earlier report by Stahlman (2) that weed recovery frequently begins at about 25 DAT. Symptomology expression in AM HOE 00661 treatments occurred at a point in time between that observed with paraquat and glyphosate as noted by Wilson and Hines (3). This is not apparent in these data as the difference in response rates appeared between the first and second days after treatment. Paraquat symptoms were often apparent on the treatment day while AM HOE 00661 symptoms began appearing in approximately 36 hours.

Activity of SC 0224 in these studies was observed to closely mirror efficacy patterns and response rates of glyphosate. There was an indication,

however, that early season control of horseweed was slightly better with SC 0224 than with glyphosate. While this might mean better performance under cooler weather conditions, no attempt has been made, at this time, to separate the confounding effects of environmental and growth variables.

The herbicide activities observed in the mowed study emphasized the dependence of glyphosate and SC 0224 on the presence of an established leaf area to achieve control. When the leaf area was reduced through mowing, control of common lambsquarters and redroot pigweed was significantly reduced. On the other hand, the activity of AM HOE 00661 was not affected by mowing but at the same time, did not offer significantly greater or improved control. Ultimately, the mowing study, while intended to simulate a double-cropping system, pointed out apparent weaknesses in all four compounds.

LITERATURE CITED

1. Kapusta, G. 1981. HOE 661: A New Herbicide for the Control of Vegetation in No-Till Fields. Proc. North Central Weed Cont. Conf. 36:92.

2. Stahlman, P. W. 1981. Weed Control for Chemical Fallow and No-Till. Res. Report North Central Weed Cont. Conf. 38:68.

3. Wilson, H. P. and T. E. Hines. 1982. Comparisons of the Activities of HOE-00661 with Paraquat and Glyphosate. Proc. Northeast Weed Sci. Soc. 36:51.

Table 1. Growth stage, treatment date, and temperatures relative to individual weed species in 1982 studies.

Weed Species	Figure reference	Growth stage at application	Treatment date	Mean temperatures for week following treatment day	night
	(no.)	(in.)	(mo/day)	F	
Horseweed	1	4-5	4/20	67	47
Horseweed	2	8-14	6/3	76	58
Horseweed	2	12-18	7/9	85	72
Common Ragweed[a]	3	6-8	7/7	87	72
Common Ragweed	3	8-14	8/17	87	71
Common Lambsquarters	2[b]	6-8	7/7	87	72
Common Lambsquarters[a]	4	8-10	8/3	86	61
Pennsylvania Smartweed[a]	5	4-10	8/3	86	61
Pennsylvania Smartweed	3[b]	4-10	8/3	86	61
Large Crabgrass	6	14-20	8/3	86	61
Large Crabgrass	6	12-16	8/17	84	65
Redroot Pigweed	7	10-16	7/7	87	71
Redroot Pigweed	8	8-10	8/3	86	61

[a] Mowed prior to herbicide application.

[b] Tables 2 and 3

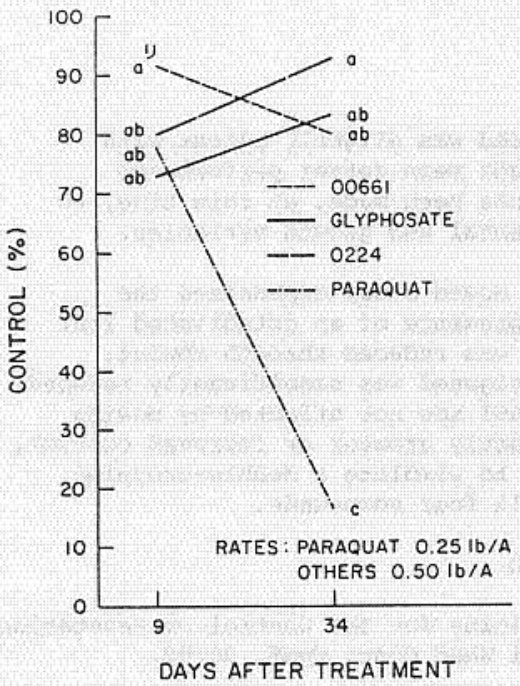

FIGURE 1. CONTROL OF HORSEWEED TREATED ON APRIL 20, 1982 WITH AM HOE 00661, GLYPHOSATE, SC 0224 AND PARAQUAT.

[y] Letters represent statistical significance at the 0.05 level within studies for each date.

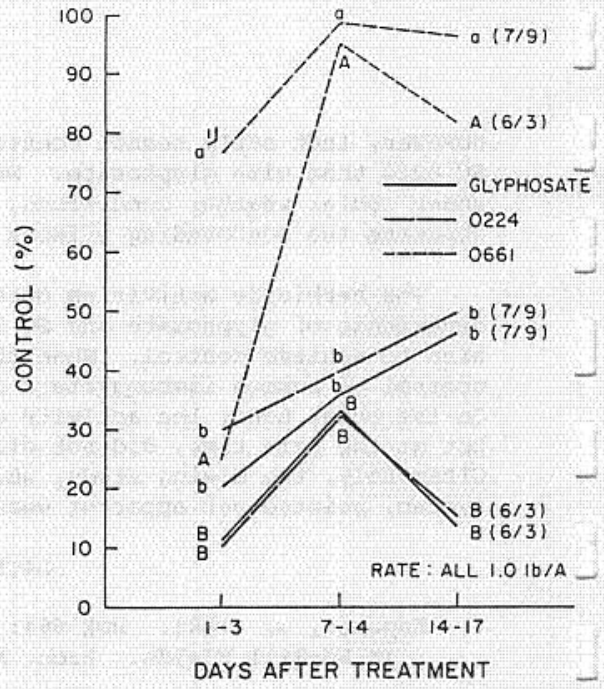

FIGURE 2. CONTROL OF HORSEWEED TREATED ON JUNE 3 AND JULY 9, 1982 WITH AM HOE 00661, GLYPHOSATE, AND SC 0224.

[y] Letters indicate statistical significance at the 0.05 level for each date.

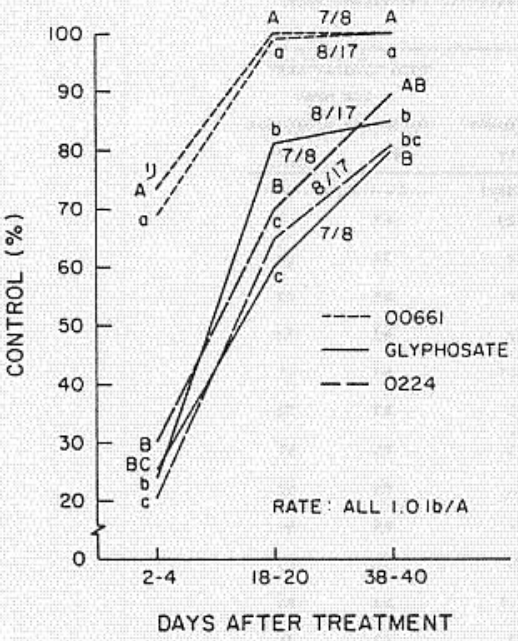

FIGURE 3. CONTROL OF COMMON RAGWEED TREATED ON JULY 7 AND AUGUST 17, 1982 WITH AM HOE 00661, GLYPHOSATE, AND SC 0224.

[y] Letters indicate statistical significance at the 0.05 level within studies for each date.

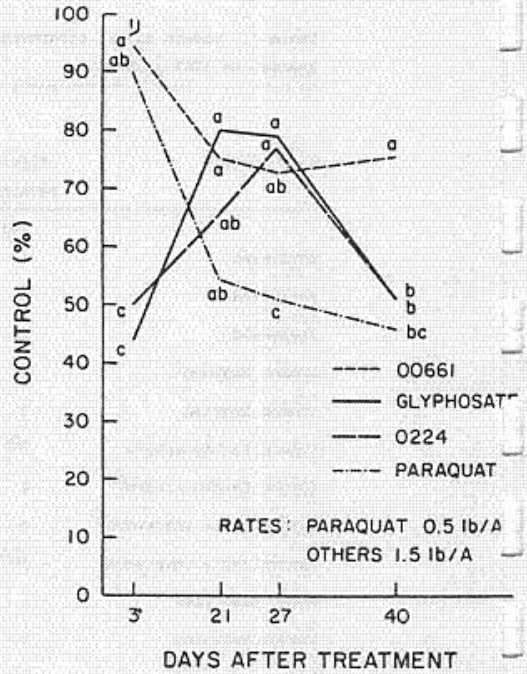

FIGURE 4. CONTROL OF COMMON LAMBSQUARTERS AFTER MOWING WITH AM HOE 00661, GLYPHOSATE, SC 0224, AND PARAQUAT.

[y] Letters represent statistical significance at the 0.05 level for each date.

Table 2. Control of common lambsquarters with AM HOE 00661, glyphosate, and SC 0224.

Herbicide	Rate	Control[a] Days after treatment 21	28	40
	(lb/A)	(%)		
AM HOE 00661	1.0	91 a	85 b	63 c
Glyphosate	1.0	79 b	85 b	79 ab
SC 0224	1.0	84 b	90 a	89 a

[a] Mean separation within columns by Duncan's multiple range test, 5% level.

Table 3. Control of Pennsylvania smartweed with AM HOE 00661, glyphosate, SC 0224 and paraquat 41 days after treatment.

Herbicide	Rate	Control[a]
	(lb/A)	(%)
AM HOE 00661	0.75	71 b
	1.0	86 ab
	1.5	96 a
Glyphosate	1.5	94 a
SC 0224	1.0	69 b
	1.5	84 ab
Paraquat	0.5	43 c

[a] Mean separation by Duncan's multiple range test, 5% level.

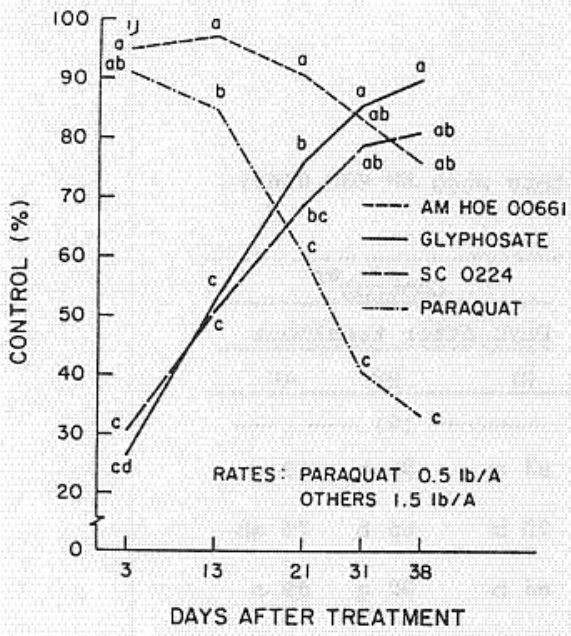

FIGURE 5. CONTROL OF PENNSYLVANIA SMARTWEED AFTER MOWING WITH AM HOE 00661, GLYPHOSATE, SC 0224, AND PARAQUAT.

[y] Letters indicate statistical significance at the 0.05 level for each date.

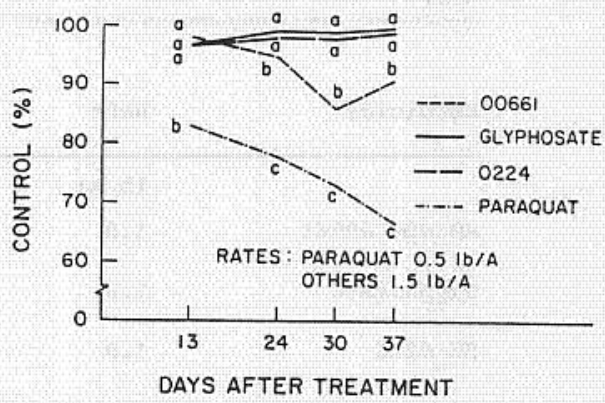

FIGURE 6. CONTROL OF LARGE CRABGRASS WITH AM HOE 00661, GLYPHOSATE, SC 0224, AND PARAQUAT. DATA ARE COMPOSITED FROM TWO STUDIES TREATED ON AUGUST 3 AND AUGUST 17, 1982.

[y] Letters indicate statistical significance at the 0.05 level for each date.

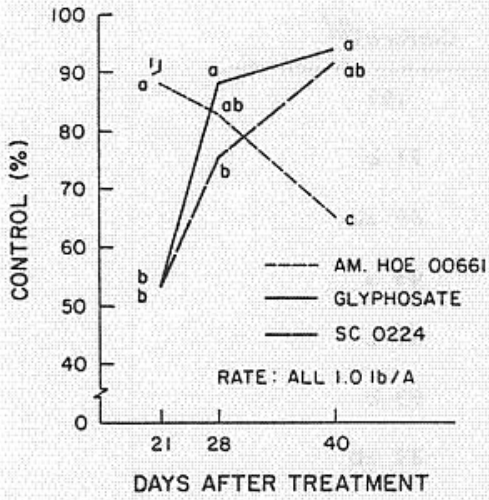

FIGURE 7. CONTROL OF REDROOT PIGWEED WITH AM HOE 00661, GLYPHOSATE, AND SC 0224.

[y] Letters indicate statistical significance at the 0.05 level for each date.

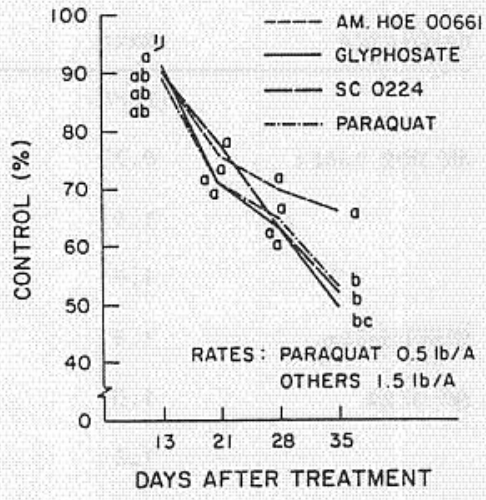

FIGURE 8. CONTROL OF REDROOT PIGWEED AFTER MOWING WITH AM HOE 00661, GLYPHOSATE, SC 0224, AND PARAQUAT.

[y] Letters indicate statistical significance at the 0.05 level for each date.

DIFFERENTIAL RESPONSE OF SOYBEAN VARIETIES TO METRIBUZIN[1/]

Prasanta C. Bhowmik[2/]

ABSTRACT

Response of nine soybean varieties to metribuzin was investigated in controlled environments. Varieties of soybeans show differential tolerance to metribuzin, an effective preemergence herbicide. Soybean tolerance has been narrow based upon the metribuzin rate effective for preemergence weed control. The symptoms of metribuzin injury and plant vigor varied among varieties. The dry weights and soybean yields were affected more than plant height. Height was least affected. The shoot dry weights, number of pods, and soybean yields of 'Altona', 'Pride X005', and 'Hardome' were significantly reduced by metribuzin at 0.25 kg/ha. All varieties responded differentially to metribuzin rates. The varietal tolerance to metribuzin greatly decreased as the rate of metribuzin increased. The most susceptible varieties were 'Altona', 'Pride X005', and 'Hardome', while 'Anoka', and 'Fiskiby V', and 'Evans' were found to be moderately susceptible. 'Amsoy', 'Beeson', and 'Corsoy' were found to be most tolerant to metribuzin. The results indicate that the relative tolerance of soybean varieties is based on the rate of metribuzin and the genetic make up of the variety. The response of soybean varieties to metribuzin may well be a criteria for the selection of a soybean variety under specific environmental conditions.

INTRODUCTION

Differential response of varieties to herbicides have been reported for several crops. In soybeans [Glycine max (L.) Merr.], Barrentine et al (3) demonstrated the varietal differences to metribuzin [4-amino-6-tert-butyl-3-(methylthio-as-triazin-5(4H)-one] ranging from low to high tolerance level. Field observations indicated that varieties of soybeans differed in their tolerance to metribuzin (6).

Soybean yields can be subjected to the effects of herbicides. Burnside (4) found that yield losses in ten soybean varieties attributable to preemergence application of six herbicides or combinations of herbicides ranged from 5% for 'Hark' and 'Harsoy 63' to 20% for 'Hawkeye 63'.

Metribuzin provides good control of weeds. Weed control from metribuzin is often variable, and the tolerance to soybeans is unacceptable under certain conditions. Performance of metribuzin is therefore based upon rate, rainfall after treatment, soil conditions, and soybean varieties or cultivars (2, 3, 5, 7).

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This paper presents the results of growth chamber experiments that were conducted to establish the differential response of nine soybean varieties to metribuzin.

MATERIALS AND METHODS

Nine soybean varieties were tested for their tolerance to metribuzin in controlled growth chamber experiments. All plants received a photosynthetic photon flux density of 570 μEm^{-2} sec^{-1} 20 cm above the pots and 16 h photoperiod. The light source was a mixture of incandescent and fluorscent bulbs. The relative humidity was 60% during the day and 70% during the night. Plants were fertilized, as needed, with a half-strength Hoagland's solution.

Ten seeds were planted in 15 cm plastic pots (945 ml) with 2:1 mixture of Harriston loam soil (Typic Hapludolf) and sand. After emergence, plants were thinned to 4 plants per pot. Metribuzin was used at 0, 0.125, 0.25, 0.50, 1.0, and 1.5 kg/ha as a preemergence treatment. Treatments were applied with a laboratory precision sprayer that delivered 225 L/ha at 276 KPa pressure. The percent injury was determined by visually rating each treatment on a scale of 0 = no injury and 10 = complete kill. The heights and dry weights of dead plants were recorded as zero. Soybean heights were measured 7, 14, 21, and 28 days after treatment (DAT). Two plants from each pot were harvested 35 DAT and the fresh and dry weights of above ground biomass were determined. The other two plants in each pot were allowed to grow till maturity for the final soybean yield determination. Total number of pods per plant, number of well developed pods per plant, and soybean yield were determined.

The experimental design was a completely randomized split-plot with varieties as main plots and metribuzin rates as subplots. Treatments were replicated four times. The experiment was repeated twice and the averages were subjected to a two-way analysis of variance. The means were separated by least significant difference (L.S.D.) at the 0.05 level of probability.

RESULTS AND DISCUSSION

Soybean varieties differed significantly in their response to preemergence application of metribuzin (Table 1). Plant vigor of nine soybean varieties, as determined by plant injury, was of distinct type. All varieties exhibited high degree of tolerance to metribuzin at 0.25 kg/ha except 'Altona' and 'Pride X005'. 'Altona' has been documented as a susceptible variety to metribuzin by Anderson (2) who reported 66% stand reduction with metribuzin at 0.56 kg/ha. None of the soybean varieties showed any tolerance to metribuzin at 1.0 kg/ha. In general, as the rate of metribuzin increased, visual symptoms of injury in all varieties progressed towards leaf necrosis and death. Metribuzin at 1.25 kg/ha killed all soybean varieties.

Plant heights 7, 14, and 21 days after treatment (DAT) were not affected greatly by metribuzin at various rates (data not presented). This suggests that plant height may not be an indicator of plant injury to metribuzin at the early stage of growth. However, significant differences in plant heights were evident with various rates of metribuzin 28 DAT (Table 2). Three soybean varieties out of the nine varieties were completely killed when metribuzin was used at 1.0 kg/ha. These were 'Pride X005', 'Evans' and 'Fiskiby V'.

Dry matter production in plants can be a measure of plant's response to herbicidal effects. The plant dry weights of 'Altona' and 'Pride X005' were reduced by metribuzin at 0.25 kg/ha (Table 3). All varieties exhibited significant reductions in shoot dry weight with metribuzin at 0.5 kg/ha.

The initiation and development of soybean pods per plant was significantly affected by the rates of metribuzin (Table 4). The number of pods per plant decreased as the rate of metribuzin increased. At 0.25 kg/ha of metribuzin, five of the varieties out of nine produced an average number of pods per plant compared to that of untreated plants. The percent of well developed pods per plant was not affected greatly by metribuzin rates except at the high rates when the total dry matter production was also reduced (data not presented).

All varieties showed a differential yield response to metribuzin at various rates (Table 5). 'Altona' was the most susceptible variety to metribuzin at 0.25 kg/ha showing a yield reduction of 98%. At this rate, four other varieties ('Pride X005', 'Hardome', 'Anoka' and 'Fiskiby V') exhibited yield reductions ranging from 11 to 62% compared to that of untreated plants. These yield reductions were associated with the number of pods per plant (Table 4). Riley and Smith (9) reported from their field studies that metribuzin at 1.68 kg/ha reduced soybean yields of 'Altona' and 'Hardome' by 93 and 77%, respectively.

'Altona', 'Pride X005', and 'Hardome' were found to be most susceptible to metribuzin. Similar varietal susceptibility to metribuzin has been reported from field studies (2, 6, 8). 'Anoka', 'Fiskiby V', and 'Evans' were grouped as moderately susceptible to metribuzin in this study. 'Evans' has been reported as moderately tolerant to metribuzin at 0.84 kg/ha (1). 'Amsoy', 'Beeson', and 'Corsoy' were found to be most tolerant to metribuzin. In earlier studies, Pitblado et al (8) documented 'Amsoy' and 'Corsoy' varieties as the most tolerant type to metribuzin.

This research indicates that the relative tolerance of soybean varieties is based on the rate of metribuzin and the genetic makeup of the variety. This interaction reflects only one aspect of plant's response to herbicide. However, the differential response of soybean varieties can vary depending on soil and environmental conditions. The activity of metribuzin in soil, as influenced by various soil factors, has been reported by other researchers (5, 7). Future research should be directed towards developing more tolerant varieties of soybeans through breeding and possibly through genetic engineering. The relatively wider margin of selectivity to metribuzin may be developed. Thus, the new varieties may increase the potential use of metribuzin on a wide spectrum of soybean culture.

LITERATURE CITED

1. Allen, W.R., D.A. Littlejohns, R.H. Brown, and G.C. Paling. 1975. Soybean variety X metribuzin interaction study V. Res. Rept., Canada Weed Committee. East. Sec., p. 88-89.

2. Anderson, G.W. 1973 Susceptibility of soybean varieties to metribuzin Res. Rept., Canada Weed Committee, East. Sec., p. 192.

3. Barrentine, W.L., E.E. Hartwig, C.J. Edwards, Jr., and T.C. Kilen. 1982. Tolerance of three soybean (Glycine max) cultivars to metribuzin. Weed Sci. 30:344-348.

4. Burnside, O.C. 1972. Tolerance of soybean cultivars to weed competition and herbicides. Weed Sci. 20:294-297.

5. Coble, H.D. and J.W. Schrader. 1973. Soybean tolerance to metribuzin. Weed Sci. 21:308-309.

6. Hardcastle, W.S. 1974. Differences in the tolerance of metribuzin by varieties of soybeans. Weed Res. 14:181-184.

7. Ladlie, J.S., W.F. Meggitt, and D. Penner. 1976. Effects of pH on metribuzin activity in the soil. Weed Sci. 24:505-507.

8. Pitblado, R.E., D.A. Littlejohns, R.H. Brown and C. Dillon. 1974. Germ plasm X metribuzin interaction study. Res. Rept., Canada Weed Committee, East. Sec. p. 132-134.

9. Riley, W.R. and A.L. Smith. 1974. Comparative tolerance of soybean varieties to metribuzin. Res. Rept., Canada Weed Committee, East. Sec., p. 135.

Table 1. Relative plant vigor of nine soybean varieties 14 days after preemergence treatment with metribuzin

Variety	Metribuzin (kg/ha) 0	0.125	0.25	0.50	1.0	1.25	Variety mean
Altona	0[a]	2.0	9.3	10.0	10.0	10.0	6.9
Pride X005	0	3.5	9.8	10.0	10.0	10.0	7.5
Hardome	0	2.0	2.0	8.3	9.8	10.0	5.4
Anoka	0	0	0.3	7.3	8.8	10.0	4.4
Fiskiby V	0	1.3	0.8	1.5	10.0	10.0	4.0
Evans	0	1.0	1.3	3.5	10.0	10.0	4.3
Amsoy	0	0	1.0	6.3	10.0	10.0	4.6
Beeson	0	0	0.8	6.3	9.8	10.0	4.5
Corsoy	0	0	1.3	3.5	10.0	10.0	5.0
Metribuzin mean	0	1.1	2.9	6.8	9.8	10.0	

$L.S.D._{0.05}$ Varieties = 0.35
Metribuzin rates = 0.30
Metribuzin rates within a variety = 0.30

[a]Plant vigor refers to injury on a scale of 0 = no injury and 10 = complete kill

Table 2. Relative plant height of nine soybean varieties 28 days after preemergence treatment with metribuzin

Variety	Metribuzin (kg/ha) 0	0.125	0.25	0.50	1.0	1.25	Variety mean
	(cm)						
Altona	20.7	18.5	14.4	11.8	10.2	9.1	14.1
Pride X005	10.2	11.1	11.2	0.1	0.1	0.1	5.5
Hardome	8.0	6.8	3.6	6.2	2.4	0.1	4.5
Anoka	8.7	9.9	10.2	10.5	9.8	8.6	9.6
Fiskiby	6.3	6.4	6.6	7.0	0.1	0.1	4.4
Evans	7.4	7.3	7.5	7.1	0.1	0.1	4.9
Amsoy	8.4	7.8	8.0	7.9	6.4	6.4	7.5
Beeson	9.4	8.9	10.1	10.5	7.2	7.4	8.9
Corsoy	8.8	9.3	9.9	9.5	8.7	8.4	9.1
Metribuzin mean	9.8	9.5	9.0	7.8	5.0	4.5	

L.S.D. $_{0.05}$ Varieties = 0.68
Metribuzin rates = 0.62
Metribuzin rates within a variety = 1.31

Table 3. Relative shoot dry weight of nine soybean varieties 35 days after preemergence treatment wtih metribuzin.

Variety	Metribuzin (kg/ha) 0	0.125	0.25	0.50	1.0	1.25	Variety mean
	(%)						
Altona	100	38	14	20	6	7	31
Pride X005	100	80	32	12	7	9	40
Hardome	100	85	82	46	24	10	58
Anoka	100	61	61	12	5	5	41
Fiskiby V	100	83	83	11	11	11	50
Evans	100	99	100	14	10	8	55
Amsoy	100	142	53	30	13	19	60
Beeson	100	105	53	27	17	14	53
Corsoy	100	93	101	27	15	13	58
Metribuzin mean	100	87	64	22	12	11	

L.S.D. $_{0.05}$ Varieties = 19.6
Metribuzin rates = 12.6
Metribuzin rates within a variety = 26.6

Table 4. Relative number of pods produced per plant of nine soybean varieties as affected by preemergence application of metribuzin

Variety	Metribuzin (kg/ha) 0	0.125	0.25	0.50	1.0	1.25	Vareity mean
Altona	11.8	11.8	2.5	1.0	1.0	1.0	4.8
Pride X005	9.0	9.0	4.5	1.0	0	0	4.3
Hardome	7.8	9.0	6.5	3.0	1.0	1.0	6.4
Anoka	16.8	13.3	13.3	13.5	1.0	1.0	9.8
Fiskiby V	13.8	11.8	13.3	10.8	0	0	8.6
Evans	17.8	16.5	19.3	15.3	0	0	11.8
Amosy	10.0	10.0	9.0	5.0	0	0	5.7
Beeson	15.5	14.0	15.5	14.8	1.0	1.0	10.3
Corsoy	11.5	13.5	13.3	8.0	1.0	1.0	8.0
Metribuzin mean	12.7	12.1	10.8	8.0	0.6	0.6	

$L.S.D._{0.05}$ Varieties = 2.28
Metribuzin rates = 1.46
Metribuzin rates within a variety = 3.10

Table 5. Relative yield of nine soybean varieties as affected by preemergence application of metribuzin

Variety	Metribuzin (kg/ha) 0	0.125	0.25	0.50	1.0	1.25	Variety mean
	(%)						
Altona	100	91.3	2.2	2.2	0	0	32.6
Pride X005	100	94.6	37.8	2.7	2.7	0	39.6
Hardome	100	100.0	64.0	36.0	4.0	4.0	51.3
Anoka	100	72.9	79.2	91.7	2.1	2.1	58.0
Fiskiby V	100	89.2	89.2	75.7	2.7	2.7	59.9
Evans	100	104.9	122.0	80.5	2.4	2.4	68.7
Amsoy	100	100.0	100.0	70.0	1.0	1.0	62.0
Beeson	100	100.0	118.0	78.9	2.6	2.6	67.0
Corsoy	100	93.3	146.0	70.0	3.3	3.3	69.3
Metribuzin mean	100	94.0	84.3	56.4	2.3	2.0	

$L.S.D._{0.05}$ Varieties = 25.9
Metribuzin rates = 14.0
Metribuzin rates within a variety = 29.8

FIELD RESULTS WITH ORYZALIN APPLIED OVERTOP OF GROWING WHEAT FOR WEED CONTROL IN NO-TILL SOYBEANS

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ABSTRACT

Oryzalin applied as an overtop spray (OTS) to fully tillered growing wheat will provide control of susceptible annual grasses and small seeded broadleaf weeds in the wheat and following no-till soybean crop. Wheat was tolerant to OTS applications of oryzalin as shown from results of field scale herbicide trials conducted in the DelMarVa during 1982. Minimal crop lodging was associated with OTS applications and usually occurred where high rates of nitrogen were applied or when applications of oryzalin were made when crop growth stage was highly variable. Weed control and crop tolerance in the no-till soybean crop were good to excellent.

INTRODUCTION

Oryzalin (3,5-dinitro-N^4,N^4-dipropylsulfanilamide) has been registered for use as a preemergence surface applied herbicide on soybeans (Glycine max) since 1974. Growth of oryzalin in the soybean herbicide market has been increasing each year since initial introduction. It is currently used extensively in stubble crop and no-till soybeans and provides effective control of many annual grasses and small seeded broadleaf weeds.

Intensive utilization of land through double-cropping small grain and no-till soybeans has increased in recent years. Effective weed control is frequently the limiting factor for optimum production in no-till culture. Current weed control programs include combinations of contact and residual herbicides applied as preemergence treatments when no-till soybeans are planted. Problems encountered with these programs include difficulty in herbicide distribution and coverage in small grain residue, application at a time of year when insufficient rainfall for activation may occur, and unsatisfactory control of existing weeds by the contact herbicides.

Application of oryzalin as an OTS treatment represents a unique approach for improved weed control over current practices. The procedure involves application of oryzalin overtop of fully tillered growing wheat (Triticum aestivum) to provide effective weed control of susceptible weeds in both the wheat and subsequent no-till soybean crop. Chemical properties of oryzalin make it an ideal product for this application concept. It is the least volatile of the dinitroaniline group of herbicides and will remain on the soil surface for an extended period of time. Oryzalin is also the most soluble of the group and may be activated by rainfall. The major advantage of the oryzalin OTS concept is that application is made over fully tillered growing wheat during a time of year when frequent rainfall occurs and before germination of susceptible weeds.

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Field results have been excellent for this application procedure (1,2) in research trials conducted in the Eastern United States. A temporary tolerance was established for oryzalin applied overtop of wheat in 1978, and the concept has been successfully evaluated under an experimental use permit (EUP) in numerous on-farm research trials since that time. Rates of oryzalin for this use are 0.75 to 1.0, 1.0 to 1.5, and 1.25 to 1.5 lb/A on coarse, medium and fine soil types, respectively. Applications may be made using either ground or aerial application equipment.

The oryzalin OTS application concept was first evaluated in the DelMarVa in 1979. Because of excellent weed control results in no-till soybeans its potential was recognized by both growers and university researchers. Wheat lodging occurred in some research trials where oryzalin was applied OTS, particularly in Northern Delaware. Lodging has been associated with factors such as nitrogen rate and time of application, sparse crop stand, and certain wheat varieties. In research trials where oryzalin was applied prior to the fully tillered wheat growth stage, lodging has also occurred. An extensive cooperative research program was conducted in 1982 to determine the relationship between OTS applications of oryzalin and other factors associated with wheat lodging in the DelMarVa. Results are presented in this paper.

MATERIALS AND METHODS

Field scale herbicide trials were established at 17 locations to determine relationship between OTS application of oryzalin and other factors associated with wheat lodging. Plot size ranged from 5 to 15 acres. Applications were made with a trailer sprayer equipped with a roller pump and calibrated to deliver a final volume of 20 gal/A. Soil samples were taken at each location to determine soil texture and percent organic matter. Oryzalin rates evaluated were 1.0 lb/A on coarse soil types and 1.25 lb/A on medium soil types. Applications were made at the fully tillered to early jointing wheat growth stage. Crop and root injury ratings were recorded at two week intervals beginning after application and continuing through wheat harvest.

No-till soybeans were planted directly into wheat stubble following harvest. Paraquat (1,1'-dimethyl-4,4'-dipyridinium ion) at 0.25 to 0.5 lb/A plus linuron [3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea] at 0.5 to 1.0 lb/A was applied preemergence at soybean planting time for control of weeds tolerant to oryzalin. Weed control ratings in the soybeans were made early, mid, and late season and injury ratings were made one month after planting.

Other data recorded were wheat variety, wheat planting date, tillage practices prior to planting, nitrogen rate and time of application, and first significant rainfall amount and total rainfall for the first thirty days after application.

RESULTS AND DISCUSSIONS

Research conducted prior to 1982 (1,2) on coarse and medium soils in the Southeast (Table 1) demonstrates that wheat is tolerant to OTS applications of oryzalin made at the fully tillered to early jointing wheat growth stage. The only injury symptom observed which was characteristic or oryzalin

was slight root injury, and this was only evident at rates which exceeded 1.5 lb/A. No significant crop injury or lodging was recorded at rates up to 2 lb/A. Data from these research trials (Table 2) show that yield was not adversely affected by oryzalin OTS application and generally was equal to or better than the untreated controls.

Table 1. Root injury, crop injury and lodging when oryzalin was applied OTS to wheat at the fully tillered growth stage.1/

Oryzalin Rate (Lb/A)	Root Injury2/	Crop Injury2/	Crop Lodging2/
1.0	0.2	0.0	0.4
1.25	0.3	0.0	0.4
1.5	0.7	0.0	0.0
2.0	1.0	0.1	0.3
Control	0.0	0.0	0.0

1/ Average of 11 herbicide research trials conducted on coarse and medium soils.

2/ Injury and lodging ratings are expressed on 0 to 10 scale where 0 represents no injury or lodging and 10 represents death of complete lodging.

Table 2. Wheat yield expressed as percent of control when oryzalin is applied OTS to wheat at the fully tillered growth stage.1/

Oryzalin Rate (Lb/A)	Yield % of Control
1.0	105
1.25	96
1.5	108
2.0	109
Control	100

1/ Average of 11 herbicide research trials.

Crop tolerance: Data from field trials conducted in the DelMarVa area in 1982 support these results (Table 3). Average crop lodging ratings ranged from 0.1 to 1.1 for 1 and 1.25 lb/A rates, respectively. No crop injury was observed. Injury and lodging ratings were based on a scale of 0 to 10 where 0 represents no crop injury or lodging and 10 represents complete lodging or death of plants. Lodging (Table 4) ratings for individual locations ranged from 0.2 to 3 based

on the 0 to 10 scale. In addition to the herbicide treatment, other factors which influenced wheat lodging were nitrogen rate, crop stand, and variety.

Table 3. Crop tolerance of wheat expressed as injury and lodging rates when oryzalin is applied OTS to wheat at the fully tillered growth stage.

Oryzalin Rate (Lb/A)	Crop Injury	Crop[1/] Lodging
1.0 (11)[2/]	0	0.1
1.25 (6)	0	1.1
Control	0	0.0

1/ Crop injury and lodging expressed on 0 to 10 scale where 0 represents no injury and 10 represents death of plants or severe lodging.

2/ Number in parentheses represents number of locations.

Table 4. Relationship of factors associated with wheat lodging.

Location	Oryzalin Rate (Lb/A)	Nitrogen Rate (Lb/A)	Growth Stage/ Crop Stand at OTS Application	Wheat Variety	Lodging[1/] Rating
Cheriton VA	1.0	95	Pre-tillering	McNair 1003	0.5
Exmore VA	1.0	75	Pre-tillering	Coker 747	0.3
Vienna MD	1.25	80		McNair 1003	0.2
Greenwood DL	1.0	100		Abe	0.5
Smyrna DL	1.25	107		Potomac	1.0
Townsend DL	1.25	65	Sparse stand	Potomac	3.0
Townsend DL	1.25	65	Sparse stand	Pioneer S76	0.8
Middleton DL	1.25	65		Abe	2.0

1/ Crop lodging expressed on 0 to 10 scale where 0 represents no lodging and 10 represents complete lodging.

At five locations, high rates of nitrogen were closely related to wheat lodging. At the Smyrna, DL location, nitrogen was applied at 100 lb/A, and slight lodging occurred as a result of tall stalk growth (Potomac variety) in both treated and untreated areas of the field. At the Vienna, MD location, lodged areas corresponded to overlap in nitrogen application.

Variable wheat growth stage and sparse stand at OTS application resulted in slight crop lodging at four locations, two in Virginia and two in Delaware. At three locations, poor germination and slow growth occurred resulting in variable crop stand and growth at application; at the other location, wheat was planted no-till during early December and slow growth occurred. Plant height was extremely variable at each location when oryzalin OTS applications were made. Lodging ratings at these locations ranged from 0.2 to 3.0.

Weed control: Control of crabgrass (*Digitaria sanguinalis*) and fall panicum (*Panicum dichotomiflorum*) was good to excellent (Table 5). Crabgrass control ranged from 91 to 95 percent for 1 and 1.25 lb/A oryzalyn OTS rates, respectively. Fall panicum control was 92 and 90 percent for the 1 and 1.25 lb/A rates. At one location, oryzalin provided 95 percent control of common lambsquarters (*Chenopodium album*). Control of foxtail (Setaria spp.) was somewhat lower at the 1 and 1.25 lb/A rates ranging from 75 to 79 percent, respectively. Preemergence applications of Paraquat in combination with linuron increased effectiveness of the OTS oryzalin treatments. No crop injury was observed in the no-till soybeans.

Table 5. Weed control ratings and crop tolerance in no-till soybeans when oryzalin is applied OTS to wheat at the fully tillered growth stage.

Oryzalin Rate (Lb/A)	Percent Weed Control 1/				Soybean Crop Injury 3/
	Crabgrass	Foxtail	Fall Panicum	Lambsquarters	
1	91 (6) 2/	75 (2)	92 (8)	95 (1)	0
1.25	95 (1)	79 (1)	90 (2)		0
Control	0	0	0	0	0

1/ Ratings made 90-120 days after application.

2/ Number in parentheses represents number of locations.

3/ Injury expressed on 0 to 10 scale where 0 represents no injury and 10 represents death of plants.

CONCLUSION

Oryzalin applied OTS to fully tillered growing wheat will provide control of susceptible annual grasses and small seeded broadleaf weeds in the wheat and following no-till soybean crop. Wheat is tolerant to OTS applications of oryzalin as shown from results of field scale herbicide trials conducted in the DelMarVa during 1982. Crop lodging associated with OTS applications in these

trials was minimal and occurred more frequently when high nitrogen rates were applied or when applications of oryzalin were made when wheat growth was highly variable. Weed control and crop tolerance in the no-till soybean crop was good to excellent.

LITERATURE CITED

1. Addison, D.A., R.D. Hicks, J.A. Keaton, and K.E. McNeill. 1976. Oryzalin: A new concept for weed control in double-cropped soybean culture. Proc. So. Weed Sci. Soc. 29:133-141.

2. Lynn, L.B., M.L. Jones, W.E. Rodgers, and G.J. Shoop. 1977. Oryzalin applied overtop wheat for weed control in soybeans planted in the stubble following wheat harvest. Proc. of Northeast. Weed Sci. Soc. 31:46-53.

PREEMERGENCE METOLACHLOR FOLLOWED BY POSTEMERGENCE ACIFLUORFEN AND BENTAZON IN SOYBEANS 1/

L.C. Horng, R.D. Ilnicki, and M. W Beale 2/

ABSTRACT

Metolachlor at 1.7 kg/ha alone was used as a preemergence treatment in soybeans and it produced excellent grass but poor broadleaf weed control. When it was followed by either acifluorfen at 0.56 kg/ha or bentazon at 0.84 kg/ha, there was a substantial increase in broadleaf weed control and yields of soybeans. Metolachlor followed by acifluorfen in combination with bentazon at 0.28 + 0.28, 0.28 + 0.56, 0.42 + 0.42, 0.56 + 0.28, and 0.56 + 0.56 kg/ha, respectively, produced excellent control of grasses, common ragweed, and redroot pigweed. These combinations produced greater yields than the herbicide applied alone or with a single sequential herbicide following preemergence metolachlor. Acifluorfen in combination with bentazon plus oil conc. at 0.28 + 0.56 kg/ha, respectively or at 0.56 + 0.28 kg/ha plus a surfactant (X-77, 0.25%) did not significantly increase broadleaf weed control.

INTRODUCTION

The use of metolachlor [2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)acetamide] either as a surface-applied or soil-incorporated herbicide is an accepted practice in soybeans (*Glycine max* L.), particularly for the control of annual grasses and yellow nutsedge(*Cyperus esculentus* L.). Sometimes, this herbicide fails to completely control lambsquarters (*Chenopodium album* L.) and other broadleaf weeds.

Recently, there have become available two herbicides for early postemergence use in soybeans that have broadleaf activity. These are acifluorfen [sodium-5(2-chloro-4-(trifluormethyl)-phenoxy)-2-nitrobenzoate] and bentazon [3-isopropyl(-1H-2,1,3-benzothiadiazin-4(3H)-one 2,2 dioxide]. Because of their activity on broadleaf weeds, with little or no activity on grassy weeds, we feel that they will never be used alone but in combination with or as a sequential to a herbicide having primarily activity on grasses.

It was the objective of this study to determine whether acifluorfen and bentazon could be effectively and successfully used postemergence in soybeans when used separately or in combination with each other, following preemergence use of metolachlor.

MATERIALS AND METHODS

This study was conducted at the Adelphia Research Center, New Jersey Agricultural Experiment Station, Adelphia, N.J., in a Sassafras loam soil with

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1/New Jersey Agricultural Experiment Station Publication No. J-15472-1-82

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an organic matter content of 1.25%. Soybeans (cv Midstate 250) were planted in 76-cm row spacings on June 30, 1982. Immediately after planting plots three rows by 4.3 m were established to receive the scheduled preemergence and postemergence treatments. Metolachlor was applied preemergence on June 15 at the rate of 1.7 kg/ha with a backpack CO_2-propelled hand held experimental plot sprayer regulated to deliver 374 L/ha at 2.11 kg/cm^2. Postemergence treatments of acifluorfen and bentazon were applied in the same manner as described above on July 2, approximately two weeks after the preemergence application of metolachlor. At this time soybeans were in the first trifoliate stage and weeds in the cotyledonary to two-leaf stage, approximately 2.5 cm tall. The experimental design was a randomized complete block with three replications.

Weeds identified in the experimental area included fall panicum (*Panicum dichotomiflorum* (L) Michx.), common lambsquarter (*Chenopodium album* L.), common ragweed (*Ambrosia artemisiifolia* L.), redroot pigweed (*Amaranthus retroflexus* L.), and a small amount of quackgrass (*Agropyron repens* L.).

Throughout the course of the experiment several observations on crop and weed response were made and on August 31, late in the season, detailed weed control ratings by species were made. On rating a scale of 0 to 10 was used where 0 = no reduction in stand or vigor and 10 = complete control or elimination of stand. On October 19 the center row of the three row plot was hand harvested and threshed using a plot thresher. After harvest, all plot samples were cleaned, weighed, and yields determined in kg/ha.

RESULTS AND DISCUSSION

Summarized in Table 1 are the weed control ratings for the individual weed species and a rating for total weed control. Included also are phytotoxicity ratings on soybeans and yield for all treatments.

From Table 1 it can be seen that metolachlor by itself at 1.7 kg/ha produced excellent fall panicum control but poor broadleaf weed control. Furthermore, the herbicide also had a slight effect on soybeans but this was short-lived. This incomplete weed control was reflected in a slight yield reduction.

Control of broadleaf weeds by acifluorfen at 0.56 kg/ha and bentazon at 0.85 kg/ha applied as single herbicides was very good with little or no effect on fall panicum. Of the two, yields from the bentazon treatment were slightly better than those from acifluorfen.

A further interesting observation can be made. Weed control was increased over that of metolachlor alone when sequential postemergence applications of acifluorfen or bentazon were made to the preemergence-treated metolachlor.

Weed control results from sequential bentazon was slightly better than the control from acifluorfen; however, the increase in yield from the improved weed control was comparable for both herbicides.

Combinations of acifluorfen and bentazon at rates of 0.28 + 0.28 to 0.56 + 0.56 kg/ha, respectively, plus some individual component variations in that range

produced excellent broad spectrum weed control and, generally, with commensurate increases in yield. Control of lambsquarters was improved with the combination and was proportional, to some extent, to the rate of acifluorfen.

Combination of acifluorfen plus bentazon at 0.28 + 0.56 kg/ha plus an addition of oil concentrate at 1 qt/A and 0.56 + 0.28 kg/ha plus an addition of a surfactant (X-77) at 0.25% did not improve broadleaf weed control. Since commercial acifluorfen is formulated with a surfactant, additions of spray adjuvants in this study did not improve weed control over that where nothing was added to the spray preparations.

It has been reported that bentazon at 1.1 kg/ha can effect better control of broadleaf weeds than at 0.84 kg/ha, particularly for lambsquarters; however, it is not too effective on redroot pigweed (1); whereas acifluorfen is not as effective as bentazon on velvetleaf (*Abutilon theophrasti* Medic). Based on these facts and what was observed in this study, combinations of these two postemergence herbicides can produce broad spectrum broadleaf weed control and when used with a herbicide that is effective on grassy weeds, the degree of weed control can be broadened still further.

LITERATURE CITED

1. Horng, L.C. and R.D. Ilnicki. 1982. Combinations of several grass and broadleaf herbicides for postemergence weed control in soybeans. Proc. NEWSS 36:16.

Table 1. Crop and weed responses to preemergence metolachlor alone and when followed by postemergence aciflurfen and bentazon and combinations.

Herbicide	Rate, kg/ha	Soybeans[1] (phytotoxicity)	Weed Contol[1]					
			Fall panicum	Common lambsquarters	Commom ragweed	Redroot pigweed	Total %	Yield, kg/ha
metolachlor	1.7 pre	1.0	9.9	4.8	3.8	7.8	60	1094.2
aciflurfen	0.56 post	0.0	0.6	9.9	10.0	10.0	18	1114.4
bentazon	0.84 post	0.0	4.1	9.1	9.0	10.0	20	1564.2
aciflurfen + bentazon	O.C. 1 qt/A 0.28 + 0.28	0.0	3.5	10.0	7.3	9.9	57	1188.2
	0.56 + o.56	0.0	5.6	10.0	10.0	10.0	60	1174.8
metolachlor (pre) followed by aciflurfen (post)	1.7 pre	0.0	9.8	6.5	8.8	10.0	74	1389.5
metolachlor (pre) followed by bentazon (post)	1.7 pre 0.84 post (O.C.)	0.0	9.9	9.6	9.7	10.0	78	1483.5
metolachlor (pre) followed by aciflurfen + bentazon	1.7 pre (0.28 + 0.28) post	0.0	9.6	8.2	10.0	10.0	89	1288.8
	1.7 pre (0.28 + 0.56) post	0.0	9.9	8.0	7.6	10.0	86	1577.5
	1.7 pre (0.28 + 0.56) post + O.C. 1 qt/A	0.0	9.8	6.5	9.9	10.0	86	1752.1
	1.7 pre (0.42 + 0.42 post	0.0	9.6	8.3	9.6	10.0	89	1765.5

Table 1. Crop and weed responses to preemergence metolachlor alone and when followed by postemergence aciflurfen and bentazon and combinations.

Herbicide	Rate, kg/ha	Soybeans[1] (phytotoxicity)	Weed Control[1]					
			Fall panicum	Common lambsquarters	Common ragweed	Redroot pigweed	Total %	Yield, kg/ha
metolachlor (pre) followed by aciflurfen + bentazon	1.7 (pre) (0.56 + 0.28) post	0.0	9.7	9.0	10.0	10.0	94	1731.9
	1.7 (pre) (0.56 + 0.28) post + X-77 0.25%	0.0	9.7	9.3	10.0	9.6	95	1288.8
	1.7 (pre) (0.56 + 0.56) post	0.0	9.9	9.2	10.0	10.0	93	1597.6
check - cultivated	-	0.0	0.0	4.3	9.6	10.0	30	1503.7
check - uncultivated	-	0.0	0.0	4.0	3.3	6.6	0	617.6
LSD 0.05								614.23

[1]Based on scale 0 to 10; 0 = no control or no effect on crop, 10 = complete control or complete reduction in vigor.

Postemergence Johnsongrass Control In No-Tillage Soybeans

T. Wiepke, R. Peregoy, B.J. Hook and S. Glenn[1/]

Several herbicides were evaluated for postemergence Johnsongrass (*Sorghum halepense* L.) control in no-tillage soybeans (*Glycine max* L.) at Washington countyand Wicomico county, Maryland. The herbicides evaluated were CGA-82725, HOE-00581, SC-1058, sethoxydim, fluazifop, and mefluidide. Treatments using glyphosate and SC-0224 applied with a wickbar were also evaluated. All plots were treated with paraquat prior to planting. Experiments were organized as randomized complete block designs with three replications. Data from the Washington county site is presented in Table 1. Postemergence herbicides provided good johnsongrass control and increased soybean yields. Johnsongrass control with wickbar treatments was not as effective.

Table 1. Johnsongrass control and soybean yields of plots treated with several herbicides applied as postemergence and wick-bar treatments in Washington county.

Treatment	MOA[d]	RATE (kg/ha)	% Johnsongrass Control (6wk)	Yield (kg/ha)
fluazifop[a]	EP	0.14	72	2358
fluazifop	EP	0.28	95	2847
fluazifop	EP	0.42	98	2936
sethoxydim[a]	EP	0.34	93	2416
sethoxydim	EP	0.45	98	2031
sethoxydim	EP+LP	0.22+0.22	100	2432
CGA-82725[b]	EP	0.28	98	2076
CGA-82725	EP	0.42	95	2624
CGA-82725	EP	0.56	97	2825
CGA-82725	EP+LP	0.28+0.28	100	1912
HOE-00581[a]	EP	0.17	88	2417
HOE-00581	EP	0.34	95	2550
HOE-00581	EP+LP	0.17+0.17	98	2714
mefluidide[c]	EP	0.28	77	1927
SC-1058[a]	EP	0.28	96	2402
SC-1058	EP	0.42	93	2283
glyphosate	wick	33%	60	1319
Control (uncultivated)		----	0	1446

[a]Applied with 2.3 L/ha crop oil.
[b]Applied with 1% (v/v) crop oil.
[c]Applied with 0.5% (v/v) surfactant.
[d]EP=Treatments when johnsongrass was 46 to 51 cm high; LP=Treatments 2 weeks after treatments.

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CONTROL OF ANNUAL BROADLEAF AND GRASS WEEDS IN SOYBEANS (*GLYCINE MAX*.) WITH POSTEMERGENCE HERBICIDES

H. P. Wilson and T. E. Hines[1/]

ABSTRACT

Studies have been conducted to investigate the activities of several herbicides for control of annual broadleaf and grass weeds in soybeans. The effects of several adjuvants (surfactants and oil concentrates) on certain of these herbicides have also been studied. Combinations of acifluorfen with bentazon at low rates were generally more effective against a broad spectrum of broadleaf weeds than either herbicide alone. Surfactants and oil concentrates increased initial activity of acifluorfen but did not always result in better control of broadleaf weeds. Two experimental herbicides, PPG 844 and PPG 1013, were active against jimsonweed (*Datura stramonium* L.) and annual morningglories (*Ipomoea spp*.) but PPG 844 in particular was weak against common lambsquarters (*Chenopodium album* L.). Control of annual grass weeds with sethoxydim, CGA-82755, RO-13-8895, DOWCO 453, and fluazifop was generally excellent although large crabgrass (*Digitaria sanguinalis* (L.) Scop.) often was slow to respond and required higher rates for control than other grass species. Combinations of bentazon or acifluorfen with grass herbicides sometimes influenced control of annual grasses but control generally was still acceptable. Emulsified soybean oil was effective as an adjuvant with postemergence grass herbicides.

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COCKLEBUR, JIMSONWEED, AND MORNINGGLORY COMPETITION IN SOYBEANS

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ABSTRACT

Large seeded broadleaf weeds are a serious problem in the production of soybeans (Glycine max (L.) Merr.) on light, sandy soils in the Delmarva region. Preemergence control of cocklebur (Xanthium pennsylvanicum Wallr.), jimsonweed (Datura stramonium L.), and morningglory (Ipomoea spp.) is often inadequate, thus growers must consider the economic feasibility of using selective postemergence measures. In order to make a wise decision, a thorough knowledge of the competitive ability of the weed population and its resulting effect on crop yield is needed.

In 1982 studies were conducted to determine the effects of full season cocklebur, jimsonweed, and morningglory competition on soybeans. The three species were established on a moderately well drained Mattapex soil at the Wye Institute, Queenstown, MD. Soybeans (var. 'Union') were planted on June 8 in 30" rows and received a preemergence application of alachlor and linuron (2 + .15 lb ai/A). Plots included a weed free check and densities of 1, 1.3, 2, and 4 plants per 20 sq.ft. for cocklebur and 1.3, 2, 4, and 8 plants per 20 sq.ft. for jimsonweed and morningglory. Plots were four rows wide and 45' long in a randomized complete block design with four replications. Weed and crop biomass samples were taken on September 7. All plots were machine harvested on November 10.

Preliminary results show yield reductions of 15, 19, 32, and 45% at densities of 1, 1.3, 2, and 4 cocklebur plants per 20 sq.ft. This represents a much greater impact of competition than that which occurred in 1981 on a similar soil when 4 plants per 20 sq.ft. caused only a 30% yield loss. In contrast morningglory at a density of 8 plants per 20 sq.ft. reduced yield only 6% in 1982 as compared to 17% in 1981. Losses from jimsonweed were approximately the same in both years. Differences in competitive ability between years were due in part to unusual growing conditions in 1982. The cool, wet conditions of spring and early summer seemed to enhance some natural biological controls such as white rust (Albugo ipomoeae-panduratae) on morningglory and leaf feeding by the beetle, Lema trivitata, on jimsonweed. On the other hand the extremely dry portion of late summer and early fall seemed to give cocklebur an advantage over other species, probably due to cocklebur's extensive root system and subsequent ability to extract moisture more readily.

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Controlled Droplet Application (CDA) of Fluazifop and Sethoxydim for Annual and Perennial Weed Control

J. R. Cranmer and W. B. Duke[1]

ABSTRACT

Field studies were conducted to evaluate the activity of fluazifop and sethoxydim for grass control following low volume controlled droplet application (CDA) compared to higher volumes using conventional nozzles. Several studies were conducted in 1982. One study was set up to evaluate these post-emergence-grass chemicals against quackgrass [*Agropyron repens* (L.) Beauv.]. Both herbicides were applied with CDA units at 9.34 l/ha (1GPA) and 37.35 l/ha (4 GPA) or with conventional nozzles at 233.42 l/ha (25 GPA). When using the lowest spray volume, the carrier used was either straight vegetable oil (93% soybean oil:7% emulsifier) or straight petroleum-based oil (80% non-paraffinic phytobland oil:20% emulsifier). This was accomplished by mixing the herbicide with either oil type and spraying directly without adding water. Applications at 37.35 l/ha were made using soybean oil at 15% (v/v) in water. At 233.42 l/ha, petroleum-based oil was used at 1% (v/v). Visual ratings and quackgrass stand counts revealed that both fluazifop and sethoxydim were more effective applied with the CDA than with conventional nozzles. Early control ratings also suggested better initial control with soybean oil than with petroleum oil.

Concurrent similar work with sethoxydim for annual grass control revealed that the herbicide was more effective for green [*Setaria viridis* (L.) Beauv.] or yellow foxtail [*S. lutescens* (Weigel) Hubb.] and Japanese millet (*Echinochloa crus-galli* L.) control when applied with the CDA than with conventional nozzles. Herbicide activity was increased when applications were made at 9.34 l/ha compared to those made at 233.42 l/ha. For example, 0.028 kg/ha of sethoxydim in a carrier volume of 9.34 l/ha gave greater than 80% control of Japanese millet while the same rate applied with conventional nozzles gave 13% control. Total spray volume with CDA units also influenced grass control at the 0.028 kg/ha sethoxydim rate. Greater control was obtained at this rate applied in 9.34 l/ha than at 37.35 l/ha. At higher sethoxydim rates, these differences were not obvious.

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CDA PERFORMANCE WITH POSTEMERGENCE HERBICIDES

G. B. Johnston and F. J. Webb[1/]

ABSTRACT

Controlled Droplet Applicators (CDA) have stimulated considerable interest in the agricultural community. This interest stems from claims of increased herbicide activity with decreased herbicide rates and decreased carrier volume using the CDA.

The first objective of this work was to evaluate the effectiveness of the CDA, using different rates of two postemergence herbicides, paraquat and glyphosate, compared to conventional floodjet nozzles. The second objective was to compare two different herbicide carriers in the CDA. The treatments were evaluated by using visual burndown ratings of horseweed (Erigeron canadensis L.).

The CDA units were operated on 40-inch spacings, at an approximate 20° angle (front to back) to crop canopy, and at 4000 RPM. The floodjet nozzles were used on 20-inch spacings. There were two carriers used with the CDA, water and soybean oil. Water was the carrier used with the floodjet nozzles.

The spray volumes were 4.0 gals/A and 1.0 gal/A of water and soybean oil, respectively, with the CDA and 20 gals/A with the floodjet nozzles. The CDA treatments sprayed in water were: 1) paraquat .25 lb/A (no surfactant)[2/] and 2) glyphosate 1.1 lb/A. The CDA treatments sprayed in soybean oil were: 1) paraquat .19 lb/A (no surfactant), 2) paraquat .25 lb/A (no surfactant), 3) paraquat .38 lb/A (no surfactant), 4) glyphosate 0.8 lb/A, and 5) glyphosate 1.0 lb/A. The floodjet nozzle treatments were: 1) paraquat .19 lb/A + surfactant at .13% V/V, 2) paraquat .25 lb/A + surfactant at .13% V/V, 3) paraquat .38 lb/A + surfactant .13% V/V, 4) glyphosate 0.8 lb/A, and 5) glyphosate 1.0 lb/A.

Burndown activity was greater for both chemicals when sprayed in soybean oil than when applied in water using the CDA (Table 1).

Burndown activity from paraquat was substantially better with floodjet nozzles than with the CDA.

Burndown activity from glyphosate was slightly better with floodjet nozzles than with the CDA at the 0.8 lb/A rate. However, at the 1.0 lb/A rate of glyphosate there was essentially no visual difference in burndown activity between floodjet nozzles and the CDA.

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2/Equipment manufacturers specify not using surfactants in the CDA due to problems associated with reduced surface tension and droplet size.

Table 1. CDA Performance With Two Postemergence Herbicides (1982).

Treatments

Herbicide	Herb. Rate (lbs/A)	Carrier	Carrier Rate (gal./A)	Spray Tip	Visual Ratings[a/] 7 days	Visual Ratings[a/] 14 days
1. paraquat	.25	water	4	CDA	5.3	5.4
2. paraquat	.19	soybean oil	1	CDA	5.3	5.3
3. paraquat	.25	soybean oil	1	CDA	6.8	7.0
4. paraquat	.38	soybean oil	1	CDA	6.9	7.4
5. paraquat + surfactant	.19 + .13% V/V	water	20	floodjet	7.5	7.8
6. paraquat + surfactant	.25 + .13% V/V	water	20	floodjet	8.9	9.1
7. paraquat + surfactant	.38 + .13% V/V	water	20	floodjet	8.8	9.1
8. glyphosate	1.1	water	4	CDA	2.0	3.6
9. glyphosate	0.8	soybean oil	1	CDA	5.5	8.4
10. glyphosate	1.0	soybean oil	1	CDA	6.5	9.4
11. glyphosate	0.8	water	20	floodjet	5.0	9.2
12. glyphosate	1.0	water	20	floodjet	5.0	9.5

[a/] Rating Scale: 0 - no injury
10 - 100% kill

Influence of Fluazifop-Butyl on Quackgrass Rhizome Bud Germination

J. H. Birk and W. B. Duke[1]

ABSTRACT

A field study was conducted to investigate the effect of fluazifop on quackgrass (Agropyron repens (L.) Beauv.). Four node rhizome segments were planted in 25 cm plastic pots, which were buried in the soil. The emerging quackgrass shoots were allowed to grow to the desired leaf stage and were treated at either the 3-4 or 6-7 leaf stage with 0.56 kg/ha or 1.12 kg/ha respectively. Also a split application was made at the 3-4 and 6-7 leaf stage using 0.56 kg/ha and 0.56 kg/ha respectively. At approximately one week intervals after treatment pots were exhumed and the plants were evaluated for rhizome bud germination. Fluazifop was shown to be very effective for preventing bud germination at all rates and leaf stages. All treatments resulted in good season long control of both above and below ground growth.

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SPRAY PRESSURE, VOLUME AND TIP STUDY

G. B. Johnston and F. J. Webb[1/]

ABSTRACT

No-tillage and narrow row crop production has placed an increased emphasis on postemergence herbicide performance. This, in turn, has led to an increased interest in the role the spray delivery system plays in the overall performance of these postemergence herbicides. The objective of this study was to evaluate some key factors of the spray delivery system (spray pressure, spray volume, spray tip, and spray tip spacing) and their effect on certain selective and non-selective postemergence herbicides.

Three spray volumes were evaluated (20, 40 and 60 gallons per acre). The spray tips used were 80° flat fans on 20-inch spacings, 150° flat fans on 40-inch spacings and floodjet nozzles on 20-inch and 40-inch spacings. The spray pressures evaluated were 20 psi and 50 psi.

The treatments were evaluated across five crop or weed species using three postemergence herbicides. They were acifluorfen 0.38 lb/A on ivyleaf morningglory (Ipomoea hederacea L. 'Jacq.'),acifluorfen 0.25 lb/A on common lambsquarter (Chenopodium album L.), sethoxydim 0.2 lb/A + crop oil conc. 1 qt/A on rye, paraquat 0.13 lb/A + surfactant 0.13% V/V on soybeans, paraquat 0.13 + surfactant 0.063% V/V on fall panicum (Panicum dichotomiflorum Michaux.), and paraquat 0.063 + surfactant 0.063% V/V on rye.

Visual ratings were used to evaluate all treatments. The treatments using paraquat + surfactant sprayed on rye also were evaluated for their effects on the yield of the rye. The yield data was interpreted as an indication of herbicide performance. In this instance,the lower the yield the better the herbicide performance.

Visual ratings from all six tests were combined and comments are drawn from these averages (Table 1).

The best treatment was the combination of floodjet nozzles on 40-inch spacing at 20 psi pressure and 20 gals/A. The worst treatment was flat fan nozzles on 20-inch spacing at 20 psi pressure and 60 gals/A. Combining the data according to different spray volumes, 20 gals/A was the best, with 40 gals/A next, and 60 gals/A the worst. The composite spray pressure data shows 50 psi pressure was better than 20 psi pressure. Combining the spray tip and tip spacing data shows floodjet nozzles, on either 20-inch or 40-inch spacing, did better than flat fan nozzles. For floodjet nozzles, the 20-inch spacing was better than the 40-inch spacing.

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Table 1. Results of spray pressure, spray volume, spray tip, and tip spacing in six tests (1981-82),

Treatments				Visual Ratings 1/							Yield (bu/A)
Spray Tip	Tip Spacing (inches)	PSI	Gal./A	Ivyleaf Morningglory 2/	Common Lambsquarter 3/	Rye 4/	Fall Panicum 5/	Soybeans 6/	Rye 7/	Avg. 9/	Rye 8/
Flat Fan	20	20	60	8.0	3.0	2.0	7.0	3.0	2.0	4.2	19.0
" "	20	50	60	8.5	5.0	1.0	8.5	2.0	2.0	4.5	13.7
Floodjet	20	20	60	9.0	7.0	5.0	7.0	6.0	4.0	6.3	10.1
"	20	50	60	8.5	8.0	6.0	7.0	4.0	5.0	6.4	9.3
"	40	20	60	8.0	3.0	2.5	6.0	3.5	3.0	4.3	12.5
"	40	50	60	9.0	3.0	3.0	7.0	3.0	3.0	4.7	14.2
Flat Fan (150°)	40	50	60	9.0	4.0	2.0	7.0	3.0	4.0	4.8	10.1
Flat Fan	20	20	40	8.5	7.0	1.0	7.0	2.0	4.0	4.9	13.4
" "	20	50	40	9.5	8.5	1.0	7.0	2.5	3.0	5.3	15.3
Floodjet	20	20	40	10.0	8.0	8.0	7.5	4.5	4.0	7.0	11.8
"	20	50	40	9.5	8.5	7.0	7.0	3.5	6.0	6.9	6.9
"	40	20	40	8.5	5.0	0.5	7.0	4.0	4.0	4.8	14.9
"	40	50	40	9.5	7.0	9.0	7.0	4.5	6.0	7.2	8.2
Flat Fan	20	20	20	9.5	7.0	0.5	7.0	3.0	5.0	5.3	10.3
" "	20	50	20	8.3	7.5	0.5	7.0	3.0	6.0	5.4	7.5
Floodjet	20	20	20	7.0	5.0	2.0	7.0	5.0	7.0	5.5	3.4
"	20	50	20	8.0	8.0	3.0	7.0	4.0	6.0	6.0	7.7
"	40	20	20	9.8	9.0	9.0	7.0	6.0	7.0	8.0	6.7
"	40	50	20	9.5	7.0	8.0	7.0	4.5	6.0	7.0	6.0
Flat Fan (150°)	40	50	20	9.0	6.0	5.0	7.0	3.0	7.0	6.2	4.8

1/Rating Scale 0 - no injury
10 - 100% kill
2/Sprayed with acifluorfen 0.38 lb/A
3/Sprayed with acifluorfen 0.25 lb/A
4/Sprayed with sethoxydim 0.2 lb/A + crop oil conc. 1 qt/A
5/Sprayed with paraquat 0.13 lb/A + surfactant 0.063% V/V
6/Sprayed with paraquat 0.13 lb/A + surfactant 0.13% V/V
7/Sprayed with paraquat 0.063 lb/A + surfactant 0.063% V/V
8/ " " " " " "
9/Average of visual ratings (six tests)

ALACHLOR AND METOLACHLOR ALONE AND IN COMBINATION WITH ATRAZINE IN CORN 1/

I.M. Detlefsen, R.D. Ilnicki, and P. Chitapong 2/

ABSTRACT

As the rates of metolachlor and alachlor are increased from their general use rates to two and four times their use rates, a wider range of weed control is obtained. Also, combinations of either of these compounds with atrazine have been shown to produce similar yields of field corn under Central New Jersey growing conditions.

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)acetamide], are effective herbicides for use in corn, particularly for the control of annual grasses. For the most part, their field performance is comparable, however, metolachlor has proven to be slightly better for yellow nutsedge, (*Cyperus esculentus* L.), control than alachlor; and the latter has proven to be slightly safer, particularly during periods of cool weather with excessive rainfall. It was the objective of this study to determine, in a highly replicated trial, the effects of these two herbicides at their use rates and higher, alone, and in combination with atrazine (2-chloro-4-ethylamino-6-isopropyl-amino-S-triazine), on weed control and corn yields.

MATERIALS AND METHODS

This study was conducted at the Adelphia Research Center, New Jersey Agricultural Experiment Station, Adelphia, New Jersey. Treatments were applied to a Sassafras loam soil (organic matter 1.5%). Plot size was 12' by 19' with 6' alleyways. The corn, Midstates 747, was planted on May 11 in 30-inch rows, with four rows per plot. The design of the experiment was a completely randomized block. All herbicide treatments were applied at 40 gpa using a backpack CO_2-propelled sprayer with water as the carrier. Nozzles were Unijet flat spray tips, number 730616. At the time of herbicide application, May 13, the air temperature was 72 F, the soil temperature was 82 F, and the soil was dry at the surface with ample moisture below. The dominant weed species growing in the experimental area were common lambsquarters (*Chenopodium album* L.), redroot pigweed (*Amaranthus retroflexus* L.), and equal amounts of fall panicum (*Panicum dichotomiflorum* Michx.), and yellow foxtail (*Setaria glauca* L.), hereafter collectively referred to as grasses.

1/ New Jersey Agricultural Experiment Station Publication No. J-15472-4-82.

2/ Graduate Assistant, Research Professor of Weed Science, and Fulbright Graduate Fellow, respectively, Dept. of Soils and Crops, N.J. Agr. Exp. Sta., Cook College-Rutgers University, New Brunswick, N.J. 08903.

Plots were rated for weed control on June 23, using a scale from 0 to 10, where 0 is no reduction in weed stand and 10 is complete reduction in weed stand. The two center rows of each plot were harvested on October 7. In this experiment, the common use rates of alachlor and metolachlor will be designated as the X rates, and 2X and 4X represent two and four times the normal use rate, respectively. All herbicide treatments evaluated are listed in Table 1.

RESULTS AND DISCUSSION

At their common use rates (2 lb a.i./A for alachlor and 1.5 lb a.i./A for metolachlor), both alachlor and metolachlor resulted in 99% control of grasses, (yellow foxtail and fall panicum), and alachlor produced slightly better lambs-quarters control than metolachlor. At twice their normal use rates, both alachlor and metolachlor gave complete control of grasses and pigweed. In general, both compounds gave satisfactory grass control at their use rates, and control of broadleaf weeds was seen to increase as the rates of alachlor and metolachlor were increased above the common use rates. Combinations of either alachlor plus atrazine or metolachlor plus atrazine produced comparable (98-100%), control of grass and broadleaf weeds.

When applied alone, metolachlor at the X, 2X, and 4X rates, and alachlor at the X rate, produced yields which were not significantly different from the yields of uncultivated check plots. However, alachlor at the 2X and 4X rates produced yields which were significantly higher than the uncultivated check.

Atrazine alone produced yields that were significantly greater than the yields obtained with either metolachlor or alachlor alone - indicating greater competitive pressure from the broadleaf weeds than the grasses.

Finally, the yields obtained from plots treated with combinations of alachlor plus atrazine were not significantly different from those obtained from plots treated with a combination of metolachlor plus atrazine.

SUMMARY

As the levels of metolachlor and alachlor are increased from their normal use rates to twice and four times their use rates, an increase in the control of broadleaf weeds, and correspondingly higher yields are realized. Where yellow nutsedge is not a problem, combinations of alachlor or metolachlor with atrazine produce comparable weed control, and result in yields which are not significantly different.

Table 1. Weed control and yield data for field corn treated with alachlor or metolachlor alone, and in combination with atrazine, Adelphia, N.J. 1982.

Herbicide	Rate, lb.a.i./A	Weed Control (a)			Yield Bu./A
		Lambsquarters	Pigweed	Grasses	
alachlor	1.75	3.6	9.5	9.9	39.4
	2.00 (X)	3.8	10.0	9.9	53.8
	2.50	4.5	9.8	10.0	58.1
	4.00 (2X)	5.5	10.0	10.0	99.4
	8.00 (4X)	7.7	10.0	9.9	85.4
metolachlor	1.50 (X)	1.3	3.1	9.9	29.6
	2.00	3.3	7.5	10.0	41.2
	3.00 (2X)	2.7	10.0	10.0	38.2
	4.00	3.9	10.0	10.0	49.4
	6.00 (4X)	5.1	10.0	9.9	59.1
atrazine	1.50	10.0	10.0	5.8	131.1
alachlor + atrazine	1.75 + 1.20	9.9	10.0	9.8	112.0
metolachlor + atrazine	1.50 + 1.20	10.0	10.0	9.8	136.4
Check-alachlor + atrazine	1.50 + 1.00	10.0	10.0	10.0	132.5
Check-uncultivated		0	0	0	45.1
LSD 0.05					25.9

(a) Weed control rating, 0 = no control; 10 = complete control

COMPETITIVE EFFECTS OF CRABGRASS AND FALL PANICUM ON CORN

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ABSTRACT

Two field experiments were conducted at the Massachusetts Agricultural Experiment Station, University of Massachusetts, Amherst to investigate the competitive effects of large crabgrass [Digitaria sanguinalis (L.) Scop.] and fall panicum (Panicum dichotomiflorum Michx.) on corn. In one study, the effects of duration of annual grass competition in corn were studied. Corn ('Agway 584S') was exposed to natural pressure of crabgrass and fall panicum for 2, 4, 6, 8, 10 weeks, and full season (weedy check) and then maintained as weed free for the remainder of the season. Corn was also kept as weed free for 2, 4, 6, 8, 10 weeks, and full season (weed free check) and then exposed to natural weed pressure for the remainder of the season. Treatments were arranged in a randomized complete block with four replications. Weed biomass, corn height, ear, grain and silage yields of corn were determined to estimate the critical period for weed competition in corn.

In another study, the variables evaluated were three planting dates (May 19, June 2, and June 16) and four levels of fall panicum density (zero, low, medium, and high). Fall panicum densities were established by preemergence application of various rates of alachlor. The experiment was a split-plot design with planting dates as a whole plot and weed density levels as a subplot, with four replications. Weed counts, weed biomass, height, leaf area, ear, grain and silage yields of corn were determined to measure the competitive effects of all panicum.

Natural grass infestation for the first six weeks did not decrease ear, grain or silage yields of corn. However, natural grass infestation beyond the first six weeks, resulted in significant reduction of ear, grain and silage yields of corn. Similar corn yields from weed free plots were not different, although they were significantly higher compared to that of weedy plot for the entire season. Corn appears to compete with annual grasses and has the ability to compensate for early weed competition. Results indicate that corn yields including ear, grain and silage were not reduced if annual grasses were removed within two to four weeks from the date of planting.

Planting dates influenced corn growth. Greater ear and grain yields of corn were obtained when corn was planted on May 19. Ear and grain yields decreased as the planting date was delayed. Corn silage yields were higher in the third planting than in the earlier plantings. Ear and grain yeilds of corn decreased as the density of grass weeds increased. Yield differences due to weed density levels were greater in the early planting than in the late plantings. Corn silage yields were slightly affected by weed densities. This research suggests that planting corn early in the growing season puts the crop in a better competitive position to annual grasses than late planting crop.

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TIMING OF POSTEMERGENCE GRASS HERBICIDES FOR ANNUAL GRASS CONTROL IN A NEW ALFALFA SEEDING

F.J. Himmelstein and R.A. Peters[1/]

ABSTRACT

A number of recently developed postemergence grass herbicides were evaluated for selective control of Japanese millet (Echinochloa crusgalli var. frumentacea (Roxb.)). Preemergence, early and late postemergence treatments were applied in a seeding of alfalfa heavily infested with millet. Early postemergence treatments were applied when alfalfa was in the 3-4 trifoliate leaf stage, 7 cm in height; Japanese millet was in the 4-5 leaf stage, 15-20 cm in height. Late postemergence treatments were applied when alfalfa was 25 cm in height; Japanese millet was 40 cm in height. All early and late postemergence treatments of Hoe 00581, Dowco 453, fluazifop, sethoxydim and CGA-82725 significantly reduced dry matter yields of Japanese millet compared to the control. All early and late postemergence treatments as shown by the first cut were equally effective in controlling the millet with the exception of fluazifop at .28 and .56 kg/ha which was significantly more effective early postemergence. Preemergence applications were less effective than the postemergence treatments. A rate of .84 kg/ha of Dowco 453, fluazifop or CGA-82725 was required to give control comparable to .14 kg/ha of these same chemicals applied early postemergence. While good control was obtained at the .84 kg/ha rate from all three materials, Dowco 453 was significantly better than the other two herbicides at the .28 kg/ha rate. Sethoxydim and Hoe 00581 were not active preemergence.

Early grass control was essential in obtaining the maximum increases in alfalfa yields. Despite the fact that the late postemergence treatments provided good control of Japanese millet, the greatest seasonal total yields of alfalfa were obtained from the preemergence and early postemergence treatments.

INTRODUCTION

A number of new postemergence herbicides for grass weeds in broadleaf crops are currently under development. Although a great deal of work has been done with soybeans (Glycine max. (L.) Merr.), relatively little has been done on the establishment of alfalfa (Medicago sativa (L.)). Annual grasses pose a serious threat prior to the first cutting. The objectives of this experiment were to compare several new materials and to determine the optimum time of application.

MATERIALS AND METHODS

The following experiment was carried out at the Agronomy Research Farm at Storrs, CT. The soil type was a Paxton fine sandy loam, coarse loamy mixed mesic Typic Fragiochrept. The field was fertilized with 170 kg/ha P_2O_5 and K_2O and received an application of 6720 kg/ha lime on May 11, 1982. The

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experimental design was a randomized complete block replicated four times. Plot size was 1.52 by 7.62 m with a .9 by 7.0 m strip removed for dry matter determinations. Iroquois alfalfa was seeded at 13.5 kg/ha with a grain drill on May 13, 1982. The predominate volunteer grass was Japanese millet (Echinochloa crusgalli var. frumentacea (Roxb.)). Preemergence treatments were applied on May 13, 1982. Early postemergence treatments were applied on June 18, 1982. Alfalfa was in the 3-4 trifoliate leaf stage, 7 cm in height. Japanese millet was in the 4-5 leaf stage, 15-20 cm in height. Late postemergence treatments were applied on July 7, 1982. Alfalfa was 25 cm in height; Japanese millet was 40 cm in height.

Herbicides evaluated included Hoe 00581 (chemistry unknown), Dowco 453 (Methyl 2-(4-1(3-chloro-5-(trifluoromethyl)-2-pyridinyl)oxy)phenoxy)propanoate), sethoxydim (2-[1-ethoxyimino)-butyl]-5-[2-ethylthio)-propyl]-3-hydroxy 2-cyclohexene-1-one), fluazifop-butyl (± butyl 2-[4-([5-trifluoromethyl)-2 pyridinyl]oxy] phenoxy propanoate) and CGA-82725 (2-propynyl 2-(4-([3,5 dichloro-2-pyrindinyl] oxy) phenoxy) propanoate). Treatments were applied in 450 l/ha of water with a small plot sprayer with Spraying Systems 6504 nozzles at 40 psi. All rates are given in terms of active ingredients. Weed oil was used in some treatments.

Yields of dry matter were determined from samples cut on August 3 and October 4, 1982. Grab samples were taken at both harvests for hand separations into alfalfa, Japanese millet and broadleaf weed components.

RESULTS AND DISCUSSION

The competitiveness of the Japanese millet that developed in the seeding is shown by the yield data in Table 1. The millet in the control at the first harvest had a dry matter four times as great as the alfalfa, (2,810 vs 620 kg/ha) while in the second harvest the millet dry matter was nearly equivalent to the alfalfa dry matter.

Both early and late postemergence applications of Hoe 00581 at .11, .17 or .22 kg/ha signigicantly reduced dry matter yields of millet compared to the control. However, Hoe 00581 (.22 kg/ha) did not display any preemergence activity.

All Dowco 453 applications (.14, .28 and .84 kg/ha) significantly reduced dry matter yields of Japanese millet. However, .84 kg/ha preemergence was required to achieve control comparable to .14 and .28 kg/ha either early or late postemergence.

Sethoxydim was effective applied either early or late postemergence. All applications (.22 and .45 kg/ha) significantly reduced dry matter yields of Japanese millet. No preemergence applications were made. Based on earlier field studies, sethoxydim showed little if any preemergence activity. (1)

Fluazifop significantly reduced Japanese millet yields at all time periods tested at .14, .28, .56, and .84 kg/ha. Fluazifop at .28 kg/ha and .56 kg/ha early postemergence was more effective than the late postemergence applications

Table 1. Control ratings and yields of Japanese millet and alfalfa following applications of postemergence grass killers.

			Japanese Millet								Yields DM					
			Control Ratings					Yields (DM)			Alfalfa			Broadleaf Weeds		
Herbicide	Rate	Time	June 17	July 8	July 22	Aug. 2	Sept. 30	Aug. 3	Oct. 4	Total	Aug. 3	Oct. 4	Total	Aug. 3	Oct. 4	Total
	kg/ha							kg/ha	kg/ha		kg/ha	kg/ha		kg/ha	kg/ha	
Hoe 00581	.11	E.P.[2]	--	9.5[5]	10.0	9.3	8.8	160e-g[6]	50d	210d-f	1830	1970	3800	450a-h	170	620a-g
Hoe 00581+oil[1]	.11	"	--	10.0	10.0	10.0	9.5	10g	10d	20ef	2060	1970	4030	470a-h	120	590a-g
Hoe 00581	.17	"	--	10.0	10.0	10.0	9.3	0g	10d	10et	1640	1620	3260	450a-h	240	690a-g
Hoe 00581+oil	.17	"	--	10.0	10.0	10.0	9.5	0g	10d	10f	1730	1690	3420	490a-h	210	700a-g
Hoe 00581	.22	"	--	9.8	10.0	9.8	9.8	190e-g	10d	200d-f	1710	1690	3400	380a-h	190	570a-g
Hoe 00581+oil	.11	L.P.[3]	--	--	7.5	8.0	9.0	280d-g	0d	280d-f	1430	1480	2910	20h	190	210d-g
Hoe 00581	.22	"	--	--	8.8	8.5	9.5	190e-g	10d	200d-f	1220	1550	2770	50h	130	180e-g
Hoe 00581	.22	Pre.[4]	0.0	0.0	0.0	0.0	0.0	2970a	1100a	4070a	370	980	1350	20h	50	70g
Dowco 453+oil	.14	E.P.	--	10.0	10.0	10.0	9.0	20fg	0d	20ef	1480	1690	3170	680a-d	150	830a-d
Dowco 453+oil	.28	"	--	10.0	10.0	10.0	9.8	0g	0d	0f	1360	1480	2840	820ab	140	960ab
Dowco 453+oil	.14	L.P.	--	--	7.8	8.3	9.8	260d-g	50d	310d-f	650	1330	1980	300c-h	230	530a-g
Dowco 453+oil	.28	"	--	--	8.8	8.8	9.8	190e-g	10d	200d-f	700	1190	1890	280c-h	260	540a-g
Dowco 453	.28	Pre.	9.0	7.3	6.5	4.3	4.3	750cd	350c	1100c	1590	1970	3560	260c-h	120	380b-g
Dowco 453	.84	"	10.0	10.0	10.0	9.3	8.8	0g	10d	10f	1920	1690	3610	630a-f	190	820a-e
Sethoxydim+oil	.22	E.P.	--	10.0	10.0	10.0	9.5	0g	0d	0f	1590	1620	3210	350b-h	200	550a-g
Sethoxydim+oil	.45	"	--	10.0	10.0	10.0	9.5	0g	30d	30ef	1290	1620	2910	750a-c	190	940a-c
Sethoxydim+oil	.22	L.P.	--	--	7.5	7.8	9.8	260d-g	20d	280d-f	910	1550	2460	90gh	230	320b-g
Sethoxydim+oil	.45	"	--	--	9.3	9.3	10.0	160e-g	30d	190d-f	1290	1330	2620	210d-h	260	470b-g
Fluazifop+oil	.14	E.P.	--	8.8	6.8	5.0	5.5	490c-g	210cd	700c-e	1430	1550	2980	330b-h	170	500a-g
Fluazifop+oil	.28	"	--	9.5	10.0	8.8	9.0	40e-g	10d	50ef	1430	1480	2910	660a-e	280	940a-c
Fluazifop+oil	.56	"	--	10.0	10.0	10.0	9.5	0g	0d	0f	1450	1400	2850	590a-g	210	800a-f
Fluazifop+oil	.14	L.P.	--	--	7.0	7.0	8.5	580c-e	120d	700c-e	890	1830	2720	90gh	90	180d-g
Fluazifop+oil	.28	"	--	--	6.5	6.3	6.8	960bc	230cd	1190c	910	1620	2530	50h	100	150fg
Fluazifop+oil	.56	"	--	--	8.0	7.8	9.0	560c-f	50d	610c-f	1730	1620	3350	50h	110	160fg
Fluazifop	.28	Pre.	8.5	5.0	2.3	2.0	1.8	1430b	840b	2270b	1190	1620	2810	380a-h	50	430b-g
Fluazifop	.84	"	9.3	8.5	7.0	5.3	4.5	420d-g	370c	790cd	1330	1620	2950	420a-h	160	580a-g
CGA-82725	.14	E.P.	--	9.8	10.0	10.0	9.3	10fg	20d	30ef	1900	1620	3520	340b-h	190	530a-g
CGA-82725+oil	.14	"	--	10.0	10.0	9.8	9.3	10g	10d	20ef	820	1260	2080	870a	280	1150a
CGA-82725+oil	.28	"	--	10.0	10.0	10.0	9.3	0g	0d	0f	1590	1330	2920	680a-d	140	820a-e
CGA-82725+oil	.14	L.P.	--	--	7.8	7.3	9.0	350d-g	110d	460d-f	930	1620	2550	120gh	190	310c-g
CGA-82725+oil	.28	"	--	--	8.0	7.8	9.3	260d-g	0d	260d-f	1380	1690	3070	150e-h	150	300c-g
CGA-82725+oil	.56	"	--	--	8.0	8.0	9.8	350d-g	10d	360d-f	790	1400	2190	140f-h	230	370b-g
CGA-82725	.28	Pre.	8.3	5.3	4.3	2.8	2.0	1310b	770b	2080b	1310	1760	3070	280c-h	50	330b-g
CGA-82725	.84	"	9.5	9.5	9.8	8.5	7.5	100e-g	170cd	270d-f	1590	1690	3280	450a-h	140	590a-g
Control			0.0	0.0	0.0	0.0	0.0	2810a	1220a	4030a	620	1120	1740	20h	40	60g

[1]Weed oil was Booster + E
[2]Early postemregence June 18, 1982
[3]Late postemergence July 7, 1982
[4]Preemergence May 13, 1982
[5]Rating scale 0-no effect; 10-complete kill
[6]Means followed by the same letter do not differ significantly at the 5% level using Duncan's multiple range test.

at .28 or .56 kg/ha at the first cut. The preemergence application of .84 kg/ha at the first cut resulted in control comparable to the postemergence treatments.

Preemergence applications were much less effective than the postemergence treatments. At the first cut a rate of .84 kg/ha of Dowco 453, fluazifop, or CGA-82725 was required to give control comparable to .14 kg/ha of these same chemicals applied early postemergence. While good control was obtained at the .84 kg/ha rate from all three materials, Dowco 453 was significantly greater than the other two herbicides at the .28 kg/ha rate.

Decline in millet control at .28 kg/ha preemergence is brought out in the control ratings in Table 1. Results show a decrease in millet control as the season progressed. Decline in millet control throughout the season with .84 kg/ha preemergence was not as dramatic as with the low rate preemergence.

All early and late postemergence treatments at the first cut were equally effective in controlling the millet with the exception of fluazifop at .28 and .56 kg/ha which was significantly more effective early postemergence.

All of these materials were slow acting. A time period of ten to fourteen days passed before maximum control was seen. The first symptoms were arrested growth. The foliage turned a reddish-brown followed by a gradual disintegration. Complete kill did not occur for nearly three to four weeks after application depending on the stage of growth the millet was treated.

Despite excellent Japanese millet control, no significant increases in alfalfa were obtained. This was largely attributed to the variability in the growth of alfalfa as related to a low and variable pH. However, a definite pattern was evident in total seasonal yields of alfalfa. Upon close examination of yield data it was evident that early grass control was essential to obtain the greatest increases in alfalfa yields. Despite the fact that the late postemergence treatments provided good control of Japanese millet, the greatest seasonal total yields of alfalfa were obtained from the preemergence and early postemergence treatments. By delaying herbicide application, the competition of Japanese millet occurred over a greater span of time. Delaying application of herbicides reduced alfalfa yields an average of eighteen percent from that of preemergence or early postemergence applications.

Since preemergence applications were effective only at the higher rates it probably will not be economically feasible to apply these herbicides at planting. However, preemergence activity will provide a measure of residual control. This will be a benefit for control of grass weeds from late germinating seeds.

LITERATURE CITED

Himmelstein, F.J. and R.A. Peters. Non-incorporated herbicides for large crabgrass [Digitaria sanguinalis (L.) Scop.] in new seedings of alfalfa. [Abstract]. 1982 Meeting of the Weed Science Society of America, p. 21.

QUACKGRASS CONTROL WITH POST EMERGENT HERBICIDES

Prasanta C. Bhowmik[1/]

ABSTRACT

Four post emergent herbicides were evaluated in controlling quackgrass [Agropyron repens (L.) Beauv.] at the Massachusetts Agricultural Experiment Station, South Deerfield. The objectives of this trial were to i) compare the efficacy of quackgrass control, ii) determine the effect of herbicides on quackgrass regrowth, and iii) establish the preemergence activity, if any, of the post emergent herbicides. The soil was a Hadley fine sandy loam (Typic Udifluvents). Quackgrass was treated in 3 x 6 m plots when the shoots were 15 to 20 cm tall. All treatments were applied in 450 L/ha at 152 KPa pressure. Treatments were replicated three times in a randomized complete block. Visual ratings of quackgrass control, shoot counts, and the number of rhizomes (with at least one node) were determined for the evaluation.

SC 0224, glyphosate, fluazifop, and sethoxydim at 1.1 or 2.2 Kg/ha provided excellent quackgrass control (Table 1). However, sethoxydim at 1.1 Kg/ha exhibited less control 42 days after the application. This was evident by a significant increase in number of shoot regrowth (35.5%) in plots with sethoxydim at the lower rate. No regrowth of quackgrass shoots was observed in the plot treated with fluazifop at 2.2 Kg/ha, while all other plots had quackgrass regrowth varying from 0.3 to 8.4% compared to the untreated check. The number of viable rhizomes that had potential for regrowth decreased as the herbicide rate increased. Maximum number of viable quackgrass rhizomes was found from the plot treated with sethoxydim at 1.1 Kg/ha.

Fluazifop and sethoxydim showed residual preemergence activity in controlling annual grasses. It is interesting to note that fluazifop at both rates provided better annual grass control compared to that obtained with the similar rates of sethoxydim.

Results of a greenhouse experiment with fluazifop in relation to stage of quackgrass growth and rate of fluazifop application will also be presented.

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Table 1. Efficacy of various post emergence herbicides in controlling quackgrass

Treatment	Rate	Quackgrass control		Growth Parameters - 42DAA[a]			
				Quackgrass shoot		Viable rhizome[b]	Number of Annual Grasses
		21DAA	42DAA	Number	Percent of check		
	(Kg/ha)	— %	—	(1000/ha)	(%)	(%)	(1000/ha)
SC 0224	1.1	100	93	98	3.4	6.6	151
SC 0224	2.2	100	98	151	5.3	4.6	160
Glyphosate	1.0	100	93	240	8.4	4.8	98
Glyphosate	2.2	100	95	160	5.6	2.2	116
Fluazifop	1.1	93	96	9	0.3	5.5	27
Fluazifop	2.2	95	98	0	0	0.2	9
Sethoxydim	1.1	92	83	1013	35.5	13.0	53
Sethoxydim	2.2	95	97	27	0.9	3.6	27
Untreated check	-	0	0	2853	100	37.4	2009
$LSD_{0.05}$	-	2	4	505	17.7	30.7	196

[a]DAA = Days after application

[b]Expressed as the percent of the total number of rhizomes present

GLYPHOSATE AND/OR QUACKGRASS EFFECT ON NO-TILLAGE ALFALFA SEEDING IN QUACKGRASS SOD

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ABSTRACT

Failure of no-till alfalfa established in a quackgrass sod has been attributed to allelopathic effects, exudation of applied glyphosate and/or competition for light, water, and nutrients. Insect, disease and slug damage may also contribute to poor stands, particularly with sod seeding. In this study, alfalfa was seeded into a quackgrass sod treated with methyl bromide or glyphosate. Insect, fungi, and slug control measures were applied to assess the influence of other pests on alfalfa establishment in glyphosate suppressed quackgrass sod. Alfalfa, quackgrass and broadleaf weed yields were significantly different among treatments. Alfalfa yields were poor except where quackgrass was killed with methyl bromide. Alfalfa establishment was not increased by following glyphosate treatments with carbofuran, benomyl or methiocarb. The data suggest that neither competition from quackgrass nor other pests could explain the poor alfalfa growth where glyphosate was applied.

INTRODUCTION

Quackgrass (Agropyron repens (L.) Beauv.) is a competitive perennial with the potential to produce an allelopathic agent to which alfalfa is particularly sensitive (3, 7). The nonselective herbicide glyphosate [N-(phosphonomethyl) glycine] has been used to control perennial weeds like quackgrass in no-till forage renovation programs with varied success. Recent reports suggest that in addition to deleterious effects of a quackgrass-produced allelopathic agent, exudates of applied glyphosate may contribute to poor establishment of no-till alfalfa in a quackgrass sod (2, 10). Although glyphosate has not been considered to be active in soil (12), some research suggests that glyphosate applied to soil (11) or exuded from roots (10) exhibits sufficient soil activity to adversely affect germination and seedling growth of alfalfa (5).

However, other workers have attributed poor germination and growth of crops planted in glyphosate-killed quackgrass to toxins and pathogens from decaying weeds (4), soil microorganisms (3) and pathogenic fungi (9). In addition, insects and slugs are serious pests whose feeding habits may have contributed to the failure of no-till alfalfa seedings (1).

The purpose of this study was to measure the influence of disease, insects and slug control measures on alfalfa establishment in a glyphosate-treated quackgrass sod compared to quackgrass control with methyl bromide.

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MATERIALS AND METHODS

Alfalfa was sod seeded on a Hagerstown silt loam (fine, mixed mesic Typic Haplaudult) with about 10% sand, 16% silt, 20% clay and 2.5% organic matter. High Mg lime was applied according to soil test recommendations and no fertilizer was added before planting. 'Honeoye' alfalfa was seeded with a Tye drill at 22 kg seed/ha on 1 June 1982.

Glyphosate and paraquat (1,1'-dimetyl-4,4'-bipyridinium ion) treatments were applied to a quackgrass sod at the fourth leaf stage (15 to 20 cm) on 18 May, thirteen days before planting. Air temperature was 16 C, with relative humidity 54% and wind 0 to 1.4 m s^{-1}. Soil temperature at 1.3, 2,5, and 7.6 cm was 19, 18, and 16 C, respectively. The soil, after an extended dry spell, was very firm and dry.

Subsequent applications of .56 kg/ha benomyl [methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate] and 1.12 kg/ha carbofuran (2,3-dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate) were made 9 June on a moist soil surface when alfalfa was at the cotyledon stage. Soil temperature was 32, 29, and 22 C at 1.3, 2.5, and 7.6 cm; air temperature was 28 C with a 1.4 to 2.4 m s^{-1} wind. Methiocarb 2% [3,5-dimethyl-4-(methylthio)phenolmethylcarbamate] was applied at 1.12 kg/ha as a pelleted bait for slug control on 11 and 23 June. Methyl bromide was fumigated with 728 kg/ha under plastic on 28 May. The soil was moist, 28 C at 1.3 cm, with air temperature 24 C and no wind. On 24 June (24 days after seeding) an early post-emergence treatment of .224 kg/ha sethoxydim (2-[1-(ethoxyimino)-butyl]-5-[2-(ethylthio)-propyl]-3-hydroxy-2-cyclohexene-1-one) plus .56 kg/ha 2,4-DB([4-2,4-dichlorophenoxy)butyric acid]) with .946 L crop oil was applied for annual grass and broadleaf weed control. Alfalfa was in the 1 to 2 trifoliate leaf stage and annual grasses and broadleaf weeds were about 2.5 cm. All sprayed treatments were applied with a small plot sprayer mounted on a Ford tractor using 186.7 L/ha water and 8001 low pressure nozzles at .195 MPa, except benomyl and carbofuran which were applied in 373.5 L/ha water.

A randomized complete block design with four replications was used. Plot size was 3.1 by 6.1 m. Yields were measured on 19 August by separating alfalfa, quackgrass and broadleaf weeds harvested from two .5 m^2 quadrats per plot. The predominant broadleaf weed was dandelion (Taraxacum officinale Weber). Data were analyzed by analysis of variance and differences between means were determined by Duncan's new multiple range test at the 5% level of significance.

RESULTS AND DISCUSSION

There were significant differences among treatments for yields of alfalfa, quackgrass and broadleaf weeds (Table 1). Alfalfa establishment and growth was poor in all treatments except where the sod was killed with methyl bromide. The addition of benomyl, carbofuran or methiocarb did not improve alfalfa establishment over the use of glyphosate alone. Paraquat reduced the effectiveness of glyphosate and the uncontrolled quackgrass resulted in a significant reduction in alfalfa yield. Alfalfa yields were significantly more when glyphosate was followed by benomyl than when glyphosate was followed by carbofuran and methiocarb.

Quackgrass was completely eliminated by the methyl bromide treatment, but the glyphosate treatments only suppressed quackgrass early in the season and it resumed growth by mid-season to give high yields on the 19 August sampling date. The low quackgrass yield in the untreated check was attributed to the normal pattern of profuse spring growth followed by senescence of mature leaves in mid-summer. Generally, none of the pest control treatments applied after glyphosate resulted in significant differences in weed yields.

Table 1. Yield of alfalfa, quackgrass and broadleaf weeds in alfalfa seeded in a quackgrass sod killed by methyl bromide or suppressed with glyphosate and followed by benomyl, carbofuron and methiocarb.

Treatment [1]	Yields		
	alfalfa	quackgrass	broadleaf weeds
	- - - - - - - kg/ha - - - - - - - - -		
glyphosate	700 bc	1370 ab	600 ab
glyphosate + benomyl	850 b	940 b	460 ab
glyphosate + benomyl + carbofuran	450 bcd	1820 ab	370 ab
glyphosate + benomyl + methiocarb	540 bc	2080 a	320 b
glyphosate + benomyl + methiocarb + carbofuran	640 bc	1500 ab	650 ab
glyphosate + carbofuran + methiocarb	400 cd	1650 ab	1000 a
glyphosate + paraquat	70 de	1400 ab	70 b
methyl bromide	4020 a	0 c	60 b
untreated check	0 e	1100 ab	10 b

[1] Application rates (kg/ha): glyphosate, carbofuran, methiocarb, 1.12; benate, 0.56; paraquat, 0.28; methyl bromide, 728.6.

[2] Means within a column followed by the same letter do not differ at the 5% level of significance according to Duncan's new multiple range test.

The extreme differences in alfalfa yield between the methyl bromide treatment and all others suggest that either competition or toxic products associated with living quackgrass severely decreased alfalfa establishment. However, several lines of evidence suggest that this effect was due to factors other than competition, allelopathy, or to other pests. The lack of a benomyl, carbofuran or methiocarb effect, for example, indicated that common disease (damping off), insect or slug pests were not the principal cause of the poor stand. Although quackgrass yields were high, competition from quackgrass recovery growth would probably not have affected the alfalfa until mid-season. The alfalfa yields reflect a possible toxic effect of quackgrass on alfalfa stands, as determined by germination and emergence, rather than a depression of growth of established plants. In addition, a stepwise regression analysis of alfalfa yield was quackgrass and broadleaf weed yields showed that alfalfa yields were not significantly related to weed yields. This would tend to indicate that the reason for the poor alfalfa stand and yield was due to something other than competition. Had the effect of quackgrass on alfalfa establishment been due to decaying rhizomes, as some reports have suggested (9, 6), this effect should also have appeared in the methyl bromide plots.

not if MBr destroyed organisms

The results do not allow conclusions to be made regarding possible exudation of applied glyphosate from quackgrass rhizomes. The depression of alfalfa establishment occurred where quackgrass was suppressed (i.e. not completely killed) by glyphosate, but not where it was completely killed by methyl bromide. Kommendahl, et al. (3) found reductions in alfalfa germination and seedling growth due to living quackgrass, though other workers (4, 6, 8) concluded that decaying rhizomes and herbage were the source of the allelopathic effect of quackgrass. Since release of allelopathic compounds is enhanced by plant stress, the suppression by glyphosate may have favored production and release of an allelopathic agent toxic to alfalfa. The effect of methyl bromide treatments may have been too rapid to allow synthesis and exudation of such compounds by quackgrass.

In conclusion, the data suggest that the failure of alfalfa to establish in a quackgrass sod was not due to insects, slugs, or fungal diseases. The reduction in yields of alfalfa sown into glyphosate suppressed quackgrass appeared to be due to factors other than competition. There was no direct evidence of glyphosate exudates from quackgrass.

LITERATURE CITED

1. Byers, R. A. 1979. Arthropod and mollusc pests of no-till forages. Northeast ASA Abstracts. 13-15.

2. Coupland, D. and J. C. Naseley. 1979. Presence of ^{14}C activity in root exudates and guttation fluid from Agropyron repens treated with ^{14}C-labelled glyphosate. New Phytol. 83:17-22.

3. Kommendahl, T., J. B. Kotheimer and J. V. Bernardini. 1959. The effects of quackgrass on germination and seedling development of certain crop plants. Weeds 7:1-12.

4. Lynch, J. M. and D. J. Penn. 1980. Damage to cereals caused by decaying weed residues. J. Sci. Food Agric. 31:321-324.

5. Moshier, L., A. J. Turgeon and D. Penner. 1978. Effects of glyphosate in sod seeding alfalfa establishment. Weed Sci. 26:163-166.

6. Mueller-Warrant, G. W. and D. W. Kock. 1908. Establishment of alfalfa by conventional and minimum-tillage seeding techniques in a quack-grass-dominant sward. Agron. J. 72:884-889.

7. Ohman, J. H. and T. Kommendahl. 1960. Relative toxicity of extracts from vegetative organs of quackgrass to alfalfa. Weeds 8:666-670.

8. Ohman, J. H. and T. Kommendahl. 1964. Plant extracts, residues, and soil minerals in relation to competition of quackgrass with oats and alfalfa. Weeds 12:222-231.

9. Penn, D. J. and J. M. Lynch. 1981. Microbiological problems from the decomposition of weeds. Grass Weeds in Cereals in the United Kingdom Conf. 1981.

10. Rodriques, J. J. and A. D. Worsham. 1982. Exudation of glyphosate from wheat (Triticum aestivum L.) plants and its effects on interplanted corn (Zea mays L.) and soybeans (Glycine max L.(Merr.)). Weed Sci. 30:316-320.

11. Salazar, L. C. and A. P. Appleby. 1982. Herbicidal activity of glyphosate in soil. Weed Sci. 30:463-466.

12. Sprankle, P., W. F. Meggit and D. Penner. 1975. Rapid inactivation of glyphosate in the soil. Weed Sci. 23:224-228.

HERBICIDE PERFORMANCE IN NO-TILL LEGUME ESTABLISHMENT IN GRAIN STUBBLE

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ABSTRACT

A series of experiments were conducted to evaluate weed control in no-till legume seedings made in grain stubble. Postemergence applications of fluazifop and sethoxydim significantly reduced annual and perennial grass yields in spring seeded alfalfa and red clover. Significant increases in legume yield did not occur. Sethoxydim and fluazifop effectively controlled volunteer oats in a fall red clover seeding. All combination treatments increased seedling numbers over any single herbicide treatment. Legume yields were not significantly different.

INTRODUCTION

Minimum tillage establishment of forage legume can pose some problems in obtaining effective weed control (2). Competition from annual grasses in spring seedings made in grain stubble and competition from volunteer grain in fall seedings particularly can be significant. New herbicides show promise for postemergence grass control in no-till seedings (1, 3).

These experiments were initiated to find effective weed control treatments for no-till legume establishment in grain stubble.

MATERIALS AND METHODS

Seven field weed control experiments were established during 1981-1982 at the Agronomy Research Farm in Aurora, New York on a Honeyoye-Lima soil. However, we will report on only three. Four of these no-till experiments failed; one because of phytophora root rot and three because of high slug populations and activity. All experiments were seeded in oat stubble except one which was in a wheat stubble. Experiment 1 was seeded with alfalfa (Medicago sativa (L.) var. Saranac) at 18 kg/ha. Experiments 2 and 3 were seeded with red clover (Trifolium pratense (L.) var. Arlington) at 13.5 kg/ha. All plantings were made with a powered drill planter. Plot size was 2.5 m x 6.0 m. The experimental design was a randomized complete block. Experiments 1 was replicated four times, and Experiments 2 and 3 were replicated six times. All treatments were applied with a bicycle sprayer utilizing compressed air delivering approximately 215 liters/ha water solution through 8004 flat spray tips. The herbicides applied in one or more of the experiments included paraquat (1,1'-dimethyl-4,4'-bipyridinium ion), glyphosate [N-(phosphonomethyl)glycine], sethoxydim [2-(1-ethoxyimine) buytl]-5-[2-ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one)], fluazifop [(±)-butyl 2-[4-[[5-(trifluoromethyl)-2-pyridinyl] oxy] phenoxy] propanoate], 2,4-DB [4-(2,4-dichlorophenoxy) butyric acid], pronamide [[3, 5-dichloro (N-1,-1-dimethyl-2-propynil) benzamide] N-(1,1-dimethylpropynyl)-3,5-dichloro-benzamide], and dalapon (2, 2-dichloropropionic acid). Paraquat and fluazifop were applied with 0.25% v/v of a nonionic surfactant. Sethoxydim was applied

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with 1% v/v of crop oil. All herbicide rates and mixture of treatments are listed in the tables. Herbicides applied at the same time were tank mixed.

Data collected include stand counts, visual weed control ratings and dry matter yields.

RESULTS AND DISCUSSION

Experiment 1 involved spring planted no-till alfalfa in an area heavily infested with annual grasses and broadleaf weeds. Sethoxydim and fluazifop treatments generally provided excellent annual grass control at all rates. Sethoxydim and fluazifop alone increased broadleaf weed yields probably because of a release from grass competition. All treatments increased alfalfa yields in the first year but this increase was not statistically significant. All combinations with 2,4-DB reduced grass control. This reduction is probably due to direct competition pressure rather than a herbicide interaction. Yields in 1982 were not significantly different (Table 1).

Table 1. Alfalfa and weed yields following postemergence herbicide treatments. Experiment 1[a].

HERBICIDE	RATE	YIELD 1981 LEG	YIELD 1981 GRASS	YIELD 1981 BL	YIELD 1982 LEG	YIELD 1982 GRASS	YIELD 1982 BL
	kg/ha	t/ha					
Fluazifop	0.28	0.63	0.46 ab	0.70 b	5.4	0.2	0.4
Fluazifop	0.42	0.66	0.28 a	0.92 b	5.3	0.1	0.6
Fluazifop	0.56	0.45	0.27 a	0.78 b	5.1	0.1	0.7
Fluazifop + 2,4-DB[b]	0.28 + 1.68	0.36	1.11 cde	0.68 ab	5.7	0.2	0.6
Fluazifop + 2,4-DB	0.42 + 1.68	0.74	0.92 bcd	0.65 ab	5.2	0.2	0.5
Fluazifop + 2,4-DB	0.56 + 1.68	0.64	0.66 abc	0.82 b	5.2	0.1	0.4
Sethoxydim	0.22	0.59	0.28 a	0.98 b	5.4	0.2	0.7
Sethoxydim	0.44	0.63	0.18 a	0.96 b	5.1	0.1	0.7
Sethoxydim + 2,4-DB	0.22 + 1.68	0.64	0.72 abc	0.85 b	5.3	0.2	0.5
Sethoxydim + 2,4-DB	0.44 + 1.68	0.55	0.62 abc	0.74 b	5.8	0.1	0.5
Dalapon	3.36	0.49	1.36 e	0.73 b	5.2	0.1	0.5
Control		0.29	1.28 de	0.34 a	4.4	0.3	0.8
LSD .05		N.S.	.60	.35	N.S.	N.S.	N.S.

[a]Postemergence treatments applied 6/11/81. Paraquat at 0.84 kg/ha was applied prior to planting. Plots were seeded May 18, 1981.
[b]The 2,4-DB formulation used was the dimethylamine salt.

Experiment 2 was initiated to evaluate the benefits of using fluazifop or sethoxydim alone or with standard herbicide treatments recommended for no-till establishment of a fall seeding of red clover in an oat stubble with an anticipated volunteer oat population.

Paraquat and glyphosate gave good control of an existing population of annual grasses and broadleaf weeds before planting. The population of

volunteer oats was heavy. Both fluazifop at 0.56 kg/ha and sethoxydim at 0.45 kg/ha gave virtually 100% control of the volunteer oats. Treatments with paraquat and glyphosate alone gave no control of volunteer oats since the oats had not germinated at the time of application. There was no visible effect from 2,4-DB as the preplant application of paraquat or glyphosate controlled the broadleaf weeds satisfactorily.

Paraquat, glyphosate, sethoxydim or fluazifop applied alone did not increase seedling numbers significantly over the control. A combination of preplant applied glyphosate or paraquat and a postemergent application of sethoxydim or fluazifop resulted in about 20% more seedlings than either paraquat or glyphosate alone and were significantly higher than the control.

A very wet period during establishment may have been responsible for reducing the amount of difference we would expect from such heavy weed pressure. Red clover is very competitive and the resulting seedling numbers were apparently high enough in all treatments to prevent any differences in dry matter yields in 1982.

Table 2. Effect of herbicides alone and in combination on red clover stand count and dry matter yield in no-till planting in the fall (Experiment 2)[a].

HERBICIDE[b]	RATE	PLANTS 11/9/81	DRY MATTER 1982
	kg/ha	no/m row	t/ha
Control		43 c	7.4
Paraquat	0.56	50 bc	6.9
Glyphosate	0.56	50 bc	7.3
Glyphosate	1.12	48 c	7.0
Sethoxydim	0.45	46 c	6.9
Fluazifop	0.56	44 c	6.3
Paraquat + Sethoxydim	0.56 + 0.45	61 a	6.9
Glyphosate + Sethoxydim	0.56 + 0.45	64 a	6.8
Paraquat + Fluazifop	0.56 + 0.56	57 ab	7.3
Glyphosate + Fluazifop	0.56 + 0.56	63 a	7.4
Paraquat + Sethoxydim + 2,4-DB	0.56 + 0.45 + 1.12	60 a	7.1
Paraquat + Fluazifop + 2,4-DB	0.56 + 0.56 + 1.12	57 ab	6.9
Glyphosate + Sethoxydim + 2,4-DB	0.56 + 0.45 + 1.12	57 ab	7.5
Glyphosate + Fluazifop + 2,4-DB	0.56 + 0.56 + 1.12	60 a	6.7
Paraquat + Pronamide	0.56 + 0.56	49 bc	7.0
Glyphosate + Pronamide	0.56 + 0.56	50 bc	7.1
	LSD .05	9.1	N.S.

[a]Total dry weight yields were recorded. The weed component was insignificant.

[b]Paraquat and glyphosate were applied preplant 8/19/81. Sethoxydim, fluazifop and 2,4-DB were applied postemergence 9/11/81. Volunteer oats were 10-20 cm high on 9/11/81. Pronamide was applied 12/3/81.

Experiment 3 was spring planted in an oat stubble infested predominantly with quackgrass (Agropyron repens (L.) Beauv.) in the 4-6 leaf stage. Annual grass and annual broadleaf weed populations were variable and not heavy.

All herbicide treatments gave an increase in seedling numbers. There was no significant increase in legume yield in the first harvest. All treatments resulted in a significant decrease in quackgrass yields over the control. Postemergence treatments with 2,4-DB did not significantly reduce broadleaf weed yields over treatments without 2,4-DB. Some crop injury occurred due to 2,4-DB.

Table 3. Spring seeded no-till red clover stand count and dry matter yields as affected by preplant and postemergence herbicides. (Experiment 3).

HERBICIDE[a,b]	RATE	PLANTS 7/1/82	1982 LEG	BL	GRASS	HAY
	kg/ha	no/m	---------- t/ha ----------			
Control	0	53	1.6	0.6 c	0.5 c	2.8
Paraquat	0.56	75	2.2	0.4 dc	0.3 ab	2.8
Glyphosate	0.56	67	2.2	0.4 abc	0.2 ab	2.9
Glyphosate	1.12	90	2.3	0.3 abc	0.2 ab	2.8
Sethoxydim	0.45	67	2.0	0.5 c	0.2 ab	2.7
Fluazifop	0.56	72	2.1	0.3 ab	0.3 b	2.7
Paraquat + Sethoxydim	0.56 + 0.45	86	2.2	0.3 ab	0.1 ab	2.6
Glyphosate + Sethoxydim	0.56 + 0.45	83	2.2	0.4 abc	0.1 ab	2.7
Paraquat + Fluazifop	0.56 + 0.56	84	2.1	0.5 bc	0.1 ab	2.7
Glyphosate + Fluazifop	0.56 + 0.56	78	2.1	0.4 abc	0.1 ab	2.6
Paraquat + Sethoxydim + 2,4-DB	0.56 + 0.45 + 0.84	101	2.2	0.2 a	0.1 ab	2.5
Paraquat + Fluazifop + 2,4-DB	0.56 + 0.56 + 0.84	67	2.2	0.3 abc	0.1 a	2.5
Glyphosate + Sethoxydim + 2,4-DB	0.56 + 0.45 + 0.84	86	2.0	0.3 ab	0.1 a	2.4
Glyphosate + Fluazifop + 2,4-DB	0.56 + 0.56 + 0.84	86	2.1	0.2 a	0.2 ab	2.5
LSD .05			N.S.	0.3	0.2	N.S.

[a]Paraquat and glyphosate treatments were applied 5/13/82. Treatment 5 and 6 were applied 5/13/82. All other herbicides applied 6/7/82. Planting date was 5/14/82.
[b]The 2,4-DB formulation used was the isooctyl ester.

Other experiments were established to see if a lower rate of sethoxydim and fluazifop would adequately control volunteer oats in a fall seeding. Although the legume stands were lost due to high slug populations, an evaluation of the volunteer oats indicated that a 0.22 kg/ha rate for both sethoxydim and fluazifop would give 60-75% control of the oats. Fluazifop appeared to give slightly better control at this rate.

CONCLUSIONS

Fluazifop and sethoxydim can adequately control volunteer grain in fall no-till stubble seedings after seeding. This could reduce the need for paraquat or glyphosate before planting, if weed populations are small prior to planting. Herbicide application may not result in a significant yield increase for fall seeded red clover if adequate moisture is present. Fluazifop and sethoxydim can significantly reduce annual and perennial grass yield in spring seeded legumes but may not significantly increase legume yields.

REFERENCES

1. Hinmelstein, F. J. and R. A. Peters. 1981. Comparison of three postemergence grass herbicides on a new alfalfa seeding. Proc. Northeastern Weed Science Society. 35:70-73.

2. Linscott, D. L., E. B. Rayburn, J. F. Hunt, R. H. Vaughan. 1980. Direct planting of legumes - an update. Proc. Northeastern Weed Science Scoiety. 34:94.

3. Peters, R. A. 1980. Postemergence control of crabgrass with BAS 9052 OH in new alfalfa and red clover seedings. Proc. Northeastern Weed Science. 34:101.

CONTROL OF POA PALUSTRIS L. IN ALFALFA

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This member of the Poa genus is named fowl bluegrass. Its primary adaptation is to moist, poorly drained sites which makes it an unlikely candidate for a weed problem in alfalfa fields. However, in many alfalfa fields in South Jersey, this weed reaches population levels that crowd out the alfalfa. It matures at the same time that the alfalfa reaches the proper stage of growth for the first cutting. Fowl bluegrass does not become a problem until the second or third year of the stand. Although most books list it as a perennial, it appears to act as a winter annual. The young growth starts in the fall and matures in the spring of the next year. For the rest of the summer, there is no evidence of the plant. No rhizome system is present.

A series of treatments indicated that the plant is easy to control. When applied on December 9, 1980, all of the following provided 100% control: (all rates as lb AI/A) pronamide 0.5 and 1.0; paraquat 0.25; simazine 0.8; and terbacil 0.8. Ratings were made on April 18, 1981.

Treatments applied on March 13, 1981 were equally successful. All of the following provided 100% control: sethoxydim 0.5 and 1.0; terbacil 0.4 and 1.0; hexazinone 0.5 and 1.0; and paraquat 0.25.

Results from treatments applied December 24, 1981 indicated that all of the following gave excellent control: pronamide 0.25 and 0.5; sethoxydim 0.2 and 0.4; simazine 0.8; terbacil 0.8; metribuzin 1.0; paraquat 0.25; diuron 1.25. Poor control was observed in simazine 0.4; terbacil 0.4; metribuzin 0.5; and hexazinone 0.2 and 0.4.

When applied on March 15, 1982, the following provided excellent control: pronamide 0.25 and 0.5; sethoxydim 0.2 and 0.4; paraquat 0.125 and 0.25; terbacil 0.4 and 0.8; metribuzin 0.5 and 1.0; diruon 1.5; hexazinone 0.2 and 0.4.

Commercial treatments by aerial and ground equipment have proven to be effective.

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CRABGRASS-ALFALFA COMPETITION AS INFLUENCED BY APPLICATION OF POSTEMERGENCE HERBICIDES

Frank J. Himmelstein and Robert A. Peters[1/]

ABSTRACT

Sethoxydim, fluazifop and CGA-82725 at .28 Kg/ha, Hoe 00581 and Dowco 453 at .17 Kg/ha, hexazinone at .22 Kg/ha and paraquat at .14 Kg/ha were evaluated for selective control of large crabgrass (Digitaria sanguinalis (L.) Scop.) in a new seeding of alfalfa (Medicago sativa L.). 2,4DB amine was applied in a tank mixture at 1.12 Kg/ha with sethoxydim, fluazifop, CGA-82725, Hoe 00581 and Dowco 453. Dinoseb at 1.12 Kg/ha was evaluated in a tank mixture with sethoxydim. Alfalfa was seeded on May 18, 1982 at the Storrs Agricultural Experiment Station. All applications of these materials, alone or with a tank mixture of 2,4DB, were effective in controlling crabgrass. The total seasonal dry matter yields of crabgrass were significantly less than that of the control for all treatments. Hexazinone, paraquat and sethoxydim + dinoseb were significantly less effective in controlling crabgrass than the other treatments.

The first cut yields of alfalfa were significantly greater than the control for all treatments except for paraquat, hexazinone and sethoxydim + dinoseb. If 2,4DB was tank mixed with Hoe 00581 or CGA-82725 alfalfa yields were significantly lower than when either of these materials were applied alone. Second harvest yields of alfalfa were significantly greater than the control for sethoxydim + 2,4DB + oil, fluazifop and CGA-82725. Yields of alfalfa in the second cut were significantly lower than the control for hexazinone and sethoxydim + dinoseb. None of the other treatments were significantly different than the control following the second cut.

From the results obtained it would appear sethoxydim, fluazifop and Dowco 453 could be tank mixed with 2,4DB for broadspectrum weed control in seedling alfalfa. To avoid antagonistic effects with alfalfa, Hoe 00581 and CGA-82725 should be applied alone.

Results indicate early grass control is important in obtaining the greatest increase in alfalfa yields. The greatest gains in yield from herbicide use is realized in the first cut. Paraquat at .28 Kg/ha applied one day after an early mowing of plots, three weeks before the first harvest, caused extreme injury to alfalfa and resulted in poor crabgrass control. Based on second harvest data yields of crabgrass were significantly greater than that of the control while dry matter yields of alfalfa were significantly lower than that of the control. Paraquat at .28 and .56 Kg/ha applied five days after the first cut resulted in significant crabgrass control. However, alfalfa yields at .28 Kg/ha were not significantly different than that of the control and yields at .56 Kg/ha were significantly lower than that of the control.

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INTRODUCTION

Control of annual grasses have been a major problem in establishing new stands of alfalfa. Herbicides such as benefin (N-butyl-N-ethyl-a,a,a,-trifluro-2, 6-dinitro-p-toluidine), EPTC (S-ethyl dipropylthiocarbamate) and profluralin (N-(cyclopropylmethyl)-a,a,a-trifluro-2, 6-dinitro-N-propyl-p-toluidine) have provided annual grass and some broadleaf control in new alfalfa seedings, but these materials must be soil incorporated prior to alfalfa planting. Therefore, these preplant incorporated materials cannot be used for no-tillage. No preemergence grass killer is available. A grass killer is badly needed for no-till seedings of alfalfa.

A number of new herbicides have recently been developed for postemergence grass control in broadleaf crops. However, little information has been reported on their compatibility in a tank mixture with 2,4DB (4-(2,4 dichlorophenoxy) butyric acid). If compatibility can be shown, broad spectrum weed control would be available for no-till seedings of alfalfa.

METHODS AND MATERIALS

The following experiment was carried out at the Agronomy Research Farm at Storrs, Ct. The soil type was a Paxton fine sandy loam, coarse-loamy, mixed mesic Typic Fragiochrept. The field was fertilized with 6720 Kg/ha lime, 175 Kg/ha P_2O_5 and 170 Kg/ha K_2O, prior to planting. The experimental design was a randomized complete block replicated four times. Plot size was 1.52 by 7.62 m. A conventional seeding of Iroquois alfalfa at 13.5 Kg/ha was made with a grain drill on May 18, 1982.

All herbicide treatments applied before mowing were applied on June 24, 1982. Alfalfa was in the 5-7 trifoliate leaf stage, 15 cm in height. Crabgrass was in the 3-4 leaf stage, 5-8 cm in height and tillering. Weed oil was Booster + E applied at 1% v/v. Paraquat treatments applied after mowing are specified in Table 3.

Table 1. Herbicides Evaluated.

Herbicide	Chemical Identity of Herbicides Applied
sethoxydim	2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one
fluazifop-butyl	(±)-butyl 2-[4-[[5-trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoate
CGA-82725	2-Propynyl 2-(4-([3,5-dichloro-2-pyrindinyl]oxy)phenoxy)propanoate
Hoe 00581	(Chemistry not available)
Dowco 453	Methyl 2-(4-((3-chloro-5-(trifluoromethyl)-2-pyridinyl)oxy)phenoxy)propanoate
hexazinone	(3-cyclohexyl-6-dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione

Table 1 (continued).

Herbicide	Chemical Identity of Herbicides Applied
paraquat	1,1'-dimethyl-4,4'-bipyridinium ion
dinoseb	2-sec-butyl-4,6-dinitrophenol
2,4DB amine	4-(2,4-dichlorophenoxy)butyric acid

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

Yields of dry matter were determined from samples cut on July 27 and September 14, 1982. Grab samples were taken at both harvests for hand separations into alfalfa, crabgrass and broadleaf weed components.

RESULTS AND DISCUSSION

Treatments applied before the first harvest

Applications of sethoxydim, Hoe 00581, fluazifop, CGA-82725 and Dowco 453 alone or with tank mixtures of 2,4DB provided significant control of crabgrass in both harvests. (Table 2) The average crabgrass yield for the two cuts was only 3% of the control.

Hexazinone, paraquat and sethoxydim + dinoseb significantly decreased crabgrass yields for the first and total seasonal cuts, however, control was significantly less than with the other materials.

The first cut yields of alfalfa were significantly greater than the control for all treatments except for paraquat, hexazinone and sethoxydim + dinoseb.

Despite the fact that sethoxydim, Hoe 00581, fluazifop, CGA-82725 and Dowco 453 with or without 2,4DB resulted in similar crabgrass control, some significant differences were noted in the yields of first cut alfalfa. When 2,4DB was included in a tank mixture with Hoe 00581 or CGA-82725 alfalfa yields were significantly decreased. Tank mixtures of CGA-82725 and Hoe 00581 caused an average of eighteen percent decrease in yield in the first cut, compared to these materials applied alone. Although no foliar injury symptoms were noted, stunting of these stands could be observed.

The impracticality of the use of hexazinone and sethoxydim + dinoseb on seedling alfalfa at the growth stage treated is brought out in the yield data of Table 2. These materials showed no selectivity causing severe injury to both alfalfa and crabgrass. First cut yields of alfalfa were significantly less than that of the control.

Paraquat at .14 Kg/ha resulted in some early injury to alfalfa but yields of alfalfa were not significantly different than that of the control.

Table 2. Control ratings and yields of crabgrass and alfalfa following applications of postemergence grass killers.

Herbicide	Rate	Crabgrass Control Ratings July 8	Crabgrass Control Ratings July 22	Crabgrass Yields (DW) July 27	Crabgrass Yields (DW) Sept. 14	Crabgrass Total	Alfalfa Injury Ratings July 8	Alfalfa Injury Ratings July 22	Alfalfa Yields (DW) July 27	Alfalfa Yields (DW) Sept. 14	Alfalfa Total	Broadleaf Weeds Yields (DW) July 27	Broadleaf Weeds Yields (DW) Sept. 14
	Kg/ha			Kg/ha	Kg/ha				Kg/ha	Kg/ha		Kg/ha	Kg/ha
sethoxydim + oil[1/]	.28	8.8[2/]	9.8	0 d[3/]	0 c	0 d	0.0	0.0	2640 a-c	2180 b-d	4820 bc	290	70
sethoxydim + 2,4DB + oil	.28+1.12	9.5	10.0	60 d	10 c	70 d	0.0	0.0	2680 a-c	2530 ab	5210 ab	0	20
sethoxydim	.28	9.3	9.3	100 d	120 c	220 d	0.0	0.0	2640 a-c	2390 a-d	5030 a-c	240	30
sethoxydim + 2,4DB	.28+1.12	8.8	9.5	60 d	110 c	170 d	0.0	0.0	2640 a-c	2320 a-d	4960 bc	0	10
sethoxydim + Dinoseb + oil	.28+1.12	7.8	1.8	880 b	980 a	1860 b	6.3	5.5	1150 f	1620 e	2770 e	30	0
Hoe 00581 + oil	.17	10.0	10.0	0 d	0 c	0 d	0.0	0.0	3010 a	2320 a-d	5330 ab	30	30
Hoe 00581 + 2,4DB + oil	.17+1.12	9.3	9.8	20 d	40 c	60 d	0.0	0.0	2540 bc	2460 a-c	5000 a-c	0	10
fluazifop + oil	.28	9.0	9.8	30 d	30 c	60 d	0.0	0.0	2720 a-c	2600 a	5320 ab	150	20
fluazifop + 2,4DB + oil	.28+1.12	9.0	9.0	140 d	30 c	170 d	0.0	0.0	2510 bc	2460 a-c	4970 a-c	0	40
CGA-82725 + oil	.28	9.3	10.0	0 d	0 c	0 d	0.0	0.0	2940 ab	2600 a	5540 a	130	40
CGA-82725 + 2,4DB + oil	.28+1.12	8.8	9.3	50 d	40 c	90 d	0.0	0.0	2360 cd	2320 a-d	4680 c	0	0
Dowco 453 + oil	.17	10.0	10.0	0 d	0 c	0 d	0.0	0.0	2790 ab	2460 a-c	5250 ab	70	10
Dowco 453 + 2,4DB + oil	.17+1.12	9.3	9.8	0 d	50 c	50 d	0.0	0.0	2550 bc	2250 a-d	4800 bc	10	10
paraquat	.14	6.8	6.0	440 c	350 bc	790 c	2.8	0.5	2060 de	2040 d	4100 d	90	40
hexazinone	.22	7.0	1.0	1000 b	980 a	1980 b	6.3	5.5	1220 f	1690 e	2910 e	20	0
Control	0	0.0	0.0	2340 a	630 b	2970 a	0.0	0.0	1800 e	2110 cd	3910 d	0	0

1/ Weed oil was Booster + L

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

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

Second harvest yields of alfalfa were significantly greater than the control for sethoxydim + 2,4DB + oil, fluazifop and CGA-82725. Second cut yields of alfalfa were significantly lower than that of the control for hexazinone and sethoxydim + dinoseb. No other treatments were significantly different than the control. However, it should be noted that the yield of crabgrass in the first cut was four times as great as the yield of crabgrass in the second cut. Therefore, the competition of crabgrass was greatest during the period between planting and the first harvest, thus had a greater impact on alfalfa yields.

It was evident that the greatest increase in alfalfa yield was obtained at the first harvest when competition from crabgrass was at its greatest. Because of early injury to alfalfa the total seasonal yields were significantly lower than that of the control for hexazinone and sethoxydim + dinoseb. The total seasonal yields of alfalfa were not significantly different than that of the control for paraquat.

It should be noted that the broadleaf weed density was quite low in all plots. In the control plots which had a heavy crabgrass stand broadleaf weeds were not released. However, in those plots in which crabgrass was controlled an open canopy gave broadleaf weeds an opportunity to establish, therefore, optimum effect of these postemergence grass killers occurs in a programmed approach for broad spectrum weed control.

From the results obtained, it would appear sethoxydim, fluazifop and Dowco 453 could be tank mixed with 2,4DB for broad spectrum weed control in seedling alfalfa. Hoe 00581 + 2,4DB caused a significant decrease in alfalfa yield in the first cut but total seasonal yields of alfalfa were not significantly different from that of Hoe 00581 applied alone. However, CGA-82725 + 2,4DB caused a significant decrease in total seasonal yields of alfalfa as well as in the first cut compared to CGA-82725 alone.

These new postemergence grass killers offer particular promise for use in no-tillage seedings of alfalfa. The total seasonal yields of alfalfa with sethoxydim, Hoe 00581, fluazifop, CGA-82725 and Dowco 453 alone or in tank mixtures with 2,4DB were significantly greater than that of the control. The total yields of alfalfa during the year of establishment were increased an average of thirty percent over that of the control with these materials.

Paraquat applications after cutting

Paraquat at .28 Kg/ha applied one day after an early mowing of plots before the first cut caused extreme injury to alfalfa and was ineffective in controlling crabgrass. (Table 3) Based on second harvest data, yields of crabgrass were significantly greater than that of the control while dry matter yields of alfalfa were significantly lower than that of the control.

Paraquat at .28 and .56 Kg/ha applied five days after the first cut was removed resulted in significantly lower yields of crabgrass than in the control at the second cut. Yields of alfalfa at .28 Kg/ha were not significantly different than that of the control in the second cut but at .56 Kg/ha yields of alfalfa were significantly lower than that of the control. Alfalfa was set

back for a period immediately after paraquat application. This was seen as chlorosis of the regrowth and a general stunting of the stand for a period of time. Paraquat timing can be a critical factor in alfalfa stand reduction. It has been reported when paraquat was applied 8 days after cutting in established alfalfa, yields were reduced almost one-third. However, when paraquat was sprayed 2 days after cutting no yield reduction occurred.

Table 3. Paraquat Applications after cutting

		Crabgrass		Alfalfa	
		Control Ratings	Yields (DM)	Injury Ratings	Yield (DM)
Herbicides	Rate	Sept. 13	Sept. 14	Sept. 13	Sept. 14
	Kg/ha		Kg/ha		Kg/ha
Paraquat one day after early mowing[1/]	.28	0.0[2/]	1830 a[3/]	9.0	420 c
Paraquat five days after first cut	.28	9.5	50 c	0.0	1970 ab
Paraquat five days after first cut	.56	9.0	30 c	0.0	1760 b
Control	0	0.0	630 b	0.0	2110 a

1/ Approximately seven weeks after seeding

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

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

CONTROL OF ANNUAL WEEDY GRASSES IN NO-TILL ALFALFA SEEDINGS

R.C. Wakefield and C.D. Sawyer[1/]

Annual weedy grasses can compete severely with legumes in no-till seedings during the year of establishment. In these experiments alfalfa was spring seeded into an old timothy stand that was known to be heavily infested with large crabgrass (Digitaria sanguinalis (L.) Scop.), fall panicum (Panicum dichotomiflorum Michx.) and yellow foxtail (Setaria lutescens (Weig.) Hubb.). Glyphosate was applied 7 days prior to seeding. Sethoxydim, fluazifop and CGA 82725, each applied at 0.25 lbs/A a.i., at the 2-3 leaf weed stage completely controlled annual grasses. Diclofop at 1.5 lbs/A a.i. was moderately successful while EPTC applied in the alfalfa seed coating at 4.0 lbs/A a.i. was only partially successful for weedy grass control. In a second no-till experiment with 0, 30 and 60-pound per acre rates of nitrogen fertilizer, sethoxydim controlled annual grasses at 0.25 lbs/A a.i. at all fertilizer levels when applied at the 2-3 leaf stage. EPTC applied in the seed coating at 4.0 lbs/A a.i. was again only partially successful. No other herbicides were tested in this experiment.

Alfalfa stand counts were similar but alfalfa yields were significantly greater following applications of CGA 82725 and fluazifop compared to sethoxydim and diclofop in the first experiment. Alfalfa stand counts were also similar but alfalfa yields were improved with 60 lbs N/A when annual grasses were controlled with sethoxydim in the second experiment.

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DELAY IN DRY MATTER PRODUCTION IN COOL SEASON GRASSES WITH PRONAMIDE

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ABSTRACT

A four year old stand of the cool season grasses orchardgrass (Dactylis glomerata L. ' Pennlate' and 'Pennmead'), smooth brome (Bromus inermis Leyss. 'Saratoga'), timothy (Phleum pratense L. 'Climax'), tall fescue (Festuca arundinacea Schreb. 'Kentucky 31'), and reed canarygrass (Phalaris arundinacea L.) were treated with pronamide at .5, 1, and 1.5 lb/A on Dec. 16, 1976. The ground was frozen at the time of application and all top growth had been killed by frost. All grasses were fall fertilized with 700 lb/A of 0-15-30 and 50 lb/A of nitrogen as urea early in the spring and after both the first and second harvests.

Orchardgrass had the greatest tolerance for pronamide with smooth brome, timothy, tall fescue and reed canarygrass showing only a moderate amount of tolerance (Table 1). By increasing the rate of pronamide from .5 to 1 lb ai/A, there was a shift of 5 to 10% of the seasonal yield from the first harvest to the third harvest without a significant loss in overall yield. The percentage of grass in the second harvest remained about the same. This would be an advantage in most years when drying conditions are not good at the time of first harvest and are normally much better in August or September when the third harvest is made. Higher rates of pronamide cause an even greater shift of dry matter yield of orchardgrass from the first harvest to the second but there was an overall yield reduction which is not desirable.

All other cool season grasses were so sensitive to pronamide that rates above .5 lb/A caused seasonal yeild reductions and even .5 lb/A may have caused yield reductions since we did not have an untreated check for comparison. The suppression of growth in these forage grasses opened them up for encrochment of yellow foxtail (Setaria lutescens L. Beauv.) and common dandelion (Taraxacum officinale Weber). This may not be an undesirable effect if we have a legume grass mixture where the legume could fill in instead of weeds when grass was suppressed, thus producing a more legume rich mixture higher in protein and feeding value.

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Table 1. Forage grass yield and distribution by harvest date, yellow foxtail and dandelion yield for various forage grasses treated with pronamide.

Grass species	Pronamide lb ai/A	Forage Grass Yield Harvest date 5/31		7/21		9/12		Total	Yellow foxtail yield 7/21	9/12	Dandelion yield 7/21	9/12	Total weed yield	Grand total yield
		lb/A												
Orchardgrass 'Pennlate'	.5	4170 a/	(33) b/	6050	(48)	2310	(19)	12530	130	35	635	610	1410	13940
	1.0	2960	(23)	6360	(50)	3510	(27)	12830	205	70	560	200	1035	13865
	1.5	1990	(20)	5305	(55)	2385	(25)	9680	205	225	925	710	2065	11745
	LSD (.05)	1054		920		410		1380	302	145	740	555		1120
Orchardgrass 'Pennmead'	.5	4235	(26)	7885	(48)	4150	(26)	16270	80	40	370	75	565	16835
	1.0	2560	(21)	5580	(46)	3985	(33)	12125	200	50	810	125	1185	13310
	1.5	1230	(16)	4640	(58)	2100	(26)	7970	555	390	1965	1290	4200	12170
	LSD (.05)	945		2230		1760		3785	320	395	2045	1250		2165
Smooth brome 'Saratoga'	.5	3150	(28)	5780	(51)	2465	(22)	11395	605	40	1905	440	2990	14385
	1.0	1430	(23)	2445	(40)	2270	(37)	6145	1455	175	2805	1100	5535	11680
	1.5	460	(30)	855	(56)	215	(14)	1530	1505	205	4280	2055	8045	9575
	LSD (.05)	715		2575		320		3210	1145	185	2845	745		2710
Timothy 'Climax'	.5	1085	(29)	785	(21)	1895	(50)	3765	1390	225	4120	930	6665	10430
	1.0	940	(24)	1605	(42)	1320	(34)	3865	1105	175	3185	1280	5745	9610
	1.5	590	(28)	680	(32)	840	(40)	2110	2300	320	3485	2050	8155	10265
	LSD (.05)	640		1190		1130		2110	1235	94	1910	740		2850
Tall Fescue 'Ky 31'	.5	2210	(26)	2120	(25)	4095	(49)	8425	2890	200	2175	560	5825	14250
	1.0	1405	(25)	1750	(32)	2390	(43)	5545	2050	175	2005	1860	6090	11635
	1.5	920	(29)	1095	(34)	1200	(37)	3215	2660	240	3235	2370	8505	11720
	LSD (.05)	575		1590		1560		2306	2430	190	2750	1080		2795
Reed Canarygrass	.5	1235	(23)	1150	(21)	3000	(56)	5385	1380	135	3500	465	5480	10865
	1.0	670	(27)	190	(8)	1610	(65)	2470	2060	200	3450	1400	7110	9580
	1.5	520	(29)	220	(12)	1045	(59)	1785	2935	170	3140	2080	8325	10110
	LSD (.05)	830		1380		1275		3125	2035	125	1715	1210		1750

a/ All yields are an average of 4 replications adjusted to 12% moisture.

b/ Percentage of total seasonal forage grass yield by harvest.

THE EFFECTS OF HERBICIDES ON DANDELIONS IN ESTABLISHED ALFALFA

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ABSTRACT

Field experiments were conducted at two locations in Connecticut to evaluate eight herbicides for the control of common dandelion (Taraxacum officinale Weber) and other weeds in established alfalfa. Location 1 at Scotland, CT included no-till seeded alfalfa, volunteer red clover, common dandelion, shepherd's purse (Capsella Bursa - pastoris L. Medic), orchardgrass, Kentucky bluegrass, volunteer white clover and common chickweed (Stellaria media L. Cyrill). Location 2 at Storrs was an old, thin stand of alfalfa heavily infested with orchardgrass, Kentucky bluegrass and common dandelion.

Herbicide treatments were applied March 16, 1982 at location 1. Alfalfa plants had no more than 1 inch new growth and dandelion plants showed no new growth. Location 2 treatments were applied April 16, 1982. Both alfalfa and dandelion plants had approximately 1 to 2 inches new growth.

Yields of established dandelions at location 1 for the first cut were significantly decreased only by the high rates of dichlobenil, hexazinone and metribuzin (Table 1). At location 2 none of the treatments decreased dandelion yields. Both rates of glyphosate, the low rate of terbacil and the high rate of simazine increased dandelion yields probably as a result of reducing competition from grasses.

None of the herbicide treatments increased first cut total plot yields over that of the control. However, first cut alfalfa yields at location 1 were significantly greater at the low rates of hexazinone and metribuzin. Alfalfa yields tended to be less at the high as compared to the low rates of hexazinone, Metribuzin and simazine. Since better weed control was acheived at the high rates this suggests alfalfa injury was occurring. No treatment decreased alfalfa yield below that of the control.

Hexazinone at .56 or 1.12, metribuzin at 1.68 and terbacil at 1.12 kg/ha gave the best overall total weed and grass control. Terbacil and hexazinone also significantly reduced yields of red clover which had volunteered in the stand at location 1.

Visual ratings indicated that hexazinone, dichlobenil and terbacil were effective in suppressing seedling dandelion establishment after the first cut. After the second cut the high rate treatments of terbacil and hexazinone had the lowest numbers of dandelion seedlings per plot.

The herbicide treatments had no effect on the quality of the alfalfa forage as judged by the percent in vitro digestible dry matter (IVDDM).

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Table 1. Influence of spring applied herbicides on alfalfa and weed yields and forage quality at first cut for two locations (L1 and L2) in Connecticut.

Herbicide	Herbicide rate	Dandelion yield		Grass yield		Total broadleaf[1] weed and grass yield		Alfalfa[2] yield	Forage quality
		L1	L2	L1	L2	L1	L2	L1	L1
	-kg ai/ha-	-kg dm/ha-							-%IVDDM-
Control	-	37abc[3]	27cde	475a	4297a	938a	4395a	1890bcd	62.9a
Dichlobenil	2.24	7cde	46abcde	79ab	3396ab	541ab	3699ab	1912bcd	57.3a
Dichlobenil	4.48	0e	28cde	37abc	3493ab	127abcd	3535ab	2235abcd	67.3a
Diuron	1.68	283a	126abc	30abc	1483abcd	578ab	1648abcdef	1496d	65.4a
Glyphosate	0.75	19bcd	173a	39abc	691bcde	804a	960bcdef	1937bcd	62.7a
Glyphosate	1.49	46abc	137ab	21bc	220e	543ab	488ef	2307abcd	67.3a
Hexazinone	0.56	16bcd	32bcde	11bc	302de	84bcde	456f	3134a	61.5a
Hexazinone	1.12	2de	15e	4bc	520cde	16de	547def	2914ab	62.9a
Metribuzin	0.84	91ab	34bcde	16bc	1697abcd	173abc	1816abcde	3230a	65.4a
Metribuzin	1.68	2de	91abc	6bc	291de	11e	539def	2378abcd	64.6a
Paraquat + X-77	0.56	-	43abcde	-	2283abc	-	2342abc	-	-
Paraquat + X-77	0.84	-	95abc	-	1826abc	-	1955abcd	-	-
Simazine	1.12	44abc	17de	28abc	2133abc	396ab	2162abc	2140abcd	61.7a
Simazine	1.68	66abc	149ab	16bc	1198abcde	201abc	1514abcdef	1724cd	66.0a
Terbacil	0.56	101ab	174a	9bc	1371abcd	197abc	1690abcdef	2464abc	64.9a
Terbacil	1.12	12bcd	80abcd	3c	455cde	32cde	658cdef	2528abc	63.7a

[1]Includes yields for dandelion, shepherd's purse, chickweed, white clover, other broadleaved weeds and grasses.

[2]Alfalfa yields for location 2 are not reported due to the unevenness of the stand.

[3]Means within columns followed by the same letter are not significantly different at the 5% level using Duncan's multiple range test.

SAFETY INTERVAL BETWEEN DICAMBA AND/OR 2,4-D APPLICATION AND LEGUME SEEDING

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ABSTRACT

Dicamba and/or 2,4-D was applied at various rates 14, 21 and 35 days before a late summer no-tillage seeding of alfalfa and red clover. The trial area was relatively free of weeds as a result of a rye cover crop and a blanket treatment of glyphosate and as a result it was possible to detect herbicide injury without interference from weeds.

Alfalfa and red clover yields were not significantly reduced by 2,4-D ester or amine at rates up to 1 1/2 lb ai./A, dicamba + 2,4-D at rates up to 1/8 + 3/8 lb ai./A or dicamba alone at rates up to 1/4 lb ai./A when used for broadleaf weed control as little as 14 days before a no-tillage seeding.

Delay of seeding for 21 days after herbicide applications did not increase the safety to alfalfa much but rates of dicamba + 2,4-D could be increased to 1/2 + 1 1/2 lb ai./A and dicamba alone to 1/2 lb ai./A on red clover without a significant seasonal yield loss.

A delay in seeding up to 35 days allowed the use of dicamba + 2,4-D at rates up to 1/4 + 3/4 lb ai./A and dicamba alone up to 1 lb ai./A on alfalfa without a significant reduction in yield. Red clover could tolerate the highest herbicide rates used in this trial, dicamba + 2,4-D at 1/2 + 1 1/2 lb ai./A and dicamba at 1 lb ai./A.

Both alfalfa and red clover had the ability to recover from early season suppression of yields. Commonly the third harvest yields as a percentage of the untreated check were 25% greater than the first harvest yields. As long as the yield reduction in the first harvest did not exceed 25%, the stand was completely recovered by the third harvest and yielded about the same as the untreated check.

INTRODUCTION

The practice of seeding legumes into pastures has been recommended for years to upgrade the quality of forage produced and to provide nitrogen to the grasses in the pasture. Suppression of the existing sod was accomplished by over-grazing or a small amount of tillage until herbicides came along. It was the promotion of paraquat (1, 1'-dimethyl-4,4'-bipyridinium ion) for no-tillage crop production in general that provided a boost in no-tillage legume seedings and more recently the availability of ghyphosate [N-(phosphonomethyl) glycine] has added to the interest in no-tillage legume seedings for pasture renovation and for hay in a rotation with other crops.

One of the problems with the use of paraquat has been the relatively poor control of established broadleaved weeds such as common dandelion (*Taraxacum officinale* Weber), yellow rocket (*Barbarea vulgaris* R. Br.),

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white cockle (Lychnis alba Mill.), plantains (Plantago spp.), healall (Prunella vulgaris L.), goldenrod (Solidago spp.), Canada thistle (Cirsium arvense (L.) Scop.), and common milkweed (Asclepias syriaca L.). The use of glyphosate has helped in the control of these weeds but at rates that a farmer might consider economical the control is still not very good. The cheapest chemical method for control of most of these weeds is still 2,4-D [(2,4-dichlorophenoxy) acetic acid] or a mixture of 2,4-D and dicamba (3,6-dichloro-o-anisic acid) for some of the more difficult to control broadleaved weeds. Since legumes and especially legume seedlings are very sensitive to both 2,4-D and dicamba, the question of how long one needs to delay legume seeding after the use of either of these herbicides needed to be answered. The purpose of this trial was (1) to determine the safety interval between 2,4-D or dicamba application and an alfalfa (Medicago sativa L.) or red clover (Trifolium pratense L.) late summer seeding and (2) to determine to what extent some initial injury carried over into successive cuttings.

MATERIALS AND METHODS

This trial was started in the summer of 1981 with yield measurements made in the summer of 1982. The soil was a Murrill silt loam (Typic Hapludult) with about 16% sand, 67% silt, 14% clay, 2.5% organic matter and a pH of 7.0. The trial area was in corn in 1980 and was seeded to winter rye in the fall of 1980. The initial 2,4-D and dicamba treatments were made in May and June of 1981 with a broadcast treatment of ghyphosate at 1 lb ai./A in early June for winter rye control. Alfalfa and red clover were seeded by the no-tillage method with a Bettison drill in late June. Due to seeding to deep, the seedling emergence was very poor and the decision was made to start the whole trial over. The same treatments were reapplied to the same plots approximately 10 weeks after the first treatments were made. The second set of treatments were applied preplant on July 22 (-25 days), August 5 (-21 days), and August 12 (-14 days). The second alfalfa 'Pioneer 501' and red clover 'Kenstar' seeding was made on August 26 with a Tye drill in 7 inch rows. The soil test was high in phosphorus and potassium so no fertilizer was applied at seeding time. All herbicide treatments were made with a small plot sprayer mounted on a Ford tractor with 20 gal/A of water and 8001 low pressure nozzles at 28 psi.

The trial area was generally weed free after the glyphosate treatment and the initial 2,4-D and dicamba treatments. This made it much easier to measure herbicide injury effects without interference from weeds. The trial was laid out as a split-split block with 2 replications. The legumes were seeded in blocks with herbicide treatments assigned to plots and time of application before seeding as sub-plots. The sub-plot size was 8 x 25 ft. with a 3 ft. strip removed at the end of each plot prior to harvest. All yields are based on the yield of a 3 x 22 ft. strip harvested out of the middle of each plot with a Carter flail type small plot harvester. Random sub-samples were saved for moisture determination and all yields were adjusted to 12% moisture. Growing conditions were ideal in the fall of 1981 and summer of 1982.

RESULTS AND DISCUSSION

Initial analysis of first harvest yields showed significant legume, herbicide and preplant application timing affects with significant legume x

herbicide and herbicide x timing interactions. In order to determine what was really happening it was necessary to look at differences between the various 2,4-D and/or dicamba treatments for each legume and preplant time of application separately.

The use of 2,4-D LVE or amine at 1.5 lb ai./A as close as 14 days preplant did not cause a significant reduction in first harvest yields of alfalfa (Table 1). When dicamba was added to 2,4-D in the form of Weedmaster, the low rate of 1/8 + 3/8 lb ai./A caused a yield reduction of about 25% when applied 14 and 21 days preplant. Higher rates caused even greater yield reductions. Dicamba applied alone generally caused significant yield reductions at all rates from 1/4 to 1 lb ai./A when applied 14 and 21 days preplant. It is apparent that dicamba used alone or in combination with 2,4-D will cause a significant loss in first harvest alfalfa yield when applied either 14 or 21 days preplant.

Table 1. Alfalfa first harvest yield following various rates of dicamba and 2,4-D applied 14, 21 and 35 days before seeding.

Treatment	Rate lb ai./A	Application in Relation to Legume Seeding -14 days			-21 days			-35 days	
		lb/A							
(dicamba + 2,4-D)	1/8 + 3/8	3300[a]	abc[b]	(73)[c]	3160	b	(75)	2910	a (68)
	1/4 + 3/4	2710	bcd	(60)	3090	b	(74)	3390	a (79)
	1/2 + 1 1/2	1510	d	(34)	1980	c	(47)	2980	a (70)
dicamba	1/4	3370	abc	(75)	3290	b	(78)	3260	a (76)
	1/2	1810	cd	(40)	2000	c	(48)	3670	a (86)
	1	1680	cd	(37)	1820	c	(43)	4430	a (104)
2,4-D LVE	1 1/2	3700	ab	(82)	4220	ab	(100)	3880	a (81)
2,4-D amine	1 1/2	4140	ab	(92)	4690	a	(112)	3170	a (74)
Untreated Check		4490	a		4200	ab		4280	a

[a] All yields are an average of 2 replications adjusted to 12% moisture.

[b] Values followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

[c] Yield as a percent of the untreated check.

There was some recovery from the initial injury as noted by the general increase in alfalfa yield as a percent of the untreated check as one goes from first to third cutting (Table 2). If the initial yield reduction was more than about 25%, the alfalfa yields did not fully recover to a level equivalent to the untreated check by the end of the season. As a result the seasonal yields were always less than the untreated check (Table 3). The 2,4-D ester and amine formulations did not cause a significant reduction in seasonal alfalfa yield even when applied as little as 14 days before seeding. When dicamba was applied either alone or with 2,4-D, the alfalfa yields usually decreased. It was possible to use dicamba + 2,4-D at 1/8 + 3/4 lb ai./A and dicamba at 1/4 lb ai./A without a significant loss in yield when applied 14 or 21 days before seeding. When seeding was delayed 35 days after herbicide application all rates were safe except for dicamba + 2,4-D at 1/2 + 1 1/2 lb ai./A.

Table 2. Alfalfa yields for 1st, 2nd and 3rd harvests following various rates of dicamba and 2,4-D applied 14 days before seeding.

Treatment	Rate lb ai./A	Harvest 1st			2nd			3rd		
		lb/A								
(dicamba + 2,4-D)	1/8 + 3/8	3300[a]	abc[b]	(73)[c]	3750	ab	(83)	3220	a	(103)
	1/4 + 3/4	2710	bcd	(60)	2540	bc	(56)	2550	ab	(81)
	1/2 + 1 1/2	1510	d	(34)	3310	ab	(73)	2130	bc	(68)
dicamba	1/4	3370	abc	(75)	3510	ab	(78)	2770	ab	(88)
	1/2	1810	cd	(40)	3010	abc	(67)	2560	ab	(82)
	1	1680	cd	(37)	1620	c	(36)	1475	c	(47)
2,4-D LVE	1 1/2	3700	ab	(82)	3910	ab	(87)	3380	a	(108)
2,4-D amine	1 1/2	4140	ab	(92)	3530	ab	(78)	2750	ab	(88)
Untreated Check		4490	a		4510	a		3130	a	
	CV =	24%			18%			14%		

[a] All yields are an average of 2 replications adjusted to 12% moisture.

[b] Values followed by the same letter are not significantly different at the 50% level according to Duncan's multiple range test.

[c] Yield as a percent of the untreated check.

Table 3. Alfalfa season yield following various rates of dicamba and 2,4-D applied 14, 21 and 35 days before seeding.

Treatment	Rate lb ai./A	Application in Relation to Legume Seeding -14 days			-21 days			-35 days		
		lb/A								
(dicamba + 2,4-D)	1/8 + 3/8	10270[a]	ab[b]	(84)[c]	10300	ab	(88)	10350	ab	(85)
	1/4 + 3/4	7800	bcd	(64)	9560	b	(81)	10170	ab	(84)
	1/2 + 1 1/2	6950	cd	(57)	7170	c	(61)	9200	b	(76)
dicamba	1/4	9650	abc	(79)	9640	b	(82)	9680	b	(80)
	1/2	7380	bcd	(61)	7600	c	(65)	11400	ab	(94)
	1	4780	d	(39)	6410	c	(54)	10480	ab	(86)
2,4-D LVE	1 1/2	10990	a	(90)	10800	ab	(92)	10920	ab	(90)
2,4-D amine	1 1/2	10420	ab	(86)	11670	a	(99)	9880	ab	(81)
Untreated Check		12140	a		11750	a		12150	a	

[a] All yields are an average of 2 replications adjusted to 12% moisture and a total of 3 harvests.

[b] Values followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

[c] Yield as a percent of the untreated check.

The use of 2,4-D amine at 1 1/2 lb ai./A or a mixture of dicamba + 2,4-D at 1/8 + 3/8 lb ai./A did not cause a significant reduction in red clover yield when applied 14 days before seeding (Table 4). When applied 21 days before seeding, 2,4-D ester at 1 1/2 lb ai./A was also safe and after a 35 day delay in seeding none of the herbicide treatments caused a significant reduction in yield. Due to the fact we had only two replications, yield reductions of up to 40% were commonly not significant, however.

Table 4. Red clover first harvest yield following various rates of dicamba and 2,4-D applied 14, 21 and 35 days before seeding.

Treatment	Rate lb ai./A	Application in Relation to Legume Seeding -14 days	-21 days	-35 days
	1/8 + 3/8	3240[a] abc[b] (74)[c]	3040 ab (66)	3790 a (88)
	1/4 + 3/4	2290 cd (52)	2880 ab (62)	3050 a (71)
(dicamba + 2,4-D)	1/2 + 1 1/2	570 e (13)	2560 b (55)	3280 a (76)
	1/4	1900 d (43)	2620 b (56)	2790 a (65)
dicamba	1/2	2210 cd (50)	2620 b (56)	2730 a (63)
	1	660 e (15)	1860 b (40)	3500 a (81)
2,4-D LVE	1 1/2	2440 bcd (56)	3220 ab (68)	3770 a (87)
2,4-D amine	1 1/2	3530 ab (80)	3660 ab (79)	3120 a (72)
Untreated Check		4380 a	4630 a	4310 a

[a] All yields are an average of 2 replications adjusted to 12% moisture.

[b] Values followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

[c] Yield as a percent of the untreated check.

Red clover also had the ability to recover from the early season suppression of yields (Table 5). Yields as a percentage of the untreated check were commonly 25% greater in the third harvest as compared to the first.

Season long yields were not significantly reduced from the untreated check for any of the treatments when applied 21 or 35 days before seeding except for the 1 lb ai./A of dicamba 21 days preplant (Table 6). The only herbicide treatments that did not cause a significant yield reduction when applied 14 days preplant were 2,4-D ester or amine at 1 1/2 lb ai./A, 2,4-D + dicamba at 1/3 + 3/8 and 1/4 + 3/4 lb ai./A, and dicamba at 1/4 lb ai./A.

In conclusion, 2,4-D ester or amine at rates up to 1 1/2 lb ai./A, dicamba + 2,4-D at rates up to 1/8 + 3/8 lb ai./A or dicamba alone at rates up to 1/4 lb ai./A may be used for broadleaf weed control as little as 14 days before a no-tillage seeding of alfalfa or red clover without causing a significant reduction in full season legume yields.

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Table 5. Red clover yields for 1st, 2nd and 3rd harvests following various rates of dicamba and 2,4-D applied 14 days before seeding.

Treatment	Rate lb ai./A	Harvest 1st			2nd		3rd	
		lb/A						
(dicamba + 2,4-D)	1/8 + 3/8	3240[a/]	abc[b/]	(74)[c/]	5400 a	(101)	3130 a	(92)
	1/4 + 3/4	2290	cd	(52)	5130 a	(96)	2670 ab	(78)
	1/2 + 1 1/2	570	e	(13)	3030 a	(57)	1560 c	(46)
dicamba	1/4	1900	d	(43)	5640 a	(106)	2790 ab	(82)
	1/2	2210	cd	(50)	3950 a	(74)	2290 bc	(67)
	1	660	e	(15)	2950 a	(55)	1730 c	(51)
2,4-D LVE	1 1/2	2440	bcd	(56)	5590 a	(105)	2670 ab	(78)
2,4-D amine	1 1/2	3530	ab	(81)	3550 a	(67)	3230 a	(95)
Untreated Check		4380	a		5330 a		3410 a	
	CV =	20%			27%		12%	

[a/] All yields are an average of 2 replications adjusted to 12% moisture.

[b/] Values followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

[c/] Yield as a percent of the untreated check.

Table 6. Red clover season yield following various rates of dicamba and 2,4-D applied 14, 21 and 35 days before seeding.

Treatment	Rate lb ai./A	Application in Relation to Legume Seeding -14 days			-21 days		-35 days	
		lb/A						
(dicamba + 2,4-D)	1/8 + 3/8	11770[a/]	ab[b/]	(90)[c/]	11570 a	(89)	12100 a	(99)
	1/4 + 3/4	10090	ab	(77)	10610 ab	(81)	10960 a	(90)
	1/2 + 1 1/2	5160	c	(39)	10990 ab	(84)	12280 a	(101)
dicamba	1/4	10330	ab	(79)	11110 ab	(85)	11870 a	(98)
	1/2	8450	bc	(64)	11220 ab	(86)	10640 a	(87)
	1	5340	c	(41)	8140 b	(62)	11830 a	(97)
2,4-D LVE	1 1/2	10700	ab	(82)	11730 a	(90)	12740 a	(105)
2,4-D amine	1 1/2	10310	ab	(78)	12670 a	(97)	11570 a	(95)
Untreated Check		13120	a		13030 a		12170 a	

[a/] All yields are an average of 2 replications adjusted to 12% moisture and a total of 3 harvests.

[b/] Values followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

[c/] Yield as a percent at the untreated check.

AC 252,214 - A NEW BROAD SPECTRUM HERBICIDE FOR SOYBEANS: GREENHOUSE STUDIES

P. L. Orwick, P. A. Marc, K. Umeda, D. L. Shaner, M. Los, and D. R. Ciarlante[1/]

ABSTRACT

Greenhouse studies have shown that AC 252,214, a new herbicide from American Cyanamid Company, provides broad spectrum weed control with selectivity in soybeans. This herbicide controls a wide range of grasses, broadleaves, and perennials from preemergence or postemergence applications. Preemergence efficacy is retained over a wide range of soil types. Uptake from soil applications appears to be primarily through the roots of the germinating plant. A nonionic surfactant is necessary for optimal postemergence activity. Symptoms on treated weeds indicate that AC 252,214 affects the meristematic regions of the plants.

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AC 252,214, A NEW BROAD SPECTRUM HERBICIDE FOR SOYBEANS: FIELD STUDIES IN THE NORTHEAST REGION

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ABSTRACT

After two years of field testing in U.S. soybeans, AC 252,214 has shown a broad spectrum of activity on hard-to-control weeds with excellent soybean selectivity. AC 252,214 can be applied preplant incorporated, preemergence or postemergence. Weeds controlled include common ragweed (*Ambrosia artemisiifolia*), common lambsquarters (*Chenopodium album*), velvetleaf (*Abutilon theophrasti*), ivyleaf morningglory (*Ipomoea hederacea*) and foxtail species (*Setaria* spp.). AC 252,214 will be tested extensively in 1983 as a new soybean herbicide.

1/ American Cyanamid Company

AC 252,214 - TIMING OF APPLICATION ON VELVETLEAF AND COCKLEBUR: GREENHOUSE STUDIES

K. Umeda, P. L. Orwick, P. A. Marc, and D. R. Ciarlante[1/]

ABSTRACT

In greenhouse studies, AC 252,214 provided excellent control of *Xanthium pensylvanicum* and *Abutilon theophrasti* at 16 and 63 g/ha, respectively, when applied postemergence. *X. pensylvanicum* was susceptible at all stages of growth from the cotyledon to 5-leaf stage and *A. theophrasti* was susceptible from the cotyledon to 2-leaf stage of growth. Soybean selectivity was excellent for postemergence applications of AC 252,214 at the cotyledon to V6 stage of growth.

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ABSORPTION, TRANSLOCATION, AND METABOLISM OF AC 252,214 IN SOYBEANS, COCKLEBUR, AND VELVETLEAF

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ABSTRACT

Studies with radiolabeled material showed that AC 252,214 can be absorbed by the roots and foliage, and translocated in the xylem and phloem of soybeans, cocklebur, and velvetleaf to the meristematic region. AC 252,214 is rapidly metabolized by soybeans and velvetleaf but appears to be only slowly metabolized by cocklebur. The order of tolerance of these three species is soybeans > velvetleaf > cocklebur. This order of tolerance is directly correlated in young plants with the half-life of AC 252,214 within the tissue. Velvetleaf exhibits increased tolerance to AC 252,214 as it grows. This increase can be partially attributed to greatly reduced absorption of the herbicide into older leaves.

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POSTEMERGENCE QUACKGRASS CONTROL IN BROADLEAF CROPS WITH FLUAZIFOP-BUTYL IN EASTERN CANADA

Wagner, Vladimir[1]

ABSTRACT

Fluazifop-butyl, a new postemergence grass herbicide is being developed in Canada by Chipman Inc.

Quackgrass is a serious weed problem on many farms in Eastern Canada. Fluazifop-butyl proved to be very effective in controlling quackgrass in soybeans, alfalfa, potatoes and other broadleaf crops when applied postemergence to the weed and crops.

Optimum timing is a very important factor in controlling perennial weeds like quackgrass. In a series of experiments, fluazifop-butyl was applied as a preplant, early postemergence (quackgrass at 2 to 4 leaf stage) and late postemergence (4 to 6 leaf stage) treatment. Applications at the late postemergence resulted in 97% quackgrass control with fluazifop-butyl at 0.5 kg ai/ha.

Primary tillage disturbs quackgrass stands and fragments the rhizomes. Applications of fluazifop-butyl at 0.5 kg ai/ha to quackgrass plants fragmented by fall ploughing resulted in 89% control as compared to 79% in unploughed plots.

Inter-row cultivation is employed in many row crops. The interval between the application of fluazifop-butyl and the first inter-row cultivation can be as short as 5 days after treatment (DAT) without affecting the quackgrass control (Table 1).

Table 1: Effect of inter-row cultivation on quackgrass control in soybeans with fluazifop-butyl.

Rate Kg ai/ha	# Shoots /M Sq.					
	No Cult		5 DAT		10 DAT	
	In	BTW	In	BTW	In	BTW
0.5	1	1	4	0	2	2
0.75	7	4	4	4	4	2
1.0	7	5	5	4	10	9
CHECK	104	112	125	123	115	102

[1] Chipman Inc., Technical Department, Stoney Creek, Ontario.

AGRAL 90 at 0.1% v/v was used in most tests as a wetter added to fluazifop-butyl. In 1982, several additives were tested and Superior Oil Concentrate at 1.2% v/v appeared to be the most consistent additive (Table 2). Work on additives will continue in the future with the aim of reducing the rates of fluazifop-butyl.

Table 2: Quackgrass control with fluazifop-butyl + additives.

Fluazifop-butyl	% Control		
0.5 kg ai/ha	Dundas	Rodney	Wilsonville
+ AGRAL 90 (0.1%)	59	85	73
+ RENEX 36 (0.1%)	72	91	64
+ CIDE-KICK (1.0%)	78	85	NA
+ Superior Oil Concentrate (1.2%)	89	98	86

Fluazifop-butyl is not only giving quackgrass control in the year of application. But at 0.5 kg ai/ha it also provided 94% control in fall 1981, 96% in spring and 92% in fall of 1982. Fluazifop-butyl and its activity on quackgrass rhizomes will allow growers to design programs to eradicate this weed in crop rotations.

CORN CHAMOMILE CONTROL IN WINTER WHEAT

R. R. Hahn and P. W. Kanouse[1/]

ABSTRACT

Preemergence and postemergence herbicide treatments were evaluated for corn chamomile (Anthemis arvensis L.) control in winter wheat. A randomized complete block design with three or four replications was used for each of three experiments conducted between 1979 and 1982.

The first experiment was established in September 1979 on a Palmyra gravelly loam soil with 3.3% organic matter in Livingston County, New York. Herbicide treatments were applied in water to 6 by 20 foot plots using 8002 flat spray tips mounted on a compressed air sprayer calibrated to deliver 15 gpa of spray solution. Fall applications of bromoxynil or dicamba provided good corn chamomile control without significant wheat injury (Table 1). The spring application of dicamba provided poor corn chamomile control and received the highest wheat injury rating. Like dicamba, fall application of 2,4-D was more effective than spring application but 2,4-D provided inadequate corn chamomile control and caused some crop injury at both treatment dates. Grain yields were harvested from an area 4 by 16 feet in the center of each plot. Wheat yield was reduced about 20 bu/A in the untreated plots compared to yields obtained with fall applications of bromoxynil or dicamba. Other treatments ranked in between with yield reductions caused by inadequate weed control and/or wheat injury.

Additional experiments were established in October of 1980 and 1981 to evaluate the efficacy of chlorsulfuron and DPX 6376 for corn chamomile control. Silt loam soils with 3.3% organic matter in Tompkins County, New York were used for both experiments. Herbicide treatments were applied in water to 10 by 25 foot plots using 8003 flat spray tips mounted on a compressed air plot sprayer calibrated to deliver 25 gpa of spray solution. Inclement weather prevented the application of fall postemergence treatments both years. Corn chamomile ratings (Table 2) made in 1980 and 1981 show that applications of bifenox or dicamba proved inadequate for control of this weed; however, dicamba was effective in controlling common ragweed (Ambrosia artimisiifolia L). Spring applications of bromoxynil were effective against both corn chamomile and common ragweed. All rates of chlorsulfuron applied postemergence in the spring provided significantly better control of corn chamomile than the preemergence applications. Common ragweed control with chlorsulfuron was erratic with postemergence applications being more effective than preemergence applications. Postemergence applications of DPX 6376 made in the spring of 1982 provided excellent control of corn chamomile and good to excellent common ragweed control. There were no significant differences in corn chamomile control between the spring applications of chlorsulfuron and DPX 6376. It would appear that low rates of either chlorsulfuron or DPX 6376 could be used postemergence for the control of corn chamomile.

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Table 1. Corn chamomile control ratings and winter wheat injury ratings and yields in 1980 with pre- and postemergence herbicide treatments.

Herbicide	Rate lb/A	How Appl.[a]	Wheat Injury[b]	Corn Chamomile Control Ratings[b]	Yield bu/A
Bifenox	1.00	PRE	0.0	6.0	72
Bifenox	1.50	PRE	0.3	7.5	74
Bromoxynil	0.38	FPO	0.5	8.5	78
Bromoxynil	0.50	FPO	0.0	8.5	74
2,4-D	0.25	FPO	1.8	6.0	67
2,4-D	0.25	SPO	1.0	3.8	62
Dicamba	0.25	FPO	0.5	8.5	72
Dicamba	0.25	SPO	3.5	4.0	63
Metribuzin	0.38	SPO	0.5	6.0	64
Control	-	-	0.0	0.0	55
LSD (0.05)			1.1	1.3	6

[a] FPO and SPO = fall and spring postemergence applications.

[b] Control and injury : 0 = no effect; 10 = complete kill.

Table 2. Corn chamomile and common ragweed control ratings for pre- and postemergence herbicide treatments in winter wheat.

Herbicide	Rate lb/A	How Appl.[a]	Corn Chamomile Control Ratings[b]		Common Ragweed Control Ratings[b]	
			1981	1982	1981	1982
Bifenox	2.000	PRE	3.0	2.3	1.5	6.3
Bifenox	2.000	SPO	-	5.3	-	6.7
Bromoxynil	0.375	SPO	9.3	7.3	8.0	9.3
Bromoxynil	0.500	SPO	9.0	8.0	7.3	10.0
Chlorsulfuron	0.016	PRE	-	5.0	-	4.7
Chlorsulfuron	0.031	PRE	8.5	5.7	5.8	5.7
Chlorsulfuron	0.063	PRE	-	6.7	-	8.3
Chlorsulfuron	0.016	SPO	10.0	9.3	2.3	7.3
Chlorsulfuron	0.031	SPO	10.0	9.3	3.3	8.3
Chlorsulfuron	0.063	SPO	10.0	10.0	5.8	7.7
Dicamba	0.125	SPO	4.0	4.3	8.8	9.3
DPX 6376	0.016	SPO	-	10.0	-	8.3
DPX 6376	0.031	SPO	-	10.0	-	9.7
DPX 6376	0.063	SPO	-	10.0	-	9.0
Control	-	-	0.0	0.0	0.0	0.0
LSD (0.05)			2.0	1.3	3.1	1.7

[a] SPO = spring postemergence applications.

[b] Control ratings: 0 = no effect on weeds; 10 = complete kill.

Activity of Fluazifop on Protein and Nucleic Acid Synthesis

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Fluazifop, an experimental herbicide for postemergence grass control in broadleaf crops, was tested for its effect on protein synthesis in corn coleoptiles. Incorporation of ^{14}C-leucine into protein was used as the measurement of protein synthesis. Corn was germinated and grown in the dark for 5 days at which time 1-cm tissue sections were excised just above the coleoptile node. One gram portions of the 1-cm coleoptile sections were placed in an incubation medium which included 0.2 µCi of ^{14}C-leucine and 0.1 ml of either the ethanol control, 10^{-4} M, 10^{-5} M, 10^{-6} M, 10^{-7} M, or 10^{-8} M fluazifop dissolved in ethanol. After incubation for 6 h in a 30° C waterbath the tissue sections were homogenized, filtered through Miracloth and the protein fraction was separated by centrifugation with trichloracetic acid.

Fluazifop at 10^{-4} M inhibited the absorption of ^{14}C-leucine by coleoptile tissue 44.6% compared to the control. The effects of lower concentrations of fluazifop on the absorption of ^{14}C-leucine was less significant. Protein synthesis, as measured by incorporation of ^{14}C-leucine into protein, was inhibited by 10^{-4} M, 10^{-5} M, 10^{-6} M, 10^{-7} M, and 10^{-8} M fluazifop 62.9, 37.6, 34.8, 30.2, and 21.8%, respectively, compared to the control. These data indicate that fluazifop directly or indirectly affects protein metabolism in meristematic tissue of corn.

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INFLUENCE OF BUTHIDAZOLE ON CHLORELLA VULGARIS FLUORESCENCE AND POST-LUMINESCENCE DECAY[1]

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ABSTRACT

Fluorescence emission and post-luminescence of *Chlorella vulgaris* were affected by the herbicide buthidazole. Algal fluorescence was increased 79% after a 5 min exposure to 1 µM buthidazole. A 206% increase in fluorescence was observed for *C. vulgaris* exposed to the herbicide for 60 min. Increase in the concentration of buthidazole to 10 uM caused a much more rapid stimulation of fluorescence, an increase of 209% being observed after only 5 min. The decay of *C. vulgaris* post-luminescence was considerably delayed by buthidazole. Measurements of post-luminescence decay and fluorescence can serve to define some aspects of herbicidal phytotoxicity and provide information on the initial action of those compounds that inhibit photosynthesis.

INTRODUCTION

Electron transport in photosynthesis is mediated by two photosystems acting in series and interconnected by a chain of electron carriers. Through these systems electrons are transported from water to $NADP^+$, a process generally referred to as the light reactions of photosynthesis. These reactions are coupled to ATP production and are essential to the reduction of CO_2 to the carbohydrate level (1,6).

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Inhibition of the light reactions of photosynthesis is the basis for the phytotoxic effect of many herbicides (9,12,13). For example, the herbicide buthidazole {3-[5-(1,1-dimethylethyl)-1,3,4-thiadizol-2-yl]-4-hydroxy-1-methyl-2-imidazolidinone} inhibits electron transport at two locations in the photosynthetic electron transport chain. The major inhibitory action occurs on the reducing side of photosystem II but a minor inhibitory site has also been located on the oxidizing side of photosystem II (17).

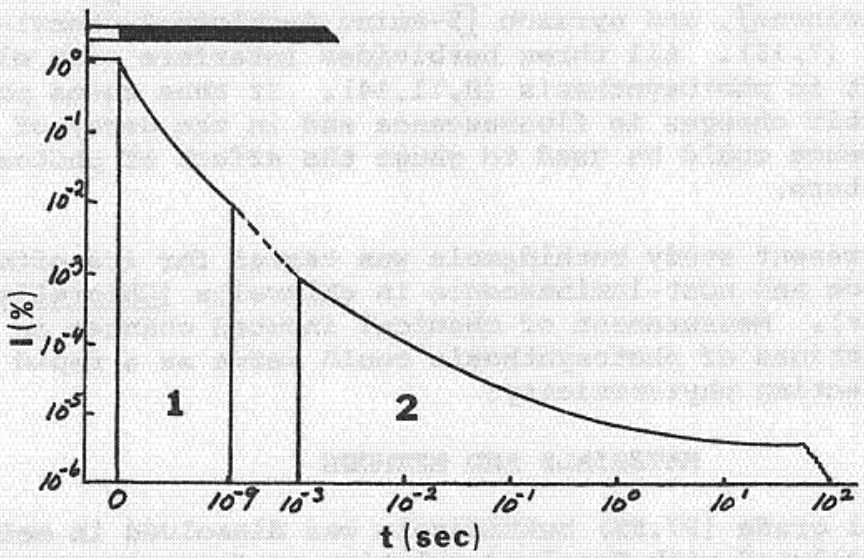

Figure 1. Curve of photoinduced luminescence (1) decay. Time (t) is expressed in seconds. 1 = fluorescence and 2 = post-luminescence.

Laboratory screening of new herbicides almost always include observations of their effect on photosynthesis. Recently, Murkowski (15) and Devlin et al. (7) demonstrated that some of the light reactions (fluorescence and post-luminescence) of photosynthesis could be used for very rapid detection of herbicide phytotoxicity. A small part of the light energy absorbed by the plant is re-emitted in the form of a weak red afterglow, detectable only by use of photomultipliers (16). Light absorbed by chlorophyll molecules evolves a state of excitation which migrates across the photosynthetic unit in less than 10^{-8} sec. In the mature chloroplast most of the excited electrons attain the active center. Those that do not give off their excess energy in the form of fluorescence.

Fluorescence is generally followed by a delayed emission of light called post-luminescence (delayed fluorescence) (Figure 1). Post-luminescence in green plants and algae is almost the exclusive property of photosystem II and is related to the functioning of the reactive centers of photosynthesis. Post-luminescence most likely involves recombination of electrons and holes that are generated at the reaction centers (3,5).

Changes in post-luminescence were observed in plants treated with simazine [2-chloro-4,6-bis(ethylamino)-s-triazine], norflurazon [4-chloro-5-(methylamino)-2-(α,α,α-trifluoro-m-tolyl)-3 (2H)-pyridazinone], and pyrazon [5-amino-4-chloro-2-phenyl-3(2H)-pyridazinone] (7,15). All three herbicides interfere with electron transport in photosynthesis (8,11,14). It thus seems possible that kinetic changes in fluorescence and in the decay of post-luminescence could be used to gauge the effect of photosynthetic inhibitors.

In the present study buthidazole was tested for its effect on fluorescence and post-luminescence in chlorella (*Chlorella vulgaris* Beyer). Measurement of chemical induced changes in the light reactions of photosynthesis could serve as a rapid method of detecting phytotoxicity.

MATERIALS AND METHODS

Technical grade (97.5%) buthidazole was dissolved in methanol and then diluted with Hoagland solution to form concentrations of 1 and 10 μM. All solutions, including those used with control tests, contained the same amount of methanol (0.2%). Chlorella was grown in Hoagland solution in 8-liter battery jars fitted with cotton plugs through which cotton-plugged tubes were passed to continuously supply the cultures with air. Air passing through the tubes also served to keep the cultures continuously agitated. Temperature was maintained at 25±1°C. Illumination was provided by two banks of fluorescent and incandescent lamps giving a light intensity of 190 μE $m^{-2}s^{-2}$ (12 hr light, 12 hr dark) at the surface of the cultures.

Fluorescence and post-luminescence decay were measured after Chlorella cultures were exposed to buthidazole in Hoagland solution for different time intervals. To give uniformity to measurements of fluorescence and post-luminescence all aliquots of algae tested contained 0.8 ng of chlorophyll per ml. Due to very low light intensity, post-luminescence was measured with the help of a photomultiplier tube and amplifier-recording systems as described

by Murkowski (15). The phytotoxic effect of buthidazole was determined by using the equation $m=N_1/N_4$. The factor m is the proportion of impulses counted during the time period from the second sec to the fourth sec after the exciting light was turned off (N_1) to the number of impulses counted during the time period from the 26th to the 28th sec (N_4). Fluorescent light was recorded by detecting its passage through a Zeiss prismatic monochromator equipped with a Zeiss photomultiplier sensitive to red light (maximum emission 685 nm). Ten sec duration measurements of fluorescence were made with a P-44 Polon convertor. Three measurements were made, the first during the first 10 sec of fluorescence, the second during the 20 to 30 sec interval, and the third during the 40 to 50 sec interval. Fluorescence was induced by a mercury line of 436 nm with a Specol Grating monochromator. There were four replications of each experiment.

RESULTS AND DISCUSSION

Algal fluorescence was increased 79% after only a 5 min exposure to 1 µM buthidazole (Table 1). This was increased dramatically as the time of exposure to the herbicide was increased. For example, a 206% increase in fluorescence was observed in C. vulgaris exposed to 1 µM buthidazole for 60 min. When the concentration of herbicide was increased to 10 µM, enhancement of fluorescence took place much more rapidly. After only five min the fluorescence of C. vulgaris exposed to buthidazole was increased 209% (Table 1). However, at the higher herbicide concentration increasing exposure time did not increase fluorescence.

Table 1. Influence of buthidazole on C. vulgaris fluorescence and post-luminescence. Each data point represents the factor m in the equation $m-N_1/N_4$. All data are presented as percent of control.

Time Exposed to Buthidazole (Min)	Fluorescence Buthidazole (1 µM)	(10 µM)	Post-luminescence Buthidazole (1 µM)	(10 µM)
0	100	100	100	100
5	179±11	309±17	85±6	33±5
10	231±12	328±17	66±6	25±3
20	298±15	337±18	42±3	17±3
60	306±15	319±15	31±3	14±2

Enhancement of fluorescence by buthidazole was expected since the herbicide has been shown to be an efficient inhibitor of photosynthetic electron transport (10,17). Electron transport is thought to be blocked by buthidazole somewhere between the primary electron acceptor (Q) of photosystem II and plastoquinone (17). When Q is functioning normally in photosynthetic electron transport, fluorescence is quenched. However, if Q is accumulated in a reduced form, such as happens when electron transport is blocked between Q and plastoquinone, fluorescence is stimulated.

As indicated by the m factor, the decay of C. vulgaris post-luminescence was considerably delayed by 1 µM buthidazole. For example, the value of m decreased 15% after only a 5 min exposure to 1 µM buthidazole (Table 1). When C. vulgaris was exposed 1 µM buthidazole for 60 min there was a 69% decrease in the value of m. The response of C. vulgaris to buthidazole was much more rapid when the concentration of the herbicide was increased to 10 µM. After a 5 min exposure to 10 µM buthidazole the value of m decreased 67% and after a 60 min exposure an 86% decrease was observed (Table 1).

Some investigators believe that conditions and reagents that alter fluorescence yield should similarly alter post-luminescence (2,4). Thus compounds such as buthidazole that stimulate fluorescence by inhibiting photosynthetic electron transport, should also stimulate post-luminescence.

As in previous studies with simazine, norfluorazon, and pyrazon (7,15), data collected in this study on the influence of buthidazole on fluorescence and post-luminescence indicate that measurements of this kind can serve to define some aspects of herbicidal phytotoxicity and provide information on the initial action of those compounds that inhibit photosynthesis.

LITERATURE CITED

1. Arnon, D.I. 1977. Photosynthesis 1950-1975: Changing concepts and perspectives, pp 7-56 in A. Trebst and M. Avron, eds. Encyclopedia of Plant Physology New Series, Vol. 5. Springer-Verlag, New York.

2. Bertsch, W.F. 1962. Two photoreactions in photosynthesis: evidence from the delayed light emission of Chlorella. Proc. Natl. Acad. Sci. 48:2000-2004.

3. Bertsch, W., J. West, and R. Hill. 1971. Delayed light studies on photosynthetic energy conversion. Photochem. Photobiol. 14:241-250.

4. Butler, W.L. 1966. Spectral characteristics of chlorophyll in green plants, pp 343-379 in L.P. Vernon and G.R. Seely, eds. The Chlorophylls. Academic Press, New York.

5. Clayton, R.K. 1971. Light and Living Matter: A Guide to the Study of Photobiology, Vol 2: The Biological Part. McGraw-Hill, New York.

6. Devlin, R.M. and A.V. Barker. 1971. Photosynthesis, pp 95-127. Van Nostrand Reinhold, New York.

7. Devlin, R.M., I.I. Zbiec, A.J. Murkowski, and S.J. Karczmarczyk. 1980. The use of post-luminescence decay and fluorescence emission to detect initial herbicide toxicity. Weed Res. 21:133-136.

8. Frank, R. and C.M. Switzer. 1969. Effects of pyrazon on growth, photosynthesis and respiration. Weed Sci. 17:344-348.

9. Gardiner, J.A. 1975. Substituted uracil herbicides, pp 293-321 in P.C. Kearney and D.D. Kaufman, eds. Herbicides: Chemistry, Degradation, and Mode of Action, Vol 1. Marcel Dekker, Inc., New York.

10. Hatzios, K.K., D. Penner, and D. Bell. 1980. Inhibition of photosynthetic electron transport in isolated spinach chloroplasts by two 1,3,4-thiadiazolyl derivatives, Plant Physiol. 65:319-321.

11. Hilton, J.L., A.L. Scharen, J.B. St. John, D.E. Moreland, and K.H. Norris. 1969. Modes of action of pyridazinone herbicides. Weed Sci. 17:541-547.

12. Izawa, S. and N.E. Good. 1972. Inhibition of photosynthetic electron transport and photophosphorylation, pp 355-377 in A. San Pietro, ed. Methods of Enzymology, Vol. 24. Academic Press, New York.

13. Moreland, D.E. 1967. Mechanisms of action of herbicides. Ann. Rev. Plant Physiol. 18:365-386.

14. Moreland, D.E., W.A. Gentner, J.L. Hilton, and K.L. Hill. 1959. Studies on the mechanism of herbicidal action of 2-chloro-4,6-bis(ethylamino)-s-triazine. Plant Physiol. 34:432-435.

15. Murkowski, A. 1973. Use of standard radiometric systems in the study of herbicide action on the photosynthetic luminescence of cultivable plants and weeds. Proc. Res. Institute of Pomology, Skierniewice, Poland 3:595-603.

16. Strehler, B. and W. Arnold. 1951. Light production by green plants. J. Gen. Physiol. 34:809-820.

17. York, A.C., C.J. Arntzen, and F.W. Slife. 1981. Photosynthetic electron transport inhibition by buthidazole. Weed Sci. 29:59-64.

Physiological Aspects of Asulam

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ABSTRACT

Corn seeds were germinated in darkness for 5 days before 1-cm sections were obtained from the stem just above the coleoptile node. One gram of coleoptile sections were incubated for 6 h at 30° C in a growth medium containing ^{14}C-leucine and asulam at 10^{-4} M, 10^{-5} M, 10^{-6} M, and 10^{-7} M. The coleoptile tissues were homogenized and the homogenate was separated by centrifuging to precipitate the proteins. The amount of protein synthesis was determined by absorption and incorporation of ^{14}C-leucine into corn coleoptile tissue. Asulam caused a reduction in the absorption of ^{14}C-leucine into corn coleoptile tissue. This reduction in leucine absorption ranged from 33% for 10^{-4} M to 11% for 10^{-6} M asulam. Protein synthesis, as measured by leucine incorporation into protein, was decreased 54%, 46%, 44% and 43% compared to the control for 10^{-4} M, 10^{-5} M, 10^{-6} M and 10^{-7} M asulam, respectively. These data indicate that asulam can alter protein metabolism in meristematic tissue of corn.

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THE TRANSLOCATION OF PENDIMETHALIN AND ITS SUBSEQUENT EFFECT ON CELL DIVISION

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ABSTRACT

Translocation studies with ^{14}C-pendimethalin in velvetleaf (Abutilon theophrasti Medic.) and pigweed (Amarathus powellii S. Wats.) indicate that root applied pendimethalin primarily remains in the root tissue, with only 3.69 and 12.44% being translocated to the shoots after 72 h. Distribution of translocated material is not to any specific portion of the shoot, but is rather uniformly distributed. Foliar penetration of ^{14}C-pendimethalin is quite rapid, reaching maximum levels in the treated leaf after 6 and 48 h in velvetleaf and pigweed, respectively. Translocation of foliar applied material does occur, but again the majority of the ^{14}C-pendimethalin remains in the treated leaf. Translocated material is rather uniformly distributed within the shoot on a DPM/mg basis, but there is very little movement to the roots. Foliar penetration is greater in pigweed than in velvetleaf; however, translocation is greater in velvetleaf, giving relatively equal levels of ^{14}C-pendimethalin in untreated areas of both species on a DPM/mg basis.

Studies on the effects of pendimethalin on cell division indicate that pendimethalin rapidly inhibits mitosis in the roots and shoots of both species. Cells affected in such a manner appear to be frozen in prophase, with their chromatin tightly condensed in a ball. Within 4 to 8 h, all cells undergoing mitosis in treated tissue are found in this frozen prophase position. In pigweed; however, cells in tissues which receive little or no herbicide spray again begin to undergo normal mitosis after 48 h. No recovery is evident in velvetleaf after 48 h, and therefore, the basic difference between velvetleaf and pigweed is in their ability to overcome the effects of the pendimethalin located in the shoot apex.

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CARBOHYDRATE CONTENT OF GLYPHOSATE TREATED JOHNSONGRASS

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ABSTRACT

Total sugar and starch content of johnsongrass [Sorghum halepense (L.) Pers] seeds and rhizomes was estimated following a wick bar application of 33% glyphosate solution. Johnsongrass was treated at the vegetative growth stage (early-post), late boot stage (mid-post), and seedhead maturity (late-post). Rhizomes and seeds from treated and untreated plots were collected in late September, 1981. Rhizomes were lyophilized, ground in a Wiley Mill, and passed through a 40 mesh screen for extraction preparation. Seeds were dried in a forced air oven at 48 C and prepared similarly. Total soluble sugars were extracted using an acetic acid:methanol:water (1:4:15 v/v/v) solution. Starch was extracted by adding 0.2 N sulfuric acid to the residue and boiling. Sugar content was measured using the phenol-sulfuric acid colorimetric procedure.

Date of application influenced carbohydrate levels in rhizome and seed tissue. Glyphosate had less effect on carbohydrate content of johnsongrass when applications were delayed to later growth stages. Total soluble sugars were decreased in rhizome tissue 70, 44, and 40% for early-post, mid-post, and late-post treatments, respectively, when compared with a control. Starch was reduced 84, 73, and 44%, respectively for the same treatments. No detectable levels of soluble sugars were found in treated or untreated seed tissue. Starch content decreased 44, 42, and 14% in seed tissue for early-post, mid-post, and late-post treatments, respectively. The level of carbohydrates remaining in storage tissue following glyphosate application may directly affect the potential for rhizome regrowth and seed germination of second generation johnsongrass in subsequent growing seasons.

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Movement and Persistence of Bromacil in Non-cultivated Soils

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ABSTRACT

Studies on the movement and persistence of bromacil (5-bromo-3-sec-butyl-6-methyluracil) were conducted from March 1969 to October 1970 on non-cropland, old field sites located within a 24 km radius of State College, Pennsylvania. A complete taxonomic survey of four test sites, each containing 138 untreated, 18.6 m^2 plots, indicated that the dominant herbaceous vegetation growing in the area consisted of little bluestem (Andropogon scoparius Michx.), poverty grass (Danthonia spicata (L.) Beauv.), timothy (Phleum pratense L.), quackgrass (Agropyron repens (L.) Beauv.), goldenrod (Solidago sp.) and Kentucky bluegrass (Poa pratensis L.). A total of 180 species, including woody plants were identified. The percent of area-wise ground cover occupied by each dominant species was obtained by ocular estimation.

The experiment was conducted on four soils of differing texture (1) Alton loamy sand (2) Duffield silt loam (3) Edom silty clay loam and (4) Penlaw light silty clay loam. During May 3 to 12, 1969, at each test site, a commercial wettable powder formulation containing 80% bromacil was applied with a pressure regulated hand sprayer at 11.2 and 22.4 kg/ha rates with three randomized replications on 3.05 m wide by 6.10 m long plots. Adjacent untreated plots of the same dimensions served as controls.

Soil samples from treated plots, including untreated control soils, were extracted from 0 to 7, 7 to 15 and 15 to 30 cm depths at each site and 3, 6, 12 and 18-month periods during the 1969 and 1970 growing seasons. Bromacil concentrations in the field samples were determined by an oat (Avena sativa L. 'Pennlawn') seedling bioassay procedure. Concentrations of bromacil were determined by comparing the mean height and weight yields of oat plants grown on field-treated soils to least-square equations developed from prepared standards. Bromacil residue concentrations developed from these bioassay prediction equations were analyzed by a partially nested analysis of variance.

Time period after the initial application and soil depth were significantly related to the dissipation and movement of bromacil. After 18 months, the maximum recovery of detectable bromacil residues occurred in the loamy sand followed by decreasing amounts in the silt loam, silty clay loam and light silty clay loam, respectively (Table 1).

Organic matter content, cation-exchange capacity, total nitrogen and soluble salt concentration were found to be significantly correlated with residue persistence and increasing depth in all four soils.

In this study, bromacil was more effective in controlling annual, and perennial grasses and broadleaf weeds on loamy sand than on heavier-textured silt loam and silty clay loam soils.

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Table 1. Bromacil parent residues recovered from three soil depths and two rates of application during the 1969 and 1970 growing seasons[a].

Soil type and depth (cm)	Months after treatment[b] 3		6		12		18		Mean depth within soil	Mean soil
	Rate (kg/ha)[c]									
	11.2	22.4	11.2	22.4	11.2	22.4	11.2	22.4		
	(ppm)									
Loamy sand										
0- 7	2.87	2.85	3.01	3.09	1.13	2.01	2.06	2.28	2.41 a	1.28 a
7-15	1.71	0.00	0.90	1.65	0.71	0.80	0.66	0.77	0.90 b	
15-30	1.09	0.13	1.22	1.20	0.08	0.38	0.00	0.01	0.51 c	
Silt loam										
0- 7	1.29	1.01	1.15	0.80	1.07	1.55	0.10	1.12	1.01 ab	1.00 b
7-15	1.48	1.36	0.89	0.79	1.23	1.49	0.11	1.20	1.07 a	
15-30	1.07	1.12	0.22	1.02	1.57	1.38	0.19	0.84	0.93 ab	
Silty clay loam										
0- 7	1.33	1.30	1.67	1.60	0.69	0.69	0.11	0.63	1.00 a	0.91 b
7-15	1.27	1.45	1.67	1.79	0.39	0.62	0.03	0.54	0.97 a	
15-30	1.37	1.00	0.55	1.11	0.42	0.97	0.00	0.61	0.75 b	
Light silty clay loam										
0- 7	1.48	1.51	1.34	1.64	0.16	0.15	0.16	0.07	0.81 a	0.59 c
7-15	0.34	1.67	0.11	1.41	0.01	0.60	0.00	0.00	0.52 b	
15-30	0.00	1.35	0.00	1.33	0.52	0.16	0.19	0.01	0.45 b	

[a]Means followed by the same letter are not significantly different at 1% level.

[b]Monthly means: 3 mo = 1.25 a; 6 mo = 1.25 a; 15 mo = 0.86 b; 18 mo = 0.54 c.

[c]Rate means: 11.2 kg/ha = 0.84 b; 22.4 kg/ha = 1.90 a.

VARIATIONS ON THE STALE SEEDBED TECHNIQUE

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ABSTRACT

Field experiments were established to study the efficacy of the stale seedbed method when various physical manipulations are employed to effect both the initial and succeeding weed flushes. After final seedbed preparation one-half the plots were covered by clear plastic. This treatment raised soil temperatures and resulted in greater densities of pigweed species (Amaranthus retroflexus, Amaranthus powellii) and common purslane (Portulaca oleracea L.) in the first flush during the cooler season of May and early June.

The plastic was removed and the initial flush of weeds was destroyed with paraquat in all plots. Treatments then included various degrees of soil disturbance e.g. no soil disturbance, shallow cultivation, and deep roto-till. One-half of these treatments were irrigated while the other half were not.

The second flush of weeds was extensive in irrigated plots regardless of the degree of soil disturbance. Without irrigation some degree of weed control was achieved in the undisturbed plots. Crabgrass (Digitaria ischaemum)which was dominant in the first flush of weeds destroyed by paraquat, was much less prevalent in the second flush. In contrast pigweed and purslane continued to germinate in great numbers when the environment was favorable. Irrigation proved particularly important in this case and consequently affected the magnitude of the soil disturbance effect.

It is clear that temperature and water are two variable factors that can have a major influence on the degree of success to be obtained from the use of the stale seedbed method for weed control in this region.

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PHOTOSYNTHETIC ANALYSIS OF TRIAZINE SUSCEPTIBLE AND RESISTANT SMOOTH PIGWEED

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ABSTRACT

Various photosynthetic electron transport reactions were performed on chloroplasts (stroma-free thylakoids) isolated from greenhouse-grown triazine susceptible (S) and resistant (R) smooth pigweed (*Amaranthus hybridus*). Rates of photosystem I (PS I) electron transport using either duroquinol or diaminodurene (DAD) as donors and methyl viologen (1,1'-dimethyl-4,4'-bipyridinium ion) as the acceptor were not significantly different between the two biotypes. The S and R biotypes also had equivalent rates in the photosystem II (PS II)-dependent reduction of 12-molybdosilicic acid (SiMo). Electron transport rates of R chloroplasts were about 50% less than rates in S chloroplasts for the PS II-dependent reduction of either diiminodurene DMMDBQ (dimethyl-methylenedioxy-p-benzoquinone). However, rates of whole chain electron transport (involving both photosystems) were not different between the S and R biotypes. These whole chain electron transport rates of about 1000 μequiv·mg chlorophyll^{-1}·h^{-1} are high enough to account for maximum rates of CO_2 fixation measured in intact leaves of S and R smooth pigweed (Ahrens and Stoller. 1983. Weed Sci. 31: in press). Thus it appears that the R biotype is not limited in its rate of photosynthetic electron transport as previously reported (Holt et al. 1981. Plant Physiol. 67:744). Slower rates of PS II electron transport in the R biotype are probably due to less efficient reaction with the electron acceptors used, and do not represent true electron transport capability.

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Allelopathic Effects of Three Thistle Species

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ABSTRACT

Canada thistle (Circium arvense L.), musk thistle (Carduus nutans L.), and plumeless thistle (Carduus ancanthiodes L.) were sectioned into root and foliage and then dried and ground. Ten grams of both root and foliage material from each of the three thistle species were extracted with 100 ml of distilled water for 24 h and filtered. The effect of the extracts on germination and radicle length of turnip (Brassica rappa L. 'Purple Top'), soybeans (Glycine max L. 'Williams'), corn (Zea mays L. 'Pioneer 3382'), musk plumeless, and Canada thistle were determined by adding 5 ml of extract to petri dishes containing 20 seeds. Extracts of thistle foliage decreased germination of turnip seed 100, 86.3, and 100% for plumeless, musk, and Canada thistle, respectively, compared to the control. Foliar extracts also decreased germination of soybean seed 89.1, 60.5, and 65% for plumeless, musk, and Canada thistle, respectively. Germination of corn was not effected by thistle extracts. Radicle length of corn, however, was reduced 85.2, 54.5, and 66.2% for plumeless, musk, and Canada thistle, respectively. Experiments with root extractions had similar results. Total phenolic concentration was determined by the difference in the colorimetric reaction with phenol reagent with and without polyvinylpyrolidine. Total phenolic concentration in foliar extracts of plumeless, musk and Canada thistle was 254, 103, and 185 ppm, respectively.

In a greenhouse study ground thistle was uniformly mixed throughout potting sol at quantities of 0.5, 1, 2, 4, 8, and 16% (w/w). Six seeds of either corn, soybean, turnip, musk, plumeless, or Canada thistle were planted in each pot. The effect of the material on the germination, height, fresh weight, and dry weight were determined after 2 weeks of growth. Plumeless thistle residue was the most toxic to corn. Foliage residue of 8% reduced the height, fresh weight and dry weight of corn 37.5, 29.6, and 32.4%, respectively.

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THE PLANT COMMUNITIES ALONG THE LONG ISLAND EXPRESSWAY, LONG ISLAND, NEW YORK

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ABSTRACT

Herbaceous and shrubby vegetation along the Long Island Expressway, Long Island, New York, was sampled by the quadrat method to determine species composition and dominance. Seven sites in Queens, Nassau and Suffolk Counties along the border of the roadway were studied. Members of the Gramineae are dominant throughout the year. Members of the Cruciferae and Caryophyllaceae are dominant on the cut-over portions of the expressway in April and early May. Members of the Compositae are conspicuous and/or dominant from mid July to October. Woody vines and shrubs are dominant on portions of the expressway that receive no maintenance. Mowing is the most important factor in maintaining the present assemblage of vegetation. Other factors of importance are soil texture, drought, fire, the activity of small mammals, allelopathy, proximity to seed sources, and local soil disturbance by motor vehicles.

INTRODUCTION

The plant communities along the Long Island Expressway (LIE) Long Island, New York were examined during the spring, summer, and fall of 1982. The LIE originates at the toll plaza of the Queens-Mid-town-Tunnel, and terminates at Riverhead, a distance of 70 miles. The first section of the expressway, from the Tunnel to the Brooklyn-Queens-Expressway, was opened in 1940. In following years, sections extending the expressway eastward were completed. The last section extending the roadway to Riverhead was opened on June 28, 1972. The LIE consists of six lanes of pavement, 36' wide separated by a median that varies in width.

During construction of the expressway, roadsides were cleared of native vegetation from the Brooklyn-Queens-Tunnel east to Glen Cove Road, Nassau County, New York. From Glen Cove Road to Riverhead, much native plant material was preserved during construction. Once construction was completed, the roadsides were allowed to revegetate. To improve the

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aesthetic character of the roadsides, thousands of shrubs and trees were planted. To the east of East Port Manor Road, most planting was done at interchanges. Plantings consist of various species of oak (Quercus spp.), weeping willow (Salix babylonica), flowering dogwood (Cornus florida), Viburnum (Viburnum spp.), Austrian Pine (Pinus nigra), hawthorne (Crataegus spp.), crabapple (Malus spp.) and numerous other species. Additional trees and shrubs were or will be planted on the expressway roadsides. Once "in the ground", the plant material has one year of maintenance and is then "on its own".

The median and up to 30 feet of shoulders are mowed at least twice a year. The clippings are left after mowing. No other maintenance takes place on a regular basis.

The present study was conducted to describe the plant communities on the roadside of the LIE. A second objective was to record the phenology (time of flowering), abundance class, and dominance of species occurring at seven sites on the roadside border of the expressway.

MATERIALS AND METHODS

Seven sites on the southern side of the LIE were selected for study: site one, Van Dam St.; site two, 108th St.; site three, exit 30; site four, exit 40; site 5, exit 50; site six, exit 60, and site seven, exit 70.

Thirty(one-meter^2)quadrats were established at each site and abundance classes for each species was recorded. Because of a mid-April snow, sampling began on April 22nd, and continued at monthly intervals terminating on October 21, 1982. Phenology (flowering date) and abundance classes were established for each species at each of the seven sites from April to October. Since the data for September and October are similar, no table was prepared expressing October data. Abundance classes for species at each study site are presented in Tables 1, 2 and 3.

RESULTS AND DISCUSSION

Members of the Gramineae e.g. Agrostis, Dactylis, and Festuca are dominant the year round at all sites. Many species demonstrate seasonal dominance. Members of the Caryophyllaceae e.g. Stellaria media and Cerastium vulgatum, and Cruciferae e.g. Draba verna, and Brassica Kaber, are conspicuous when in anthesis in late April. By May 13th, Rumex acetosella is in bloom. Many of the dominant grasses e.g. Bromus japonicus, Agrostis alba, Festuca octoflora, F. rubra, Dactylis glomerata, and Poa pratensis are in flower or just prior to flower by mid May. Fragaria

virginiana is one of the flowering dominants at site seven. (Table 1.).

On June 10, Plantago heterophylla was in flower at sites two and three, while Trifolium hybridum, Hieracium spp. and Erigon strigosus are flowering and conspicuous at site four. Hieracium spp. are the most conspicuous species at sites four through six and abundant at site seven, while Trifolium arvense is abundant at site six and the dominant plant at site seven. In July, many common weeds e.g. Ambrosia artemisiifolia, Digitaria sanguinalis and Panicum dichotomiflorum are well developed and dominant plants at site one. The Compositae represented by Rudbeckia hirta and Centaurea are conspicuous and/or dominant at sites three through seven. Trifolium arvense is the dominant plant at site seven.

In August, Daucus Carota, is one of the dominant plants at site one while the Compositae and Gramineae are dominant at sites two through seven. Triodia flava blooms at this time and is a conspicuous component of the flora at sites three, four and six. Early flowering goldenrods, especially Solidago arguta and S. juncea are in full bloom and comprise a conspicuous portion of the plant communities at stations four through seven. Daucus Carota is common or dominant at stations one, five, six and seven during August. By September 23rd, the late-flowering composites are at their peak. Artemisia vulgaris, the dominant plant at station one is in flower. Solidago rugosa (station five) and Solidago nemoralis (stations six and seven) are at peak bloom. Aster ericoides (stations one, five, six and seven) is beginning to flower, and is at peak bloom in early October. By October 21, stations through seven have experienced several frosts; flowering in the goldenrods (Solidago spp.) and Aster ericoides is past its peak.

Maintenance techniques have produced two distinct plant communities on the roadside of the LIE. Dominant plants in the communities that exist on roadsides that are mowed twice a year include early flowering and/or low-growing members of the Caryophyllaceae, Cruciferae, Compositae and Gramineae. On uncut portions of the roadside, especially where plantings of oaks Quercus spp., Austrian Pine Pinus nigra and maples Acer occur, perennials e.g. Solidago spp., Aster ericoides, and woody species e.g. Rhus radicans, Rubus allegheniensis, Lonicera japonica, Celastrus orbiculatus and Rhus copallina are locally dominant.

Many "old field" species are common on the roadsides of the Long Island Expressway (1, 2, 3). It is apparent that mowing is the most important factor in maintaining the present assemblage of vegetation. Other factors influencing the composition of vegetation in the plant communities include soil texture, drought, fire, the activity of small mammals, allelopathy,

proximity to seed sources, and soil disturbance by an occasional car or truck. The importance of these factors in producing and maintaining plant communities on Long Island is well documented (4,5).

Within each of the communities are minor "subcommunities". Digitaria and Polygonum aviculare thrive in the driest areas adjacent to curbs at sites one, two and five. Ambrosia artemsiifolia is common wherever the soil has been recently disturbed and is most common at site one.

Several woody species have invaded portions of the shoulders of the LIE. Within New York City, Ailanthus altissima has been successful in colonizing portions of the roadside. Prunus serotina also has become established at many sites. In Nassau and Suffolk Counties, at and between stations four through seven, Rhus glabra, Rhus copallina, Rhus radicans, Lonicera japonica, Rubus allegheniensis and Celastrus orbiculatus are locally common. Few Juniperus virginiana , Pinus rigida, Pinus nigra and Quercus spp. have become established on the roadside. These taxa may become more numerous in the future.

Present and future maintenance techniques e.g. mowing at least twice a year, will favor the perpetuation of the present flora. The Caryophyllaceae and Cruciferae will be conspicuous and/or dominant in April and early May. The Compositae with the exception of Hieracium are dominant or conspicuous in late summer and fall. The Gramineae are dominant throughout the year. On portions of the roadside that are not mowed, oaks Quercus spp. may eventually assume dominance.

LITERATURE CITED

1. Bard, G. Secondary succession on the Piedmont of New Jersey. Ecol. Monogr. 5: 195-215.

2. Conrad, H. S. 1935. The plant associations of central Long Island. Amer. Midl. Nat. 16: 433-516.

3. Oosting, H. J. 1942. An ecological analysis of the plant communities of Piedmont, North Carolina. Amer. Midl. Nat. 28: 1-126.

4. Stalter, R. 1981. Some ecological observations of Hempstead Plains, Long Island, New York Proceedings of the Northeastern Weed Science Society 35: 101-106.

5. Stalter, R. 1982. Additional ecological observations at Hempstead Plains, Long Island, New York. Proceedings of the Northeastern Weed Science Society 36: 76-80.

Table 1. Species composition and dominance as determined by abundance class for plant communities on seven sites on the roadside of the Long Island Expressway. See methods section for site location. Data were collected in April and May, 1982.

SPECIES	APRIL Study Sites 1	2	3	4	5	6	7	MAY Study Sites 1	2	3	4	5	6	7
Agropyron repens	2							3						
Dactylis glomerata	1	1	1	1	1	1		1	1	1	2	1	1	
Agrostis alba		5	5	5	5	5	1		5	5	5	5	5	1
Poa pratensis		1	1	2	2	1			1	1	3	2	1	
Bromus japonicus			1	1	1				2	3	4	3		
Artemisia vulgaris	4	3		2				4	2		2			
Taraxacum officinale	2	2		2				2	2					
Draba verna		2				1	3		2				1	3
Allium sp.		2		2					2		2			
Plantago heterophylla		2	3	2			2		2	3	3			2
Cerastium vulgatum		5	4	2		4	3		4	3	2		4	3
Stellaria media		2	2	2					2	2	2			
Lonicera japonica			3	2	4	2				3	2	4	2	
Rhus radicans			2	4	5		2			2	4	5		2
Celastrus orbiculatus					2							2		
Rubus allegheniensis			2	3	4					2	3	4		
Potentilla canadensis				2	2	3					3	3	4	1
Rumex acetosella			3	3	2	2	3			3	3	3	3	4
Hieracium spp.				2	3	3	4				4	4	5	5
Trifolium arvense						2	5						3	5
Brassica Kaber				2							2			
Fragaria virginiana							3							5

Abundance Class

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

Table 2. Species composition and dominance as determined by abundance class for plant communities on seven sites on the roadside of the Long Island Expressway. See methods section for site location. Data were collected in June and July, 1982.

SPECIES	JUNE Study Sites 1	2	3	4	5	6	7	JULY Study Sites 1	2	3	4	5	6	7
Agropyron repens	3							3						
Dactylis glomerata	1	1	1	2	1	1		1	1	1	1	1	1	
Agrostis alba		5	5	5	5	4	1		5	5	5	5	4	1
Poa pratensis		2	2	3	3	2			2	2	3	3	2	
Bromus japonicus		1	3	3	2				1	2	2	1		
Polygonum aviculare	3	1						2	2					
Ambrosia artemisiifolia	1							3						
Daucus carota	2		2					2		3		3	1	1
Artemisia vulgaris	4							4						
Digitaria sanguinalis	1							2						
Trifolium hybridum	1	3		4	3			2	2		2	2		
Eleusine indica	2							2						
Plantago heterophylla		2	3			2			3	3			1	
Cichorium intybus		2	1						2	1				
Chrysanthemum leucanthemum			2	2	2	1	1			1	1	1	1	1
Potentilla argentea				2		1					1			
Rudbeckia hirta												3	2	1
Erigeron strigosus			2	3	2		2			2	1	2	1	2
Centaurea cyanis						2							3	
Achillea millefolium				2	2	1	1				1	1		1
Trifolium pratense	1		1	2	4	2		2		1	1	2	1	1
Potentilla canadensis					4							4		
Rubus allegheniensis					5							5		
Rhus radicans			2	2	4					2	2	4		
Trifolium arvense						3	5						3	5
Lespedeza capitata					2	1						2	2	
Rumex acetosella						1	3						1	1
Fragaria virginiana							5							3
Eragrostis spectabilis							2							2
Panicum dichotomiflorum								3						

Table 3. Species composition and dominance as determined by abundance class for plant communities on seven sites on the roadside of the Long Island Expressway. See methods section for site location. Data were collected in August and September, 1982.

SPECIES	AUGUST Study Sites 1	2	3	4	5	6	7	SEPTEMBER Study Sites 1	2	3	4	5	6	7
Daucus carota	4		1		3	4	4	3		1		2	2	1
Ambrosia artemisiifolia	2				3	3	1	3				2	3	1
Digitaria sanguinalis	4	2	4	1	3	3	1	1	1	1	1	3	3	1
Erigeron canadensis	2				4	2		2		2				
Polygonum aviculare	2	4	1		2	2		2	2			1	1	
Artemisia vulgaris	5	2						5	2					
Triodia flava			4	1						3	1		1	
Erigeron strigosus			3	2						2	2			
Cichorium intybus			2							1				
Solidago arguta				3	2	2	2				3	3	2	2
Solidago juncea				2	3	1					2	2	1	
Solidago graminifolia			3	4						4	3			
Trifolium pratense	1		1	2	1	1		1		1	1	1	1	
Sorghastrum nutans	1				3			1				1		
Trifolium arvense						4	5						4	5
Melilotus alba	2					1		1					1	
Eupatorium hyssopifolium							2							2
Rudbeckia hirta						2	2						1	2
Eragrostis spectabilis							3							3
Aster ericoides	2			1	1	1	1	2			1	1	1	1
Linaria vulgaris				2							3			
Solidago rugosa					2	1						3	1	
Solidago nemoralis						3	3						5	4
Agropyron repens	3							2						
Dactylis glomerata	1	1	1	2	1	1		1	1	1	1	1	1	
Agrostis alba		4	4	5	5	4	1		4	4	5	5	4	1
Poa pratensis		1	2	3	1	2			1	2	3	3	2	
Panicum dichotomiflorum	3							3						

SUCCESSION ON OLD FIELDS ELEVEN YEARS AFTER APPLYING HERBICIDES

David J. Machlica[1] and Robert D. Shipman[2]

ABSTRACT

The purpose of this investigation was to determine the effects of selected herbicides on the species composition and successional development of two old field communities eleven years after treatment. Both sites experienced distinct successional transitions. Timothy (Phleum pratense L.), snakeroot (Eupatorium rugosum Houtt.) and poverty grass (Danthonia spicata (L.) Beauv.) were early stage dominants. Kentucky blue grass (Poa pratensis L.) and goldenrod (Solidago sp.) dominated the intermediate stage, and dogwood (Cornus spp.), white ash (Fraxinus americana L.), and goldenrod dominated the late stage.

The herbicides applied in this study caused increases in species diversity on nearly all treated plots between 1969 and 1971. Pelleted Fenuron (low rate), pelleted Picloram (low and medium rates), and Bromacil wettable powder (high rate) eliminated grasses as dominant species for at least two growing seasons after treatment. For the 1980 data, higher average diversity measures were found on plots treated with Picloram + Bromacil and pelleted Picloram and granular Tandex. Lower average diversity measures were found for plots treated with Diuron + Bromacil, granular Tandex, and Picloram + Diuron. The granular forms of Bromacil and Diuron also caused a reduction in species diversity.

INTRODUCTION

Numerous studies describe the short-term effects (1 to 3 years) of various herbicides on plant community characteristics, particularly where herbicides have been applied over consecutive growing seasons. However, there are few documented studies of the long term effects of herbicides on plant communities. The primary purpose of this investigation was to determine the effect of five herbicides, applied in eleven formulations, on species composition, diversity and succession at two old fields eleven years after treatment.

Both sites are located in The Pennsylvania State University Experimental Forest, Huntingdon County, Pennsylvania, within the Ridge and Valley Province of the Appalachian Mountains. The terrain at Site One slopes gently toward the southwest. The soil type is Edom silty clay loam, a well drained soil with a pH of 6.8 and an organic matter content of 3.1 percent. Site Two slopes gently to the southeast. The soil type is Penlaw light silty clay loam, a moderately well-drained soil with a pH of 5.1 and an organic matter content of 3.8 percent. A wetland, fed by intermittent streams borders the southern edge of Site Two.

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MATERIALS AND METHODS

The herbicides listed in Table 1 were applied to both sites, as part of an earlier research project, during the period May 3-14, 1969 (Shipman 1971). The assumption was made that each group of plots received a low, medium, and high rate of herbicide regardless of the specific dose applied.

The experimental design employed in this investigation was based on the original work by Shipman (1971). Shipman established eleven groups of plots at both sites, with each group allocated a different herbicide formulation. A group consisted of three 18.5-m^2 (3.05 m x 6.10 m) plots treated with a herbicide. The plots were staked out side by side, with control plots of the same dimension separating the groups. Each test plot in a group received a different concentration of herbicide.

Field measurements of species frequencies were taken visually on control plots in 1969 and on treated plots and controls in 1971. Vegetation composition on all plots was ascertained in 1980 through intensive sampling using a point quadrat (Goodall 1952). The field data were converted to cover abundance estimate for each species (Chapman 1976). Using the cover abundance data, three diversity measures (Brillouin's Diversity Index, McNaughton's Community Dominance Index and species richness) were calculated for each plot. Graminoid: Forb ratios (G:F, the ratio of grasses to herbaceous species) were also calculated for each plot. Analysis of variance (AOV) and multivariate techniques were used to analyze the data.

RESULTS AND DISCUSSION

Accepting the assumption that vegetation composition on the treated plots was about the same as that on the controls prior to treatment, certain qualitative comparisons can be made. The species frequency data for both sites indicated a general trend toward greater species diversity on the treated plots from 1969 to 1971. The results agree with the findings of Shipman (1971), but disagree with those of Sagar (1974), Tschirley (1969), Young and Evans (1974), and Tompkins and Grant (1977) concerning the short-term effects of herbicides on species diversity.

The incompatibility of the type of data collected in 1971 with that collected in 1980 made it impossible to determine, with statistical confidence, changes in species diversity between 1971 and 1980. However, a qualitative comparison of the data indicated that diversity increased slightly between 1971 and 1980 on most of the treated plots at each site. Statistical analysis of the 1980 data revealed several interesting results that reads (Table 2).

At Site One, granular Bromacil- and granular Diuron-treated plots produced higher average McNaughton's values and lower average Brillouin's values than all other plots. Average species richness values were lower on plots treated with granular Bromacil and higher on plots treated with granular Tandex. Brillouin's values were lower on the granular Tandex-treated plots as well.

At Site Two, Picloram + Bromacil and pelleted Picloram-treated plots produced higher average Brillouin's Diversity Index values and lower average

McNaughton's Community Dominance Index values than all other plots. Diuron + Bromacil, granular Tandex-, and Picloram + Diuron-treated plots produced lower average Brillouin's and higher McNaughton's values than all other plots. Increases in Brillouin's values were not always accompanied by higher species richness values.

The course of succession at both sites after 1969 generally reflects the early (timothy and poverty grass dominated), intermediate (Kentucky blue grass and goldenrod dominated), and late (dogwood and goldenrod dominated) stages of secondary succession described by Mellinger and McNaughton (1975) for northern temperate old fields. Site One in 1969 may be categorized as a young field abandoned for less than 20 years. An increase in species diversity by 1971 signaled a transition to an intermediate-aged field. By 1980, Site One had reached maturity as an intermediate-aged field dominated by a mix of broad-leaved species (goldenrod and snakeroot) and grasses (poverty grass and Kentucky blue grass). The results of a canonical correlation analysis for Site One suggest that portions of the site were entering the late field (or young forest) stage by 1980.

The successional pattern at Site Two is similar to that at Site One. However, the presence of red-panicled dogwood as a dominant species in 1969 indicates that, in part, Site Two was at a more advanced successional stage than Site One at the same time. Subsequent results from 1971 and 1980 established part of Site Two as an intermediate-aged old field characterized by goldenrod and Kentucky blue grass. The presence of red-panicled dogwood as a dominant species is indicative of a late field. But, goldenrod and red-panicled dogwood generally do not occur together. The results of the multivariate analysis for the 1980 data support the idea that two successional stages were present at Site Two, influenced primarily by soil moisture conditions. Goldenrod and Kentucky blue grass were dominant on drier, open plots. In contrast, red-panicled dogwood dominated the wetter plots, where it formed dense stands. Below the dogwood canopy, an understory of shade- and moisture-tolerant vegetation developed, such as poison ivy, Virginia creeper, and dewberry, forming the beginnings of a young forest.

CONCLUSIONS

The period of greatest herbicide effect on species cover abundance and diversity occurred within two growing seasons after application. Measurable increases in species diversity were detected between 1969 and 1971 on nearly all treated plots. Fenuron (low rate), pelleted Picloram (low and medium rates), and Bromacil wettable powder (high rate) eliminated grasses as dominant species for at least two growing seasons after treatment. This condition most likely led to a rapid recolonization of the treated plots by broadleaved species, with a subsequent increase in species diversity and shortening of the successional process. These results are particularly interesting since Diuron and Picloram are known to be effective primarily against woody plants and perennial weeds. Herbicide removal of grasses, particularly perennials, would open the way for colonization by broadleaved species capable of exploiting the newly created niches. Simplification of the plant community should be expected for

a short time (e.g. one or two growing seasons) after treatment on sites where invader species are not readily available; for instance, large agricultural fields. On abandoned fields surrounded by more advanced plant communities, such as intermediate-aged fields or forests, increases in species diversity could occur within one growing season as the result of species invasion.

The granular herbicides had a marked effect on species diversity after eleven growing seasons. Granular Bromacil and granular Diuron produced a reduction in species diversity at Site One, whereas granular Tandex produced an increase in species diversity. At Site Two, granular Tandex produced a decrease in species diversity over eleven growing seasons. Picloram + Diuron and Diuron + Bromacil also produced lower species diversity. In contrast, pelleted Picloram and Picloram + Bromacil produced increased species diversity at Site Two. These results suggest that while some herbicides have long-term effects on species diversity and succession, the nature of the effects may be site specific.

LITERATURE CITED

Chapman, S. B. (ed.) 1976. Methods in Plant Ecology. Blackwell Sci. Publ., Oxford.

Goodall, D. W. 1952. Some considerations in the use of point quadrats for the analysis of vegetation. Aust. J. Sci., Res. Ser. B, 5: 1-41.

Mellinger, M. V. and S. J. McNaughton. 1975. Structure and function of successional vascular plant communities in central New York. Ecol. Monogr. 45:161-182.

Sagar, G. R. 1974. On the ecology of weed control. Pages 52-56 in D. P. Jones and M. E. Solomon, Eds., Biology in Pest and Disease Control. Blackwell Sci. Pulb., Oxford.

Shipman, R. D. 1971. Soil applied herbicides in the control of temperate zone grasses, broadleaf weeds and woody plants. Document No. AD732502, Nat. Tech. Inform. Serv., Springfield, VA.

Tompkins, D. J. and W. F. Grant. 1977. Effects of herbicides on species diversity of two plant communities. Ecology 58:398-406.

Tschirley, F. H. 1969. Defoliation in Vietnam. Science 163:779-786.

Young, J. A. and R. A. Evans. 1974. Population dynamics of green rabbitbrush in disturbed big sagebrush communities. J. Range Mgmt. 27:127-132.

Table 1. Herbicides applied to Site One and Site Two (after Shipman 1971).

Herbicide	Formulation	Rates (lb/acre)		
1. Bromacil[a]	85.0% granule	5.00	10.00	20.00
2. Bromacil	80.0% wettable powder	5.00	10.00	20.00
3. Diuron[b]	8.0% granule	10.00	20.00	30.00
4. Tandex[c]	50.0% granule	5.00	10.00	20.00
5. Tandex	80.0% wettable powder	5.00	10.00	20.00
6. Fenuron[d]	25.0% wettable powder	10.00	20.00	30.00
7. Picloram[e]	10.0% pellet	2.00	5.00	10.00
8. Picloram + Bromacil mix (1:4)	11.25% pellet plus 45.0% granule	6.25	12.50	25.00
9. Picloram + Tandex mix (1:4)	10.0% pellet plus 45.0% granule	6.25	12.50	25.00
10. Picloram + Diuron mix (1:8)	33.3% granule plus 8.0% granule	11.25	22.50	25.00
11. Diuron + Bromacil mix (1:1)	5.0% granule plus 4.0% granule	5.63	11.25	22.50

[a]Chemical name: 5-bromo-3-sec-butyl-6-methyluracil.

[b]Chemical name: 3-(3,4-dichlorophenyl)-1,1-dimethylurea.

[c]Chemical name: m(3,3-dimethylureido)phenyl-tert-butylcarbamate.

[d]Chemical name: 3-phenyl-1,1-dimethylurea.

[e]Chemical name: 4-amino-3,5,6-trichloropicolinic acid.

Table 2. Changes in species diversity following herbicide treatment in 1969[a].

	Site 1		Site 2	
Herbicide	1969-1971	1971-1980	1969-1971	1971-1980
1. Bromacil (granular)	+	-	+	0
2. Bromacil (wettable powder)	+	0	+	0
3. Diuron (granular)	+	-	+	0
4. Tandex (granular)	+	+	+	-
5. Tandex (wettable powder)	+	0	+	0
6. Fenuron (wettable powder)	+	0	+	0
7. Picloram (pelleted)	+	0	+	+
8. Picloram + Bromacil	+	0	+	+
9. Picloram + Tandex	+	0	+	0
10. Picloram + Diuron	+	0	+	-
11. Diuron + Bromacil	+	0	+	-

[a] + = significant increase in diversity over the internal given versus other treated plots.

0 = no significant change in diversity over the internal given versus other treated plots.

- = significant decrease in diversity over the internal given versus other treated plots

significance p = 0.05.

PHYSIOLOGICAL EFFECTS OF SC-7245 ON CORN AND RADISH 1/

R.M. Devlin, I.I. Zbiec, and S.J. Karczmarczyk 2/

ABSTRACT

The effects of the experimental herbicide, SC-7245, on the germination and growth of corn and radish were studied. Only the highest concentrations of SC-7245 (1,000 and 10,000 µM) tested inhibited germination of corn and radish seeds. Slight inhibition of corn shoot growth occurred in corn treated with 100 µM SC-7245. Radish shoot length was not affected by any concentrations of SC-7245 tested. At 1,000 and 10,000 µM SC-7245 radish shoot fresh and dry weight were reduced. The influence of SC-7245 on the uptake and translocation of N, P, K, Ca, Mg, Cu, Fe, and Zn by corn and radish was also studied.

INTRODUCTION

The experimental herbicide SC-7245 (chemistry not released) is a chemical analog of napropamide [2-(α-naphthoxy) -N,N-diethylpropionamide] , a pre-emergence herbicide commonly used on cranberry bogs to control nutsedge (Cyperus dentatus Torr.) and a number of annual grasses (1,2). In the present paper the influence of SC-7245 on the germination and growth of corn (Zea mays L. cv 'Merit') and radish (Raphanus sativus L. 'White Icicle') was studied. In addition, the effect of the herbicide on mineral uptake and translocation in corn and radish was also observed.

MATERIALS AND METHODS

Seeds of corn and radish were imbibed for 6 h in suspensions of SC-7245 containing 0.5% Tween 80. For germination tests some

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of the imbibed seeds were transferred to 9 cm (radish) and 14 cm (corn) petri dishes containing 3 pads of filter paper (Whatman No. 1). The smaller petri dishes contained 5 ml of distilled water and the larger dishes 25 ml. Each petri dish held 50 seeds and one of the pads of filter paper was used to cover the seeds. Constant conditions of light (130 $uEm^{-2}s^{-1}$ and continuous) and temperature ($25\pm1^{o}C$) were maintained by allowing the seeds to germinate in a Percival growth chamber (Model E-540). Germination was recorded after 5 days for radish and after 8 days for corn. Each experiment was replicated four times.

The remaining imbibed seeds were sown in 16 cm styrofoam pots (12 seeds per pot) containing moist vermiculite and grown in the greenhouse. The plants were grown under natural light (average intensity about 56 $\mu Em^{-2}s^{-1}$) and received an average of 15 h light per day. Greenhouse temperature was maintained at $20\pm3^{o}C$. All plants were supplied daily with Hoagland solution (100 ml for corn and 40 ml for radish) from shoot emergence until they were removed from the pots. After 21 days the fresh weight, dry weight, and shoot length were recorded.

For mineral nutrition studies plant tissue was dried for 24 h at $105^{o}C$ and then ground into a fine powder with a Wiley mill (120 mesh screen). The powdered samples were analyzed for N by semi-micro Kjldahl, for P by phosphomolybdate colorimetry and for K by ion selective electrode. An atomic absorption spectrophotometer (Varian-Techtrom AA-5) was used for the determination of Mg, Ca, Cu, Fe, and Zn. All data is presented as percent of control of nutrient found per dry weight of plant tissue. All experiments were replicated four times.

RESULTS AND DISCUSSION

The germination of corn seed was not affected by all but the highest concentration of SC-7245 tested. A 13% reduction in germination was recorded for seeds treated with 10,000 µM SC-7245 (Table 1). A slight but significant inhibition of shoot length was noted in corn treated with 100 µM SC-7245. However, at 10,000 µM a 90% reduction in shoot length was observed (Table 1). The fresh weight of corn shoots treated with 10, 100, and 1,000 µM was reduced 24, 33, and 91%, respectively (Table 1). As expected, the concentrations of SC-7245 that reduced fresh weight also reduced dry weight, the largest reduction (86%) being observed in corn treated with 1,000 µM (Table 1).

Germination of radish seeds was inhibited by 1,000 and 10,000 µM SC-7245. Shoot length, however, was unaffected by all concentra-

tions of the herbicide tested (Table 2). Fresh weight and dry weight of radish shoots were reduced by 1,000 and 10,000 µM SC-7245. For example, 10,000 µM SC-7245 reduced fresh weight 19% and dry weight 17% (Table 2).

Table 1. Effect of SC-7245 on the germination and growth of corn. Length of shoot was determined by measuring the longest leaf.

SC-7245 (µM)	Germ. (%)	Shoot Length (cm)	Shoot Fr. Wgt. (g/10 plt.)	Shoot Dry Wgt. (g/10 plt.)
0	96	44.6	17.2	1.17
10^{-2}	98	42.6	16.8	1.02
10^{-1}	99	42.6	15.7	1.07
10^{0}	97	45.7	16.2	1.12
10^{1}	99	40.7	13.1	0.90
10^{2}	98	34.7	11.6	0.83
10^{3}	98	4.5	1.6	0.16
10^{4}	87	----	----	----
LSD 5%	3.4	3.7	1.6	0.12
1%	4.6	5.0	2.1	0.16

Corn root absorption of N, K, and Mg was unaffected by all but the highest concentration of SC-7245 tested. At the highest concentration (1,000 µM) there was a 14% increase in N uptake and a 14% decrease in the uptake of Mg (Table 3). Root uptake of P was stimulated, peak stimulation (97%) occurring in corn plants treated with 1,000 µM SC-7245 (Table 3). In contrast, the uptake of Ca was inhibited by the herbicide. Corn root absorption of the minor elements Cu, Fe, and Zn was strongly inhibited by SC-7245 (Table 3).

With the exception of corn treated with 1,000 µM SC-7245, root to shoot translocation of N in treated plants was similar to that in control plants. However, corn treated with 1,000 µM had 30% more N in the shoot tissue (Table 3). Also at 1,000 µM there were increases of 44, 23, and 26% for P, Ca, and Mg, respectively, in the shoot tissue (Table 3). In contrast the K content of corn shoot tissue treated with 1,000 µM SC-7245 was down 28% (Table 3). Root to shoot translocation of the minor elements Cu

and Fe was slightly inhibited in corn treated with the lower concentrations of SC-7245, but was stimulated in those plants treated with 1,000 µM of the herbicide (Table 3). There were also higher concentrations of Zn in corn shoots from plants treated with 100 and 1,000 µM SC-7245 (Table 3).

Table 2. Effect of SC-7245 on the germination and growth of radish. Length of shoot was determined by measuring the longest leaf.

SC-7245 (µM)	Germ. (%)	Shoot Length (cm)	Shoot Fr. Wgt. (g/10 plt.)	Shoot Dry Wgt. (mg/10 plt.)
0	95.5	11.8	13.3	746
10^{-2}	96.5	12.2	13.0	710
10^{0}	96.5	12.2	12.9	733
10^{2}	93.0	12.4	12.8	712
10^{3}	80.5	12.0	12.1	613
10^{4}	64.5	11.9	10.8	541
LSD 5%	5.1	0.7	1.0	71
1%	7.0	1.0	1.4	98

Root absorption of N by radish was not affected by SC-7245. This was also true for P except for the highest concentration (10,000 µM) of herbicide tested. At 10,000 µM an 18% increase in P uptake was observed (Table 4). Radish root uptake of K was inhibited by SC-7245, inhibition increasing with increase in concentration of SC-7245 (Table 4). Root absorption of both Ca and Mg was slightly stimulated by the lower concentrations of SC-7245, but inhibited by the higher concentrations tested (Table 4). Root uptake of Cu by radish was severely inhibited by SC-7245, peak inhibition (53%) occurring at 10,000 µM. In contrast, both Fe and Zn uptake by roots was stimulated. For example, 100 µM SC-7245 caused a 67% increase in Fe absorption and 0.1 µM a 50% increase in Zn absorption (Table 4).

SC-7245 stimulated radish shoot uptake of all but two (K and Cu) of the mineral elements tested in this study. Of the major elements observed, the highest stimulation (32%) occurred with the uptake of P by shoots treated with 1,000 µM SC-7245 (Table 4). Of

the minor elements tested, the highest stimulation (149%) occurred with the uptake of Fe by radish shoots treated with 0.1 µM SC-7245 (Table 4). Compared to control plants, shoots from radish plants treated with 1,000 and 10,000 uM SC-7245 had 43 and 47% less K, respectively. Under the same circumstances there was 31 and 35% less Cu (Table 4).

Similar to its chemical analog napropamide (3), SC-7245 influences the uptake and translocation of mineral nutrients by plants. This influence, however, appears to differ from one plant to another. For example, the Fe content of shoot tissue from corn (monocotyledon) treated with 0.1 µM SC-7245 was down 19% (Table 3) while that of radish (dicotyledon) was up 149% (Table 4). Differences in influence of SC-7245 from one plant species to another on the uptake and movement of mineral nutrients suggests differences in sensitivity to the herbicide.

LITERATURE CITED

1. Devlin, R.M. and I.E. Demoranville. 1973. Influence of the herbicide R-7465 on cranberry fruit development. HortScience 8:400.

2. Devlin, R.M. and I.E. Demoranville. 1973. Influence of devrinol (R-7465) on cranberry vine growth and crop. Proc. NEWSS 28:240-243.

3. Devlin, R.M., I.I. Zbiec, and S.J. Karczmarczyk. 1982. Influence of napropamide on the uptake and translocation of mineral nutrients. Weed Sci. 30:503-506.

Table 3. Effect of SC-7245 on the uptake of mineral elements by corn. All data points are presented as percent of control. Roots are represented by the letter R and shoots by the letter S. The actual amounts of N, P, K, Ca, Mg, Cu, Fe, and Zn found in one g of dry root tissue from control plants were 25.0, 2.9, 37.1, 4.3, 3.2, 1.06, 0.74, and 0.05 mg, respectively; in one g of dry shoot tissue 51.0, 6.7, 68.1, 7.2, 4.2, 0.05, 0.17, and 0.04 mg, respectively.

SC-7245 (uM)	N		P		K		Ca		Mg		Cu		Fe		Zn	
	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S
0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
10^{-2}	100	99	108	101	97	105	91	101	97	99	93	91	82	86	94	95
10^{-1}	99	96	108	102	95	102	89	102	93	99	76	87	76	81	73	98
10^{0}	95	98	119	105	96	96	95	99	94	98	72	85	78	81	71	93
10^{1}	96	97	123	109	91	95	88	108	92	106	61	91	64	84	69	95
10^{2}	103	105	141	126	93	96	82	116	95	113	57	106	63	94	63	122
10^{3}	114	130	197	144	104	72	71	123	86	126	34	130	92	121	59	161
LSD 5%	5.7	3.1	18.2	10.9	3.0	1.0	7.7	4.0	6.5	4.5	3.6	10.9	6.9	5.1	8.4	10.5
1%	7.8	4.3	24.9	14.8	4.1	1.4	10.4	5.5	9.0	6.2	4.9	14.9	9.4	6.9	11.5	14.2

Table 4. Effect of SC-7245 on the uptake of mineral elements by radish. All data points are presented as percent of control. Roots are represented by the letter R and shoots by the letter S. The actual amounts of N, P, K, Ca, Mg, Cu, Fe, and Zn found in one g of dry root tissue from control plants were 38.3, 1.7, 35.3, 26.3, 4.6, 0.95, 0.80, and 0.06 mg, respectively; in one g of dry shoot tissue 52.4, 2.5, 68.1, 37.7, 9.3, 0.22, 0.38, and 0.03 mg, respectively.

SC-7245 (μM)	N		P		K		Ca		Mg		Cu		Fe		Zn	
	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S
0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
10^{-2}	96	107	112	108	97	97	117	111	104	116	99	90	101	154	148	126
10^{-1}	94	108	106	116	92	89	114	110	104	112	56	78	108	249	150	107
10^{0}	94	123	112	120	89	85	117	107	109	111	55	69	131	232	150	106
10^{1}	97	102	106	124	86	81	109	105	109	110	54	70	158	183	110	102
10^{2}	100	102	112	124	83	79	94	106	96	114	56	71	167	148	105	99
10^{3}	109	98	112	132	82	57	90	94	91	96	55	69	97	113	110	100
10^{4}	107	97	118	132	77	53	71	92	85	91	47	65	92	79	58	98
LSD 5%	7.8	4.7	12.3	3.6	6.5	5.5	5.6	8.6	6.3	12.2	5.4	7.1	10.3	15.1	10.9	14.7
1%	10.6	6.4	16.5	4.8	8.9	7.5	7.5	11.7	8.4	16.6	7.3	9.6	14.0	20.4	11.6	20.0

EFFECT OF SC-7245 ON ENZYME ACTIVITY IN CORN AND RADISH[1/]

Robert M. Devlin, Irena I. Zbiec and Stanislaw J. Karczmarczyk[2/]

ABSTRACT

The influence of the experimental herbicide SC-7245 on the activity of acid phosphatase, alkaline phosphatase, invertase, α-amylase, β-glucosidase, peroxidase, and phenylalanine ammonia-lyase (PAL) in corn and radish was studied. The herbicide stimulated alkaline phosphatase activity in mature corn and radish plants. Of the hydrolytic enxymes tested, α-amylase and β-glucosidase were the most affected by the presence of SC-7245. Stimulation of peroxidase activity was observed in all growth systems analyzed except for the germinating corn seed. PAL activity was inhibited in both the germinating radish seed and the mature radish plant.

INTRODUCTION

In preliminary screening tests the experimental herbicide SC-7245 (chemistry not released) has proven to be an effective preemergence control for certain sedges, annual grasses, and annual broadleaf weeds. This was expected since SC-7245 is a chemical analog of napropamide [2-(α-naphthoxy)-N,N-diethylpropionamide] and as such possesses a weed control spectrum similar to that of napropamide.

In the present paper the influence of SC-7245 on several enzyme systems in corn (Zea mays L. cv 'Merit') and radish (Raphanus sativus L. cv 'White Icicle') was studied.

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MATERIALS AND METHODS

Plant preparation. Seeds of corn and radish were imbibed for 6 h in suspensions of SC-7245 containing 0.5% Tween 80. Some of the imbibed seeds were sown in 16 cm styrofoam pots (12 seeds per pot) containing moist vermiculite and grown in the greenhouse. The plants were grown under natural light (average intensity about 56.5 $\mu E\ m^{-2}s^{-1}$) and received an average of 15 h light per day. Greenhouse temperature was maintained at $20 \pm 3^{o}C$. All plants were supplied daily with Hoagland solution (100 ml for corn and 40 ml for radish) from shoot emergence until they were removed from the pots. After 21 days the plants were harvested and examined for enzyme activity.

The remaining imbibed seeds were placed in 9 cm (radish) and 14 cm (corn) petri dishes containing 3 pads of filter paper (Whatman No. 1). The smaller petri dishes contained 5 ml of distilled water and the larger dishes 25 ml. Each petri dish held 50 seeds and one of the pads of filter paper was used to cover the seeds. Constant conditions of light (130 $\mu E\ m^{-2}s^{-1}$ and continuous) and temperature ($25 \pm 1^{o}C$) were maintained by allowing the seeds to germinate in a Percival growth chamber (Model E-540). After 5 days (radish) and 8 days (corn) the germinating seeds were examined for enzyme activity.

Enzyme analyses. In all enzyme studies leaf and seed tissue were homogenized in the appropriate chilled buffer ($4^{o}C$) with a Virtis-45 homogenizer. The homogenate was then centrifuged for 15 min at 17,000 G and the supernatant collected for enzyme study. All data points presented represent the average of at least 3 replicates.

A. Phosphatases. The activity of acid and alkaline phosphatases was determined according to the method of Linhardt and Walter (6). The incubation mixture for acid phosphatase contained sodium p-nitrophenylphosphate in citric acid buffer (pH 4.8) as substrate. For alkaline phosphatase glycine buffer (pH 10.5) was used. After plant extract was added, the incubation mixture was allowed to stand for 30 min at $37^{o}C$. Paranitrophenol is released in the reaction and its presence is detected by reading the optical density (OD) of the reaction mixture at 405 nm. A phosphatase unit is the amount of enzyme contained in 1,000 g of fresh plant tissue which liberates 1 mM of p-nitrophenol.

B. Invertase. Invertase activity was determined according to the method of Hofmann (5). A sample of plant extract in phosphate buffer (pH 5.5) was added to an equal volume of 20% sucrose solution

and the mixture incubated for 24 h at 37°C. The amount of glucose released was determined using Fehling's solution method.

C. α-Amylase. Amylase activity was determined according to the method of Hofmann (5). The incubation mixture contained equal amounts of plant extract in phosphate buffer (pH 5.5) and 1% amylase solution. This mixture was incubated for 72 h at 37°C. The amount of glucose released was determined using Fehling's solution method.

D. β-Glucosidase. Glucosidase activity was determined according to the method of Hofmann (5). The incubation mixture contained equal amounts of plant extract in phosphate buffer (pH 6.2) and 10% arbutine (β-D-glucosidohydroquinone) solution. The mixture was incubated for 96 h at 37°C. The amount of glucose released was determined using Fehling's solution method.

E. Peroxidase. Peroxidase activity was determined according to the method of Lück (7). The reaction mixture contained 2 ml plant extract in phosphate buffer (pH 7), 1 ml phosphate buffer (pH 7), 0.1 ml H_2O_2, and 0.1 ml of a 1% solution of p-phenylenediamine. The OD of the reaction was read at 485 nm after 30, 60, 90, and 120 sec. A unit of peroxidase activity is the increase in OD of the reaction mixture per one min per 100 g fresh tissue.

F. Phenylalanine ammonia-lyase (PAL). PAL activity was determined according to the method of Gordon and Koukkari (3). Plant material was homogenized with 0.05M borate buffer (pH 8.8) containing 28 mM mercaptoethanol and 3% polyclar. The homogenate was filtered through 6 layers of cheesecloth and then centrifuged at 17,000 G for 15 min. A 2 ml aliquot of the supernatant was added to 2 ml of L-phenylalanine solution that contained 20 μM of L-phenylalanine and incubated at 30°C. The production of trans-cinnamic acid was followed by recording increases in OD at 290 nm at 3-h intervals. A unit of PAL activity is the amount of enzyme in 100 mg fresh tissue which yields 1 μM of trans-cinnamic acid per min.

RESULTS AND DISCUSSION

Phosphatases, which are classified as "acid" or "alkaline" according to their pH optimum, catalyze the hydrolytic cleavage of phosphoric acid esters. They are found in all plants and are essential participants in a number of biochemical reactions.

Acid phosphatase activity in the germinating corn seed was slightly inhibited by 10 μM SC-7245. Inhibition was not increased

when the seeds were exposed to 1,000 µM of the herbicide (Table 1). Acid phosphatase activity in the mature corn plant was not affected by SC-7245 (Table 1). Slight stimulation of alkaline phosphatase activity was observed in germinating corn seeds treated with 0.001 µM SC-7245. However, higher concentrations either had no effect (0.1 µM) or were inhibitory (10 and 1,000 µM). At 1,000 µM SC-7245, alkaline phosphatase activity was inhibited 43% (Table 1). In the mature corn plant alkaline phosphatase activity was stimulated by SC-7245, peak stimulation (74%) occurring at 0.1 µM (Table 1).

Table 1. Influence of SC-7245 on acid and alkaline phosphatase (Phos) activity in corn and radish. Both the germinating seed (GS) and the mature plant (MP) were analyzed. Data are presented in units of activity per 100 g of fresh tissue.

	Corn				Radish			
SC-7245 (µM)	Acid Phos (GS)	Acid Phos (MP)	Alkaline Phos (GS)	Alkaline Phos (MP)	Acid Phos (GS)	Acid Phos (MP)	Alkaline Phos (GS)	Alkaline Phos (MP)
0	13.3	10.2	0.21	0.15	18.4	24.1	0.07	0.78
10^{-3}	13.4	----	0.24	----	18.9	25.6	0.11	0.84
10^{-2}	----	11.0	----	0.17	----	----	----	----
10^{-1}	13.0	10.7	0.22	0.25	19.8	25.3	0.14	0.92
10^{0}	----	9.8	----	0.20	----	----	----	----
10^{1}	11.7	10.2	0.16	0.21	18.8	27.2	0.17	0.90
10^{2}	----	10.2	----	0.13	----	----	----	----
10^{3}	11.5	----	0.12	----	19.0	26.0	0.16	0.91

In the germinating radish seed and in the mature radish plant, SC-7245 had only a nominal influence on acid phosphatase activity (Table 1). In contrast, alkaline phosphatase activity in the germinating radish seed was considerably stimulated by the herbicide. For example, activity was stimulated 100,143, and 129% by 0.1, 10, and 1,000 µM SC-7245, respectively (Table 1). Alkaline phosphatase activity was also stimulated in the mature radish plant but not to the extent observed in the germinating seed (Table 1).

The hydrolytic enzymes invertase, α-amylase, and β-glucosidase are found in most if not all plants. The primary function

of invertase is the hydrolysis of sucrose to glucose and fructose. The enzyme α-amylase attacks 1, 4 linkages which are within the starch molecule, liberating first dextrins and then a mixture of reducing sugars. Aryl and alkyl β-glucosides are hydrolyzed by β-glucosidase.

Table 1. Influence of SC-7245 on invertase, α-amylase, and β-glucosidase activity in the germinating corn seed (GS) and the mature corn plant (MP). Data are presented in mg of glucose per 100 g of fresh tissue.

SC-7245 (μM)	Invertase (GS)	Invertase (MP)	α-Amylase (GS)	α-Amylase (MP)	β-Glugosidase (GS)	β-Glugosidase (MP)
0	14,196	15,294	9,870	4,196	6,480	3,058
10^{-3}	14,705	------	9,771	-----	6,426	-----
10^{-2}	------	15,507	-----	4,726	-----	3,228
10^{-1}	14,763	16,570	10,885	4,567	6,347	3,172
10^{0}	------	16,463	------	4,248	-----	2,916
10^{1}	14,090	16,578	12,320	4,195	6,240	2,804
10^{2}	------	18,481	------	3,983	-----	2,379
10^{3}	6,974	------	13,598	-----	6,108	-----

Except for the highest concentration tested, invertase activity in the germinating corn seed was not affected by SC-7245. There was a 51% drop in activity when 1,000 μM of the herbicide was applied (Table 2). In the mature corn plant a 21% increase in invertase activity was observed in plants treated with 100 μM SC-7245 (Table 2). The activity of α-amylase in the germinating corn seed increased with increase in the concentration of SC-7245, peak stimulation (37%) occurring when 1,000 μM of the herbicide was applied (Table 2). In the mature corn plant, SC-7245 had little effect on α-amylase activity. The activity of β-glucosidase in the germinating corn seed was not affected by SC-7245, but in the mature corn plant activity was inhibited 22% by 1,000 μM of the herbicide (Table 2).

With the exception of the highest concentration tested (10,000 μM), SC-7245 did not influence invertase activity in the germinating radish seed or in the mature radish plant. A 26% increase in activity was observed in radish plants treated with 10,000 μM SC-7245 (Table 3). All concentrations of SC-7245 tested stimulated

α-amylase activity in the germinating radish seed, peak stimulation (128%) occurring in seeds treated with 10,000 µM of the herbicide (Table 3). However, in the mature radish plant stimulation of α-amylase activity was not observed (Table 3). Very low concentrations of SC-7245 stimulated β-glucosidase activity in the germinating radish seed. For example, 0.001 µM SC-7245 caused an 18% increase in enzyme activity (Table 3). In the mature radish plant β-glucosidase activity was stimulated by SC-7245. The greatest increase in activity (53%) occurred in radish plants treated with 1,000 µM SC-7245 (Table 3).

Table 3. Influence of SC-7245 on invertase, α-amylase, and β-glucosidase activity in the germinating radish seed (GS) and the mature radish plant (MP). Data are presented in mg of glucose per 100 g of fresh tissue.

SC-7245 (µM)	Invertase (GS)	Invertase (MP)	α-Amylase (GS)	α-Amylase (MP)	β-Glucosidase (GS)	β-Glucosidase (MP)
0	3,638	50,076	2,602	2,347	1,687	96
10^{-3}	3,611	50,507	3,718	2,262	1,986	106
10^{-1}	3,425	49,277	4,328	2,170	1,964	104
10^{1}	3,505	50,976	4,753	2,220	1,773	138
10^{3}	3,504	51,140	4,779	2,212	1,548	147
10^{4}	3,481	63,082	5,933	2,120	1,436	0

Peroxidase enzymes are common to all higher plants. In the presence of H_2O_2, peroxidase catalyzes the oxidation of substrates such as phenols, aromatic-, primary-, secondary- and tertiary-amines and certain heterocyclic compounds such as ascorbic acid and indole. Also, a large number of H-donors are oxidized in coupled oxidation in which the peroxidase system results in the formation of an oxidation product which, in turn, oxidizes another compound (2).

Peroxidase activity in the germinating corn seed was inhibited by SC-7245. Enzyme activity was inhibited 9, 52, and 61% by herbicide concentrations of 0.1, 10, and 1,000 µM, respectively (Table 4). In the mature corn plant, however, peroxidase activity was stimulated by SC-7245. Peak stimulation (41%) was noted in those plants treated with 0.1 µM SC-7245 (Table 4).

Unlike corn seeds, peroxidase activity in germinating radish seeds was stimulated by SC-7245, stimulation increasing with increase in the concentration (up to 1,000 µM) of herbicide applied (Table 4). In the mature radish plant the lowest concentration of SC-7245 (0.001 µM) applied caused a 22% inhibition of peroxidase activity. However, as the concentration of herbicide was increased, peroxidase activity also increased. Radish plants treated with 10,000 µM SC-7245 showed a 112% increase in peroxidase activity (Table 4).

Table 4. Influence of SC-7245 on peroxidase activity in the germinating seed (GS) and mature plant (MP) of corn and radish. Data are presented in units of activity per 100 g of fresh tissue.

	Corn		Radish	
SC-7245 (µM)	Peroxidase (GS)	Peroxidase (MP)	Peroxidase (GS)	Peroxidase (MP)
0	0.23	0.10	0.10	0.05
10^{-3}	0.24	----	0.11	0.04
10^{-2}	----	0.11	----	----
10^{-1}	0.21	0.14	0.12	0.03
10^{0}	----	0.13	----	----
10^{1}	0.11	0.13	0.13	0.05
10^{2}	----	0.12	----	----
10^{3}	0.09	----	0.14	0.09
10^{4}	----	----	0.06	0.11

The enzyme PAL catalyzes the elimination of NH_3 from L-phenylalanine to give trans-cinnamic acid. This is an important reaction because PAL is the first committed enzyme of phenylpropanoid metabolism in higher plants (4). There is evidence that PAL can catalyze the removal of NH_3 from L-tyrosine as well as L-phenylalanine (1,3). Thus PAL activity diverts these two amino acids away from protein synthesis and into secondary metabolism which eventually can lead to the production of metabolites such as flavinoids, lignin, tannins, and alkolids (3). Obviously, plant growth and development can be influenced by this enzyme.

Table 5. Influence of SC-7245 on phenylalanine ammonia-lyase (PAL) activity in the mature corn plant (MP), the germinating radish seed (GS), and the mature radish plant (MP). Data are presented as units of activity per 100 mg of fresh tissue.

SC-7245 (µM)	PAL (MP)-Corn	PAL (GS)-Radish	PAL (MP)-Radish
0	0.36	1.01	0.15
10^{-3}	----	1.08	0.16
10^{-2}	0.40	----	----
10^{-1}	0.38	0.76	0.09
10^{0}	0.42	----	----
10^{1}	0.44	0.65	0.10
10^{2}	0.38	----	----
10^{3}	----	0.41	0.05
10^{4}	----	0.17	0.05

In the mature corn plant PAL activity increased with increase in concentration (up to 10 µM) of herbicide applied. Application of 10 µM SC-7245 caused a 22% increase in activity (Table 5). In contrast, SC-7245 dramatically inhibited PAL activity in both the germinating radish seed and the mature radish plant (Table 5).

LITERATURE CITED

1. Camm, E.L. and G.H. Towers. 1973. Phenylalanine ammonia-lyase. Phytochem. 12:961-973.

2. Dilley, D.R. 1970. Enzymes. In A.C. Hulme, ed., The Biochemistry of Fruits and Their Products. Academic Press, New York.

3. Gordon, W.R. and W.L. Koukkari. 1978. Circadian rhythmicity in the activities of phenylalanine ammonia-lyase from Lemna perpusilla and Spirodela polyrhiza. Plant Physiol. 62:612-615.

4. Hanson, K.R. and E.A. Havir. 1981. Phenylalanine ammonia-lyase. In E.E. Conn, ed., The Biochemistry of Plants, Vol. 7. Academic Press, New York.

5. Hofmann, E. 1963. Invertase: Determination in botanical and agricultural chemistry. In H. Bergmeyer, ed., Methods of Enzymatic Analysis. Academic Press, New York.

6. Linhardt, K. and K. Walter. 1963. Phosphatase (phosphomonoesterases). In H. Bergmeyer, ed., Methods of Enzymatic Analysis. Academic Press, New York.

7. Luck, H. 1963. Peroxidase. In H. Bergmeyer, ed., Methods of Enzymatic Analysis. Academic Press, New York.

NEWLY DESCRIBED CHARACTERISTICS OF *Poa palustris*[1/]

M.J. Matthews, J.A. Meade and M.A. Jackson[2/]

ABSTRACT

A close look at a new weed in alfalfa fields in southern New Jersey reveals an out of place species with a previously undescribed morphological feature. It is identified as *Poa palustris* (L), a perennial grass of temperate regions, considered a non-aggressive species. The plant is described as existing in small loosely tufted colonies primarily on moist ground and marsh areas (C. E. Hubbard, 1968). Frequently used common names include fowl meadow grass, fowl bluegrass, swamp meadow grass, and fowl grass. It has not previously been mentioned as a weed species in row or forage crops. In alfalfa fields in southern New Jersey, *P. palustris* begins growth early in spring before the alfalfa or other weeds are active, having overwintered as inconspicuous loose tufts. It continues to exploit its early start and keeps ahead of the alfalfa. Around mid June, the grass reaches maturity and flowers, producing a purplish panicle that stands well above the alfalfa and is likely to lodge. Early competition by *P. palustris* substantially reduces the alfalfa yield, although total harvested biomass may be higher in the presence of the grass. After setting seed, the grass senesces and persists through the summer dry period as stalks with a series of swollen basal internodes on each culm. This is apparently the first time these structures have been observed to develop in *P. palustris*. The swellings are distinct and occupy the lower 4 or 5 internodal spaces of the culm, forming a chain. They may be round or oblong, green or white in color, and are usually 0.5 to 2.0 cm long. These storage and reproductive structures allow the plant to survive the dry periods of July and August. In late August, probably in response to an increase in available moisture, the swollen internodes produce new growth from axillary buds which are present at the base of the internodes. The buds develop and initiate a shoot and a new root system. Within a few weeks the grass has reestablished itself from these vegetative propagules and continues to grow slowly into the winter.

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YELLOW NUTSEDGE (*Cyperus esculentus* L.) TUBER DEVELOPMENT AS INFLUENCED BY GLYPHOSATE

J. F. Hunt and D. L. Linscott[1]

ABSTRACT

Yellow nutsedge is one of the most serious of weed pests in the Northeast. The studies described were initiated to experimentally determine the effect and interactions of (1) time of season, (2) time of emergence and (3) glyphosate application on tuber development. Nutsedge was started in the field at fifteen day intervals from May 15 to August 30 in Ithaca, New York. Glyphosate was applied at 0, 1/2, 1 and 2 kg/ha at 2, 4 and 6 weeks after plant emergence. All plants were grown through the growing season and harvested. Tubers were counted, stored and tested for viability.

Peak yellow nutsedge reproductive potential was obtained from control plants started on June 15. All nutsedge started on May 15 produced viable tubers regardless of time or amount of glyphosate application. The 2 kg/ha rate of glyphosate was needed to significantly reduce production of viable tubers from plants started May 30, June 15 and June 30. As the season progressed, less glyphosate was needed for tuber reduction and time of application became more critical. Plants started on July 15 and sprayed at 4 weeks after emergence did not produce viable tubers after 1 kg/ha glyphosate whereas 2 kg/ha was still needed for the 2 and 6 week after emergence applications. By July 30, complete prevention of viable tuber formation was obtained by 1/2 kg/ha glyphosate at 4 weeks, 1 kg/ha at 2 weeks and almost complete control was obtained at 6 weeks by the 1 kg/ha rate. Complete viable tuber control was realized with all rates of glyphosate for the August 15 and 30 plantings when applied at 2 and 4 weeks. Less than satisfactory results were obtained at all 6 week treatments of these late season nutsedge emergences.

It can be concluded from these studies that (1) there is significant interaction between season, glyphosate rates and time of application on viable tuber production potential, (2) at the rates used, viable tuber production is not prevented on plants emerging before May 30, (3) regardless of time of application, 2 kg/ha is needed for effective control for plants started in June, (4) yellow nutsedge plants started after July 15 can be controlled with less glyphosate and (5) the optimal time for glyphosate application is 4 weeks after emergence but may be less for plants emerging after July 15.

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SYNERGISTIC INTERACTION OF FLURIDONE AND BENTAZON ON CANADA THISTLE AND YELLOW NUTSEDGE

John P. Sterrett[1/]

ABSTRACT

The herbicidal response of Canada thistle [*Cirsium arvense* (L.) Scop.] and yellow nutsedge (*Cyperus esculentus* L.) to combinations of fluridone and bentazon was determined in a controlled environment.

Root cuttings from 1 clone of Canada thistle were propagated in 10-cm pots filled with loam:peatmoss:vermiculite (2:1:1 v/v/v) and kept at 20° C and an 11-h photoperiod in the growth chamber which prevented bolting. After 30 days, the thistle plants were sprayed to the point of runoff with 5 or 10 mg/L fluridone alone and 50 mg/L bentazon alone or in combination with fluridone. Thirty-four days after spraying the growth of Canada thistle was reduced synergistically by 5 or 10 mg/L fluridone in combination with 50 mg/L bentazon.

Yellow nutsedge was grown from nutlets in 10-cm pots filled with loam: sand:peatmoss:perlite (3:1:1:1 v/v/v/v) in the growth chamber at 25 ± 1 C in a 16-h photoperiod. After 30 days, the nutsedge plants were sprayed to the point of runoff with 15 mg/L fluridone alone and 200 mg/L bentazon alone or in combination with fluridone. Two weeks after spraying the phytotoxicity to nutsedge was increased synergistically by the combination of fluridone and bentazon.

It appeared that fluridone was only active on the young developing foliage of Canada thistle whereas bentazon was mainly effective on the mature foliage. This foliage selectivity could explain (at least in part) the synergistic interaction between the two herbicides.

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WEED CONTROL IN WINTER SQUASH WITH SOME OLD AND NEW HERBICIDES [1/]

C. Kupatt, R.D. Ilnicki and D.B. Vitolo [2/]

ABSTRACT

Pendimethalin, alone and in combination with chloramben, and ethalfluralin were studied to determine whether these compounds are suitable for use in squash culture. Due to increased crop injury, treatments with these herbicides resulted in lower yields than bensulide + chloramben or chloramben applied alone. This was true for both preemergence and preplant incorporated applications of both herbicides. The primary factor involved in reduced crop yields was decreased crop vigor resulting from pendimethalin or ethalfluralin treatment.

INTRODUCTION

A glance at any set of weed control recommendations quickly shows that the number of herbicides available for squash (*Cucurbita maxima* Duchesne) and general cucurbit culture is limited. This is due to the sensitivity of this crop to large numbers of herbicides and herbicide families. One of the more frequently used herbicides is chloramben (3-amino-2,5-dichloro benzoic acid) which is applied prior to crop emergence. Recent experience with the appearance of triazine resistant weed species shows the folly of continuous reliance on one or a few herbicides in crop culture. It is necessary to develop an enlarged arsenal of compounds to maintain adequate levels of weed control in squash.

The objective of this study was to determine the suitability of pendimethalin [*N*-(ethyl propyl)-3,4-dimethyl-2,6-dinitrobenzenamide] alone and in combination with chloramben, and ethalfluralin [*N*-ethyl-*N*-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoromethyl)benzeneamide] for squash culture. These compounds were studied at various application rates, and under two application methods, preplant incorporated and preemergence to the crop. The herbicides were compared, on the basis of yield, which has as components, crop injury and weed control, to chloramben alone, and a previously superior treatment(2) a combination of bensulide [*O,O*-diisopropyl phosphorodithioate *S*-ester with *N*-(2-mercaptoethyl)benzene sulfonamide] plus chloramben, applied preplant incorporated and preemergence, respectively.

MATERIALS AND METHODS

This study was conducted at the Soils and Crops Research Center, New Jersey Agricultural Experiment Station, Adelphia, N.J. Treatments were applied to a Sassafras loam soil. Plot size was 5' x 19' with 2' alleyways. The study was conducted utilizing a randomized complete block design with three replications of

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each herbicide treatment. All treatments were applied at 40 gpa using a backpack CO_2-propelled sprayer with water as a carrier. Nozzles were Unijet flat spray tips number 730616. Preplant incorporation (ppi) treatments were applied on June 1, 1982, and incorporated immediately after application to a depth of 3 inches. Winter squash (var. *Tay Belle*) was planted on June 1 following incorporation of herbicide treatments. Preemergence (pre) treatments were applied on June 3. Squash stands were thinned to one plant per hill (10 hills per plot) at the one to two-leaf stage of development. The dominant weed species growing in the experimental area were common lambsquarters (*Chenopodium album* L.), redroot pigweed (*Amaranthus retroflexus* L.), common ragweed (*Ambrosia artemisiifolia* L.), and mixed grasses which include fall panicum (*Panicum dichotomiflorum* Michx.) and yellow foxtail [*Setoria glauca* (L.) Beauv.]. Plots were rated on July 8, using a scale from 0 to 10, where 0 is no effect on weed or crop and 10 is complete control. A combination treatment of bensulide and chloramben at 4.0 lb/A applied prior to planting and incorporated and 3.0 lb/A applied preemergence served as a check. All herbicide treatments evaluated are listed in Table 1. Statistical analysis of data was performed using the ANOVA and Stepwise regression programs of the Statistical Analysis System (SAS Institute, Inc., Box 8000, Cory, N. C. 27511).

RESULTS AND DISCUSSION

Summarized in Table 1 are squash injury, total weed control (TWC), and yield data as effected by herbicide treatments. Values for TWC generally reflected trends in the control of individual weed species rated. All treatments induced some injury to squash plants, expressed as reductions in both stand and vigor of plants. Generally, where injury was evident, squash plants were observed to be stunted, retarded in development, and in the most severe instances the hypocotyl became swollen and brittle. These symptoms were also associated with reductions in plant stands.

Data for total weed control are also presented in Table 1. Numerous treatments resulted in weed control values equivalent to those obtained for the control. This was particularly evident for pendimethalin + chloramben at all the rates studied. Slightly less control was obtained from the high rate of pendimethalin applied alone and chloramben alone. This was also true for the high rate of ethalfluralin when applied preemergence. Pendimethalin, alone or in combination with chloramben, produced no better weed control than when applied preemergence or preplant incorporated. In contrast, preemergence applications of ethalfluralin produced greater weed control than the same rate applied preplant incorporated. It is well known that many dinitroaniline herbicides require incorporation to retain their herbicidal activity. However, herbicide structure will mediate this requirement. This may explain the difference in response between pendimethalin and ethalfluralin to incorporation.

Herbicide-induced injury to squash plants was expressed as reductions in both stand and vigor. Pendimethalin, applied alone or in combination with chloramben, effected more severe reductions in stand when incorporated than when applied preemergence with the exception of the 0.5 lb/A rate, where both application methods produced equivalent reductions in squash stand. It should be noted,

Table 1. The effects of several herbicides and application schedules on the response of squash and on weed control.

Herbicide Treatment	Application Method	Rate (lb/A)	Squash[a,b] S	Squash[a,b] V	Weed Control[c] Common Lambsquarters	Weed Control[c] Redroot Pigweed	Weed Control[c] Common Ragweed	Weed Control[c] Grasses	TWC %	Yield (CWT/A)[c]
pendimethalin	ppi	0.50	3.0	3.0	8.0	7.0	8.0	7.0	50	90.2
		0.75	5.0	4.0	8.0	8.0	5.0	8.0	71	52.9
		1.00	7.0	8.0	9.0	10.0	9.0	8.0	84	46.9
	pre	0.50	3.0	6.0	10.0	9.0	6.0	6.0	63	78.9
		0.75	1.0	9.0	10.0	10.0	8.0	7.0	81	31.0
		1.00	4.0	10.0	10.0	8.0	9.0	8.0	81	1.2
chloramben	pre	2.00	1.0	2.0	8.0	10.0	10.0	6.0	79	247.0
pendimethalin + chloramben (2.0 lb/A pre)	ppi	0.50	3.0	5.0	10.0	10.0	10.0	9.0	91	163.4
		0.75	2.0	7.0	10.0	10.0	10.0	9.0	93	171.6
		1.00	7.0	9.0	7.0	10.0	10.0	9.0	94	48.6
	pre	0.50	1.0	7.0	9.0	9.0	10.0	8.0	89	102.1
		0.75	2.0	10.0	10.0	10.0	9.0	9.0	93	40.5
		1.00	5.0	10.0	7.0	10.0	10.0	9.0	92	31.1
ethalfluralin	ppi	0.50	2.0	0.0	5.0	5.0	8.0	6.0	42	131.3
		1.00	2.0	1.0	8.0	10.0	7.0	6.0	65	156.2
	pre	0.50	5.0	3.0	8.0	9.0	7.0	7.0	68	83.8
		1.00	5.0	4.0	9.0	10.0	9.0	8.0	86	121.5
Bensulide + chloramben	ppi	4.0								
	pre	3.0	1.0	0.0	10.0	10.0	10.0	10.0	91	264.4
Check-Uncultivated			1.0	0.0	0.0	0.0	0.0	0.0	0	75.2
LSD 0.05										63

[a] Crop and weed control ratings (0.0 = No control or reduction of stand; 10.0 = Complete control) made July 8, 1982.

[b] S = Stand, V = Vigor (0.0 = No affect on crop; 10.0 = Severe injury to crop).

[c] CWT/A = Hundred weight marketable squash per acre.

however, that the most severe reduction in squash vigor from pendimethalin occurred from preemergence applications. Preemergence applications of ethalfluralin produced more severe injury, measured as stand reduction and vigor, than did the preplant incorporated treatments of this herbicide. The effects of dinitroaniline herbicides on plant tissues have been well documented. These compounds disrupt cell division and elongation, with an increase in radial expansion of cells, resulting in disorganization of tissues, with a concomitant brittleness in affected organs[1]. They are also poorly translocated; affected areas are limited to those in the immediate region of the plant in direct contact with the herbicide. Duration of exposure has also been shown to influence the incidence of herbicide injury. These considerations suggest a possible explanation of the above observations in response to pendimethalin incorporation. When incorporated, pendimethalin would be dispersed throughout the seedbed to the depth of incorporation, resulting in an increased duration of herbicide contact with germinating seeds. This may result in more greatly decreased emergence of seedlings, with a concomitant reduction in stand, for the incorporated treatments compared to preemergence treatments. However, the preemergence treatments may produce a greater reduction in vigor relative to the incorporated treatments due to a higher concentration of herbicide at the soil surface, resulting in a greater disruption of tissue, albeit localized, than occurs when pendimethalin is incorporated. In most instances, applications of pendimethalin and ethalfluralin were more injurious than either the bensulide + chloramben control or chloramben applied alone.

None of the herbicide treatments in this study resulted in yield better than or equivalent to the control, with the exception of chloramben applied alone, although numerous treatments produced equivalent weed control, as noted above. When pendimethalin was applied in combination with chloramben, yield was decreased below that obtained from applications of chloramben alone. This suggests that the increase in injury due to pendimethalin application is responsible for decreased yields. It is not clear from the data, however, what balance between total weed control and injury results in the highest yields. To answer this question, multiple regression analysis was performed on the data. The procedure used progressively determines the best one, two, and three variable regression models that result in the largest value for r^2, the square of the correlation coefficient. The value of r^2 has been described as the proportion of the variance of Y (yield here) that can be attributed to the regression[3]. When the data in Table 1 are analyzed , it was found that vigor is the most important single factor determining yield, with a value of $r^2 = 0.465$ for the regression. The best two factor regression had vigor and total weed control as the two variables most important for determining yield, with a value for r^2 of 0.757. Adding stand to the regression model resulted in a value of r^2 0.822 for the regression. Reductions in squash vigor were most strongly responsible for decreases in yield, followed by total weed control and the interaction between the two. Reductions in squash stand were not as important in determining yield as the other two factors. It appears that pendimethalin, applied alone or in combination with chloramben, and ethalfluralin, at the rates and with the application methods used in this study, are unsatisfactory for use in winter squash culture. This is due to the injury they cause at rates required to provide sufficient weed control for optimum yields.

SUMMARY

From this study it was found that applications of pendimethalin and ethalfluralin result in lower yields than previously established treatments of chloramben alone or in combination with bensulide. This is due to the severe injury, both in reduction of stand and plant vigor, caused by these herbicides. Regression analysis reveals that squash vigor is the most important factor associated with yield, closely followed by the level of total weed control. It is evident that pendimethalin and ethalfluralin, at the rates and application methods used in this study, are unsuitable for the control of weeds in squash due to unacceptable levels of injury induced by these compounds.

LITERATURE CITED

1. Gentner, W.A. and L.G. Burk. 1968. Gross Morphological and Cytological Effects of Nitralin on Corn Roots. Weed Sci. Vol. 16, pp. 259-260.

2. Herman, D.J. 1974. A Study of Some Preplant Soil Incorporated and Preemergence Herbicides and Herbicide Combinations in Summer Squash (*Curbita pepo* L.). M.S. Thesis, Rutgers University, New Brunswick, N.J.

3. Snedecor, G.W. and W.G. Cochran. 1973. Statistical Methods, Sixth Edition, Iowa State University Press, Ames, Iowa, USA.

A COMPARISON OF RATES OF FLUAZIFOP-BUTYL AND TIME OF APPLICATION ON YIELD, CROP INJURY, AND WEED CONTROL OF KATAHDIN POTATOES

Leigh S. Morrow and Hugh J. Murphy[1]

ABSTRACT

To test for tank-mix compatibility between the grass herbicide fluazifop-butyl and the fungicide mancozeb, several layby applications were made in a white potato (*Solanum tuberosum* L. 'Katahdin') crop. These followed preemergence applications of metribuzin on quackgrass (*Agropyron repens* L.) infested plots at Aroostook Farm; Presque Isle, Maine in 1982. While as many as three applications of fluazifop-butyl plus mancozeb had no detrimental effect on potato plants, the grass herbicide controlled quackgrass as well as, but no better than, the standard treatment of dinoseb plus dalapon applied before crop emergence. Metribuzin controlled the broadleaf weeds present as well as the standard treatment.

INTRODUCTION

Since the recently developed grass herbicide fluazifop-butyl [butyl 2-{4-(6-trifluoromethyl-2-pyridyl oxy) phenoxy} propionate] is a post emergence herbicide which may be applied at layby in a potato crop, there is a possibility to tank-mix it with fungicides which are normally sprayed intermittently to protect potato foliage. In this trial, plots were first treated with metribuzin [4-amino-6-*tert*-butyl-3-(methylthio)-*as*-triazin-5(4*H*)-one] preemergence to control broadleaf weeds. One, two, or three layby applications of fluazifop-butyl plus mancozeb fungicide were made to evaluate compatibility of the two pesticides. Several treatments included a non-ionic surfactant to determine if there might be an improvement in efficacy. These treatments may be compared to cultivated and uncultivated plots as well as the standard treatment of dinoseb [2-*sec*-butyl-4,6-dinitrophenol] plus dalapon [2,2-dichloropropionic acid]. Tables 1 and 2 show the effect of all treatments on crop yield and relative weed control of barnyardgrass (*Echinochloa crus-galli* (L.) Beauv.), quackgrass, kale (*Raphanus raphanistrum* L.) and mustard (*Brassica sp.*).

MATERIALS AND METHODS

Test plots were one potato row, 20 feet in length. These were replicated six times and arranged in a randomized block design. The location consisted of Caribou gravelly silt loam with 3.5 percent organic matter. Pesticides were applied in 80 gallons of water per acre with a compressed air sprayer at 40 psi. The hand-held spray boom included Delavan raindrop nozzles with No. 33974-3 tips. Ratings were made on crop injury and weed

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control in June and eight days following the final layby application in August. Yields were recorded from all plots in October.

RESULTS AND DISCUSSION

Yields from all herbicide treated plots were greater than check plots, perhaps as a result of some quackgrass control. Crop injury ratings for all plots in July and August scored a perfect 9.0, so no phytotoxicity symptoms were evident.

Barnyardgrass was found in the uncultivated check plots but was almost eliminated by cultivation practices in the other check and herbicide plots. Quackgrass was a serious problem and was not satisfactorily controlled by any treatment. Although fluazifop-butyl applications were a slight improvement over the check plots, no differences were noted with an increase in number of layby applications or the inclusion of mancozeb or surfactant. Broadleaf weeds were satisfactorily controlled by the metribuzin applications.

While it seems that a tank-mix of fluazifop-butyl and mancozeb are compatible, satisfactory control of quackgrass in serious infestations is doubtful.

Table 1. Effect of metribuzin plus a tank-mix of fluazifop-butyl and mancozeb fungicide on yield and weed control in Katahdin potatoes. Maine - 1982.

Treatments (Lbs. a.i. per Acre)[a]	Yield Cwt./A.	Weed Control Ratings[b]			
		Barnyardgrass		Quackgrass	
		6-21	8-10	6-21	8-10
No treatment (no herbicide and no cultivation)	236	7.7	8.5	4.0	4.0
No treatment (no herbicide)	292	8.7	9.0	4.5	4.8
4.5 Dinoseb + 5.0 Dalapon, PE	377	8.5	9.0	5.3	5.7
0.25 Metribuzin, PE + 0.25 Fluazifop-butyl, LB	342	8.5	9.0	4.3	5.7
0.25 Metribuzin, PE + 0.25 Fluazifop-butyl, LB[c]	349	8.3	8.8	4.2	5.5
0.25 Metribuzin, PE + 0.5 Fluazifop-butyl, LB	361	8.7	8.8	4.3	5.5
0.25 Metribuzin, PE + 0.5 Fluazifop-butyl, LB[c]	382	8.7	9.0	4.7	5.5
0.25 Metribuzin, PE + 0.5 Fluazifop-butyl and Mancozeb, LB	367	8.5	9.0	4.8	5.2
0.25 Metribuzin, PE + 0.25 Fluazifop-butyl and Mancozeb, LB + 0.25 Fluazifop-butyl and Mancozeb, 2nd LB	411	8.0	9.0	5.0	6.2
0.25 Metribuzin, PE + 0.125 Fluazifop-butyl and Mancozeb, LB + 0.125 Fluazifop-butyl and Mancozeb, 2nd LB + 0.125 Fluazifop-butyl and Mancozeb, 3rd LB	349	9.0	9.0	4.7	5.7
0.25 Metribuzin, PE + 0.25 Fluazifop-butyl and Mancozeb, LB[c] + 0.25 Fluazifop-butyl and Mancozeb, 2nd LB[c]	341	8.5	9.0	4.3	5.0
0.25 Metribuzin, PE + 0.5 Fluazifop-butyl, LB[c] + 0.5 Fluazifop-butyl, 2nd LB[c]	354	8.5	9.0	4.0	5.7
Waller Duncan L.S.D. (0.05)	45				

. . . . Continued

Table 1 - continued

[a]Planted - May 25; killed - September 14; harvested - October 1, 1982.

Preemergence (PE) treatments applied - June 6. Temperature - 62F., clear; soil - moist; wind - 8-12 mph, southwest.

Layby (LB) treatments applied - July 14. Temperature - 82F., cloudy; soil - moist; wind - 2-5 mph, north.

July 26. Temperature - 72F., cloudy; soil - moist; wind - 2-6 mph, northwest.

August 2. Temperature - 55F., sunny; soil - moist; wind - 6-10 mph, north.

[b]Rating code: 9 = perfect crop or weeds absent.

1 = all crop plants killed or weeds cause crop abandonment.

Less than 7 is unacceptable crop injury or weed control.

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

Echinochloa crus-galli - 6.8

Agropyron repens - 27.5

[c]Plus 0.1% non-ionic surfactant.

Table 2. Effect of metribuzin plus a tank-mix of fluazifop-butyl and mancozeb fungicide on yield and weed control in Katahdin potatoes. Maine - 1982.

Treatments (Lbs. a.i. per Acre)[a]	Weed Control Ratings[b]			
	Kale		Lambsquarters	
	6-21	8-10	6-21	8-10
No treatment (no herbicide and no cultivation)	9.0	9.0	8.2	6.5
No treatment (no herbicide)	8.3	8.7	8.5	7.3
4.5 Dinoseb + 5.0 Dalapon, PE	9.0	9.0	9.0	9.0
0.25 Metribuzin, PE + 0.25 Fluazifop-butyl, LB	8.8	9.0	9.0	8.2
0.25 Metribuzin, PE + 0.25 Fluazifop-butyl, LB[c]	9.0	9.0	9.0	8.8
0.25 Metribuzin, PE + 0.5 Fluazifop-butyl, LB	9.0	9.0	9.0	8.8
0.25 Metribuzin, PE + 0.5 Fluazifop-butyl, LB[c]	9.0	9.0	9.0	9.0
0.25 Metribuzin, PE + 0.5 Fluazifop-butyl and Mancozeb, LB	9.0	9.0	9.0	8.5
0.25 Metribuzin, PE + 0.25 Fluazifop-butyl and Mancozeb, LB + 0.25 Fluazifop-butyl and Mancozeb, 2nd LB	9.0	9.0	9.0	8.8
0.25 Metribuzin, PE + 0.125 Fluazifop-butyl and Mancozeb, LB + 0.125 Fluazifop-butyl and Mancozeb, 2nd LB + 0.125 Fluazifop-butyl and Mancozeb, 3rd LB	9.0	9.0	9.0	9.0
0.25 Metribuzin, PE + 0.25 Fluazifop-butyl and Mancozeb, LB[c] + 0.25 Fluazifop-butyl and Mancozeb, 2nd LB[c]	9.0	9.0	9.0	9.0
0.25 Metribuzin, PE + 0.25 Fluazifop-butyl, LB[c] + 0.5 Fluazifop-butyl, 2nd LB[c]	9.0	8.8	9.0	8.8

Footnotes a,b, and c - see Table 1.

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

Raphanus raphanistrum - 0.2

Chenopodium album - 2.1

EFFECT OF MORNING, MID-DAY AND EVENING APPLICATION ON CONTROL OF LARGE CRABGRASS BY SEVERAL POSTEMERGENCE HERBICIDES

B. G. Ennis and R. A. Ashley[1/]

ABSTRACT

The influence of application of several postemergence herbicides at various times of day on crabgrass (Digitaria sanguinalis, (L.) Scop.) control was evaluated. Herbicide treatments included sethoxydim, CGA-82725, SC-1058 and fluazifop-butyl. These were applied at the rate of 0.28 kg ai/ha + 1% v/v crop oil concentrate on June 26, 1982 at 8 a.m., 1 p.m., and 6 p.m. In a second experiment these herbicides were sprayed at the rate of 0.56 kg ai/ha on July 30, 1982 at 6 a.m., 1 p.m., and 7 p.m. In the first experiment, afternoon and evening applications of sethoxydim and CGA-82725 provided better crabgrass control than the morning applications. Increased crabgrass control was associated with high afternoon and evening temperatures in comparison to a cooler morning temperature. SC-1058 provided significantly better control with the afternoon application in comparison to morning and evening applications. Increased control during the afternoon application was associated with the maximum daytime temperature occurring at this time. Length of light period occurring before and after the afternoon application was also associated with increased crabgrass control following the afternoon application. Fluazifop-butyl provided poor crabgrass control regardless of time of day of application. In the second experiment, insignificant differences occurred between the herbicides and various spray times. Regardless of time of day of application, both experiments showed that, in order of decreasing crabgrass yields, sethoxydim provided the best control, followed by SC-1058, CGA-82725, and fluazifop-butyl. Results show that time of day of application is a significant factor in reducing crabgrass yields when using sethoxydim, CGA-82725, and SC-1058 at lower rates of application.

INTRODUCTION

Duirnal variations in weed and crop response to various herbicides has been demonstrated by several researchers. Ashley (1) showed that morning or evening applications of diclofop [2-(4-(2,4-dichlorophenoxy) phenoxy) propanoic acid] at 1.1 kg ai/ha provided better crabgrass control than afternoon applications. Weaver and Nylund (6) found that peas were more susceptible to MCPA (2-methyl-4-chlorophenoxy acetic acid) during mid-day applications than with morning or evening spray times. White mustard (Brassica hirta, L.) was only minimally affected by the time of day of application (6).

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Doran and Anderson (2) found that common cocklebur (Xanthium pensylvanicum, Wallr.) and velvetleaf (Abutilon theophrasti, Medic.) were more efficiently controlled with afternoon applications of bentazon [3-isopropyl-1H-2,1,3-benzothiadiazin 4 (3H)-one 2,2-dioxide] than with morning and evening applications. The degree of cocklebur control was related to increasing temperatures, such that maximum injury occurred during the peak mid-afternoon temperatures. Velvetleaf control was related to photoperiod. The authors suggested that nyctitropic leaf movements during the morning and evening applications reduced control, when drooping leaves reduced spray contact and retention on the foliage. In comparison, turgid, upright foliage during mid-afternoon applications was associated with a greater degree of herbicide contact and retention.

The objective of this paper was to determine if crabgrass control by several postemergence herbicides was affected by time of day of application.

METHODS AND PROCEDURES

The experiments were conducted at the University of Connecticut Agronomy Research Farm in Storrs, Connecticut. The soil in the research area was a Woodbridge fine sandy loam of pH 6.5 and organic matter content of 3 to 4 percent.

Interactions between time of day of application and individual herbicide treatments were evaluated using a split plot design in both experiments. Main block treatments were comprised of morning, afternoon, or evening applications. Herbicide treatments included sethoxydim [(2-(1-(ethoxyimino)-butyl)-5-(2-(ethylthio)-propyl)-3-hydroxy-2-cyclohexene-1-one] CGA 82725 (chemical name undisclosed), SC-1058 (chemical name undisclosed) and fluazifop-butyl [(±)-butyl 2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy] propanoate] at the rate of 0.28 kg ai/ha + 1% v/v crop oil concentrate. These were applied on June 26, 1982 at 8 a.m., 1 p.m., and 6 p.m. In a second experiment, these herbicides were applied at the rate of 0.56kg ai/ha + 1% v/v crop oil concentrate at 8 a.m., 1 p.m. and 7 p.m. on July 30, 1982. Crabgrass at the time of applications in both experiments was at the four to five leaf stage with 50% tillering. Plot size was 3 m long by 1 m wide with 30.5 cm between plots. Herbicide treatments were made using a compressed air knapsack spray which applied 374 l/ha of water at 2.8 km/cm^2 pressure.

Environmental conditions were recorded on June 26 at each time of application and are reported in Table 1.

Field conditions between the two experiments varied. The first experiment was carried out on a very dense (greater than 100 plants/30 cm^2), natural stand of crabgrass that had developed in a cropland field, last used in 1982 for sweet corn. Broadleaf weeds were controlled with a 50% v/v wick application of glyphosate [N-(phosphonomethyl)-glycine)] on June 28, followed by a bentazon application at 1.1 kg ai/ha on July 1, 1982. Field conditions in the second experiment also included a natural stand of crabgrass. However, the stand was much less dense, averaging eight plants/30 cm^2.

Table 1. Experiment 1. Environmental Conditions During Morning, Afternoon or Evening Herbicide Treatments.

	June 24th			
	Air Temp. °C	r.h.	Light Intensity, LUX[a]	Soil Temp. °C
8 am	16.6	67%	50,000 c	14.4
1 pm	26.1	43%	45,000 - 66,000 p.c.	25.6
6 pm	20.0	45%	41,000 c	20.6

[a]c = clear, pc = partially cloudy

Crabgrass yields from the first experiment were harvested from 30.5 cm^2 samples in each plot on July 22, 1982, and from the second experiment on September 13, 1982. Fresh weights were taken, and then the samples were dried at 54°C for five days.

RESULTS AND DISCUSSION

Sethoxydim and CGA-82725 provided better crabgrass control from afternoon and evening applications than the morning applications (Table 2), although the decrease in crabgrass dry yield between the morning and afternoon applications of sethoxydim were not significantly different. Decreased crabgrass control during the morning spray time was associated with the high relative humidity (67%) and low air and soil temperatures of the day (16.6° and 14.4°C, respectively). High relative humidity may have been a factor in decreasing control; however, it was not due to surface spray dilution on wet foliage, since most of the dew had evaporated by the 8 a.m. applications.

Table 2. Experiment 1. Crabgrass Dry Yields Following Morning, Afternoon, or Evening Applications of Several Postemergence Herbicides

	July 22nd			
		g/30.5 cm^2		
Herbicide	Rate kg ai/ha	8 a.m.	1 p.m.	6 p.m.
Sethoxydim	0.28 + 1% v/v crop oil conc.	9.9	7.2	3.5
SC - 1058		13.0	6.6	12.0
CGA - 82725		14.4	9.7	8.01
Fluazifop - butyl		11.6	11.6	10.6
Control		15.3	17.6	14.8
LSD	4.27			

Low morning air and soil temperatures may have decreased crabgrass control by inhibiting translocation and movement of the herbicide in the plants. This is in agreement with the findings of Hewitt and Curtis (3), who showed that 20-30°C was the optimal range in which maximum translocation occurred. Temperatures above and below this range were associated with decreasing translocation rates. Their results suggest that maximum translocation of the herbicides used in our experiment occurred during the afternoon and evening spray times when temperatures were 26.1° and 20°C, respectively. Reduced crabgrass control following the 8 a.m. application could have been due to a lower temperature of 16.6°C, which decreased the rate of herbicide translocation for sethoxydim and CGA-82725.

SC-1058 provided significantly better crabgrass control during the afternoon application at 1 p.m. than during the morning and evening applications at 8 a.m. and 6 p.m., respectively (Table 2). A significant environmental difference occurring during the 1 p.m. application in comparison to the 8 a.m. and 6 p.m. spray times was temperature. A high temperature of 26°C occurred at 1 p.m. in comparison to the lower 16°C and 20°C temperatures occurring during the morning and evening applications, respectively. This high afternoon temperature may have increased the translocation rate of SC-1058 in the crabgrass and the rate of chemical reactions occurring between the herbicide and plant at the site of action. However, in growth chamber experiments with controlled temperature and humidity, Doran and Anerson showed that maximum control or velvetleaf during mid-day applications of bentazon coincided with duration of photoperiod. Duration of light period before and after the 1 p.m. application of SC-1058 may have also increased the phytotoxicity of this herbicide on crabgrass.

Comparison of fluazifop-butyl dry yields from different times of application show that toxicity of this herbicide was not influenced by spray time. It is possible that the poor crabgrass control observed in this experiment was caused by not attaining a critical level required for differences in phytotoxicity to occur between the various application times. Possibly at slightly higher application rates, or under more favorable field conditions, differences in crabgrass response to fluazifop-butyl would have occurred between the morning, afternoon, and evening applications.

At the rate of 0.56kg ai/ha + 1% v/v crop oil concentrate, crabgrass control by each of these herbicides was not affected by applications at various times of the day (data not given). At this rate, herbicide concentrations in the plant may have been too great to be affected by diurnal responses of crabgrass to these herbicides.

A comparison of the effect of herbicide treatments on crabgrass in both experiments shows that the rate 0.28 kg ai/ha + 1% v/v crop oil concentrate used in the first experiment resulted in poor crabgrass control for each of these herbicides (Table 3). In contrast, the rate 0.56 kg ai/ha + 1% v/v concentrated crop oil used in the second experiment resulted in excellent crabgrass control for all the herbicides. Differences in application rates were probably the main factor accounting for the variation in crabgrass control between the two experiments.

Differences in field conditions between the two experiments may have also influenced the response of crabgrass to these herbicides. Low soil nitrogen levels in the first experiment resulted in stunted crabgrass growth[1] whereas sufficient nitrogen levels in the second experiment produced plants which were green and vigorous. Crabgrass plants under stress in the first experiment could have been more tolerant of these herbicides than the vigorously growing plants in the second experiment. A combination of poor field conditions with low application rates in the first experiment may have further increased tolerance of crabgrass to these herbicides.

Table 3. Effect of Herbicide Treatments Over all Times of Application on Crabgrass Dry Yields

	Experiment 1.		Experiment 2.	
Herbicide	rate kg ai/ha	$g/30.5cm^2$	rate kg ai/ha	$g/30.5cm^2$
Sethoxydim	0.28 + 1% v/v crop oil concentrate	6.88	0.56 + 1% v/v crop oil concentrate	3.8
SC-1058		10.54		6.82
CGA-82725		10.71		15.60
Fluazifop-butyl		11.56		21.92
Control		15.92		393.5
LSD 5%		2.11		7.40

Significant differences in crabgrass control occurred among the herbicides in both experiments. At the rate of 0.28 kg ai/ha + 1% v/v crop oil concentrate, sethoxydim provided the best crabgrass control, followed by SC-1058 and CGA-82725, which were not significantly different from each other. Insignificant differences also occurred between CGA-82725 and fluazifop-butyl, which provided the least crabgrass control. At the rate of 0.56 kg ai/ha + 1% v/v crop oil concentrate, sethoxydim and SC-1058 provided the best crabgrass control, followed by CGA-82725 and fluazifop-butyl.

In conclusion, sethoxydim, CGA-82725, and SC-1058, applied at 0.28 kg ai/ha + 1% v/v crop oil concentrate to crabgrass growing under unfavorable

[1] Ennis, B.G. and R.A. Ashley. 1982. The effect of soil nitrogen levels on phytotoxicity of several postemergence crabgrass herbicides. unpublished.

conditions, provided varying degrees of control depending on the time of day of application. These different degrees of control were associated with diurnal responses of crabgrass to these herbicides. Diurnal responses were associated with temperature differences at the time of herbicide application. Sethoxydim and CGA-82725 provided better crabgrass control when higher temperatures occurred during afternoon and evening applications. In contrast, poorer crabgrass control was associated with the cooler temperature occurring during the morning application.

SC-1058 controlled crabgrass significantly better during the afternoon application when the maximum temperature occurred. In contrast, less control was associated with the cooler morningand evening temperatures occurring at these spray times. Duration of light occurring before and after application may have also increased herbicidal activity during the afternoon application.

Crabgrass control by fluazifop-butyl at 0.28 kg ai/ha + 1% v/v crop oil concentrate was not affected by applications at the various times of the day.

Results from these experiments show that crabgrass control by sethoxydim, SC-1058, and CGA-82725 is influenced by the time of day of application. Further research is needed to determine the effect of the various environmental conditions occurring at different times of the day on diurnal responses of crabgrass to these herbicides.

LITERATURE CITED

1. Ashley, R.A. 1982. Timing applications of diclofop for control of large crabgrass. Proc. Northeast Weed Sci. Soc. 36:199-202.

2. Doran, David L. and Robert N. Anderson. 1976. Effectiveness of bentazon applied at various times of the day. Weeds. 24:567-570.

3. Hewitt, S.P. and D.F. Curtis. 1948. The effect of temperature on the loss of dry matter and carbohydrate from leaves by respiration and translocation. Am. J. Botany 35:746-755.

4. Weaver, M.L. and R.E. Nyland. 1963. Factors influencing the tolerance of peas to MCPA. Weeds. 11:142-148.

5. Weaver, M.L. and R.E. Nyland. 1965. The susceptibility of annual weeds and Canada thistle to MCPA applied at different times of day. Weeds. 13:110-113.

DIFFERENTIAL RESPONSE OF GRASS SPECIES TO FLUAZIFOP AND SETHOXYDIM

A.C. Hinton and P.L. Minotti[1]

ABSTRACT

This report summarizes the results of two greenhouse experiments conducted in the spring and fall of 1982. The objective was to compare the effectiveness, on a rate for rate basis, of sethoxydim and fluazifop-butyl in suppressing several grass species. These species (see Table 1) were selected on the basis of suitability for use in a "living mulch" cropping system where it is necessary to suppress, but not kill, the associated cover crops to prevent excessive competition with the cash crop.

The herbicides were applied to the grass about 6 weeks after seeding at rates of 0, 0.1, 0.2 and 0.4 lbs ai per acre. Species specific differential responses were evident. For example Tall Fescue and two varieties of perennial rye grass were severely injured by sethoxydim at all rates but only slightly injured by fluazifop. On the other hand wheat, barley and bentgrass showed greater susceptibility to fluazifop than to sethoxydim. Red fescue and annual bluegrass were slightly affected by either compound while Aroostook rye, common rye and Ticondiroga wheat were affected by all rates of each compound.

Results from both greenhouse experiments were consistent and also are in agreement with limited field observations.

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Table 1. A comparison of sethoxydim and fluazifop activity on selected grass species

Grass Species	sethoxydim lbs/acre (ai)			fluazifop-butyl lbs/acre (ai)		
	0.1	0.2	0.4	0.1	0.2	0.4
Tall fescue (K-31)	F	F	G	P	P	F
Red fescue (Pennlawn)	P	P	P	P	P	P
Bentgrass (Colonial seaside)	F	F	G	G	G	G
Per. Ryegrass (Elka)	F	F	E	P	P	F
Per. Ryegrass (Linn)	F	G	E	P	P	F
Annual bluegrass	P	P	P	P	P	P
Barley (Schuyler)	P	F	E	F	F	E
Rye (Aroostook)	G	G	E	G	G	E
Rye (Common)	E	E	E	E	E	E
Wheat (Ticondiroga)	F	G	G	G	E	E

[1] Degree of grass suppression P = poor, F = fair, G = good, E = excellent

POST-EMERGENCE GRASS CONTROL IN CANTALOUPES AND WATERMELONS

Ed Kee[1]

ABSTRACT

Annual grasses can pose serious weed problems in cantaloupes and watermelons. Grasses often emerge in these crops later in the growing season when vine growth limits the effectiveness of hoeing or cultivation. A study was established in 1982 on a Norfolk loamy sand with 'Gold Star' cantaloupes and 'Crimson Sweet' watermelons. A preplant incorporated treatment was applied of bensulide (4 lbs/A) and naptalam (2 lbs/A) on April 30. Both crops were planted on May 4. Post-emergence treatments were applied on the cantaloupes on June 15 and on the watermelons on June 29. Grasses ranged from 1-6" tall and in the 1-4 leaf stage. Crabgrass, Fall Panicum and the Foxtail species were the major grasses present.

Fluazifop-butyl was applied at .25 lb/A and at .50 lb/A with non-ionic surfactant at a rate of 10% V/V. Sethoxydim was applied at .2 lb/A with 1 qt of oil concentrate. All treatments were applied with 25 gallons of water/A at 48 p.s.i. with 8005 fan tip nozzles.

All treatments provided excellent control of the grasses with no phytotoxicity to either crop. As expected, there was no activity on broadleaf weeds.

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WEED CONTROL FOR FIELD SEEDED TOMATOES

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ABSTRACT

Several herbicides and herbicide combinations were evaluated for weed control and crop phytotoxicity on gel seeded tomatoes. Activated carbon was mixed with the anti-crustant and evaluated for improved crop safety with chloramben, diphenamid and metribuzin.

As the rate of chloramben increased so did the safening effect from the carbon. Diphenamid phytotoxicity was not a problem during 1982 so the effect of the carbon could not be evaluated. The addition of activated carbon to the anti-crustant significantly reduced the injury from metribuzin. However, this injury rating was still only marginally acceptable. As the season progressed the plants outgrow this injury and produced acceptable yields. Metribuzin treated tomatoes without carbon never outgrew this injury and were the lowest yielding treatment.

Treatments with napropamide produced an apparent growth stimulation in the tomato plants. At the time of rating,plants were noticeably taller with more foliar growth then the check treatments. By harvest this difference in growth was not present. Yields were not significantly increased over the check.

Pebulate treated tomatoes were stunted and the plant stand appeared to be reduced. The addition of napropamide to pebulate did not seem to reduce this early injury. Again by harvest the plants outgrew this injury and produced acceptable yields.

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HERBICIDES FOR ANNUAL GRASS CONTROL IN CARROTS

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ABSTRACT

Four selective postemergence grass herbicides were studied alone or in combination with linuron in carrots. Sethoxydim, applied at 0.28 kg/ha in combination with linuron, was less efficacious on grasses than when used alone at this rate -- suggesting some antagonistic reaction may exist between these two products. However, the use of a higher rate of sethoxydim or the addition of 0.1% crop oil to the tank-mix provided complete grass control. Tank-mix treatments of linuron with sethoxydim, fluazifop-butyl and CGA82725, were not phytotoxic to carrots; however, diclofop combinations resulted in severe crop injury with significantly reduced yields. Sequential applications of diclofop and linuron, seven days apart, were not phytotoxic. A significant observation from these trials was that the addition of 0.1% crop oil, required as a surfactant for the grass herbicides, did not appear to increase the potential phytotoxicity from linuron, which is supposed to be used without surfactants.

INTRODUCTION

There has been and still is a critical need for a selective postemergence herbicide for annual grass control in carrots (Daucus carota L.). While trifluralin (a,a,a,-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine) will effectively control grasses in mineral soils, it is not active in high organic matter soils. The price of stoddard solvent almost prohibits its use as a herbicide; and the standard material, linuron (3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea), used for broadleaf weed control is only partially effective on grasses. The recent discovery of the diphenoxy type herbicides such as sethoxydim (2-{1-(ethoxyimino) butyl} -5-{2-ethylthio) propyl} -3-hydroxy-2-cyclohexen-1-one), diclofop (2-{4-(2,4-dichlorophenoxy) phenoxy} propanoic acid), fluazifop-butyl ((±)-butyl 2-{4-{{5-trifluoromethyl)-2-pyridinyl } oxy } phenoxy } propanoate), and CGA82725 (chemistry not released), appear to offer a solution to this problem. During 1980 and 1981, studies in Ohio with some of these materials were very encouraging (1). Our data indicated that tank-mix combination treatments of linuron with sethoxydin may not be as efficacious as sequential applications. However, because the experiment had not been designed to separate this possible antagonism, it was repeated in 1982, along with an experiment to study other grass herbicides in combination with linuron.

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MATERIALS AND METHODS

Two adjacent experiments were conducted in 1982, on a sandy clay soil with 2% organic matter. Danvers 126 carrots were sown on April 23, using 2-row plots spaced 75 cm apart and running 9.1 m long in a randomized split-plot experiment with 4 replicates. The plots were split with treatments as main plots and sub-plots, consisting of 6.1 m of weed-free area (supplemental hand hoeing) and 3 m where weed escapes were permitted to grow. Yields were recorded from the weed-free area to measure herbicide effects on the crop without confounding from weed competition. All treatments were applied with a bicycle plot sprayer delivering 270 l/ha at 2.1 kg/cm^2. Initial applications were made on May 25 to variable carrot seedlings ranging from cotyledon to 2½-leaf stage. Lambsquarters (Chenopodium album L.), redroot pigweed (Amaranthus retroflexus L.), smartweed (Polygonum pensylvanicum L.), and black nightshade (Solanum nigrum L.) were 10 to 12 cm tall; and annual grasses: giant foxtail (Setaria faberi Herrm.), and crabgrass (Digiteria sp.) were 8 to 10 cm tall and developing tillers. May 25 treatments were applied when temperatures were 19° C, under cloudy conditions and high relative humidity. On June 2, temperatures were also 19° C, but the sun was bright following two cloudy days. Weed control assessment was made on July 6, using a visual rating system of 1 to 9 -- in which 1 = no control, 9 = perfect control, and 7 is a minimum for commercial acceptance. Crop phytotoxicity was evaluated on a 1 to 5 rating, where 5 = no visual signs of injury, and 1 = crop dead. Carrots were harvested September 9 from 4 m of row in the center of the weed-free plot area.

RESULTS AND DISCUSSION

The weed pressure in these trials was moderate for broadleaf species at 11/m^2 and light for grasses at 4.5/m^2.

Experiment 1. -- This study involved applications of linuron and sethoxydim alone, in tank-mix combinations with and without oil at an 0.1% concentration, and as sequential applications seven days apart. Linuron alone, even with two applications, failed to provide the level of grass control achieved with sethoxydim, Table 1. The tank-mix of linuron + sethoxydim at 1.12 + 0.28 kg/ha had a lower level of grass control than sethoxydim at 0.28 kg/ha alone -- supporting our observations in 1981 -- that an antagonistic reaction may be involved. The use of a higher rate of sethoxydim in the tank-mix or the use of an oil additive appears to overcome this problem of reduced grass control. Carrots tolerated tank-mix treatments of linuron + sethoxydim even when repeated twice, seven days apart.

In the sequential application treatments, it was found that linuron should be applied first and sethoxydim later (rather than vice versa) in order to maximize broadleaf weed control. When application of linuron was delayed until after sethoxydim, broadleaf weeds became too tolerant for satisfactory control.

Experiment 2. -- This experiment was conducted to study the three other promising grass herbicides alone and in combination with linuron, and data are summarized in Table 2. Diclofop, tank-mixed with linuron, provided excellent weed control but severe crop phytotoxicity resulted and yields were significantly reduced. This phytotoxicity may result from increased linuron absorption from carriers or solvents in the diclofop formulation. A sequential application of diclofop first, followed by linuron 7 days later, eliminated the phytotoxicity problem. Similar tank-mix treatments of linuron with fluazifop-butyl or with CGA82725 did not result in appreciable phytotoxicity to carrot foliage, although yield from carrots receiving linuron + CGA82725 at 0.28 kg/ha was significantly lower than the untreated control. All tank-mix combination treatments provided excellent weed control. Fluazifop-butyp alone resulted in some leaf burn to carrots but carrot yields were not adversely affected. Sequential applications with the grass herbicide applied first and linuron following a week later resulted in poorer broadleaf weed control because lambsquarter and smartweed recovered. From these experiments, we conclude that when sequential applications are being considered, linuron should be applied first -- to achieve proper control of broadleaf weed problems -- and follow with the grass herbicides to control any annual grass escapes. Further work should be conducted to determine how long a time should be allowed between herbicide applications to reduce phytotoxicity problems -- as in the case of diclofop.

An important observation from these trials was that the use of 0.1% crop oil with these combination treatments did not increase the phytotoxicity of linuron. It is a well-recognized fact that linuron should not be applied for at least 24 hours after stoddard solvent has been used and the label specifies that surfactants should not be used with this product. We recognize that these observations are based on one year's data and one set of environmental conditions and that additional studies should be conducted to verify these results.

LITERATURE CITED

1. Henne, R. C. 1982. Selective postemergence annual grass control in carrots. Proc. NEWSS 36:113-116.

Table 1. Response of weeds and carrots to linuron and sethoxydim combinations at Napoleon, Ohio, in 1982.

Treatment	Rate, kg/ha	Appl. Dates	Weed control rating, 1 - 9 BLW	Weed control rating, 1 - 9 Grass	Crop response Phyto rating, 1 - 5	Crop response Yield m ton/ha
Control	--	--	1	2.5	4.75	46
Linuron	1.12	5/25	9	7.7	4.60	57
Linuron	1.12	5/25, 6/2	9	8.0	4.50	46
Sethoxydim	0.28	5/25	1	9.0	4.60	51
Sethoxydim	0.56	5/25	1	9.0	4.50	47
Sethoxydim + crop oil	0.28 + 0.1%	5/25	1	8.8	4.50	43
Linuron + sethoxydim T.M.	1.12 + 0.28	5/25	9	8.0	4.50	50
Linuron + sethoxydim T.M.	1.12 + 0.56	5/25	9	9.0	4.50	52
Linuron + sethoxydim + crop oil	1.12 + 0.28 + 0.1%	5/25	9	9.0	4.50	51
Linuron + sethoxydim + crop oil	1.12 + 0.56 + 0.1%	5/25	9	9.0	4.75	56
Linuron + sethoxydim T.M.	1.12 + 0.28	5/25, 6/2	9	9.0	4.60	52
Linuron + sethoxydim T.M.	1.12 + 0.56	5/25, 6/2	9	9.0	4.40	55
Linuron ; sethoxydim	1.12 ; 0.28	5/25; 6/2	9	9.0	4.70	50
Linuron ; sethoxydim	1.12 ; 0.56	5/25; 6/2	8.9	9.0	4.70	49
Sethoxydim ; linuron	0.28 ; 1.12	5/25; 6/2	7.2	9.0	4.20	50
Sethoxydim ; linuron	0.56 ; 1.12	5/25; 6/2	7.9	8.8	4.60	47
Bayes LSD 5%			0.5	0.9	NSD	NSD

Table 2. Response of weeds and carrots to combinations of linuron with diclofop, fluazifop-butyl and CGA82725 at Napoleon, Ohio, in 1982.

Treatments[1/]	Rate, kg/ha	Appl. Dates	Weed control rating, 1 - 9		Crop response	
			BLW	Grass	Phyto rating, 1 - 5	Yield m ton/ha
Control	--	--	1.5	2.7	4.5	60
Linuron	1.12	5/25	9.0	8.0	4.9	63
Linuron + diclofop T.M.	1.12 + 1.12	5/25	9.0	9.0	3.1	43
Linuron + diclofop T.M.	1.12 + 2.24	5/25	8.8	8.0	2.6	36
Diclofop ; linuron	1.12 ; 1.12	5/25; 6/2	8.0	9.0	4.5	58
Linuron + fluazifop-butyl T.M.	1.12 + 0.11		8.6	8.0	4.6	52
Linuron + fluazifop-butyl T.M.	1.12 + 0.22		9.0	9.0	4.5	63
Linuron + fluazifop-butyl T.M.	1.12 + 0.33		9.0	9.0	4.5	63
Fluazifop-butyl	0.33		1.5	8.8	3.4	52
Linuron + CGA82725 T.M.	1.12 + 0.14	5/25	9.0	9.0	4.1	56
Linuron + CGA82725 T.M.	1.12 + 0.28	5/25	9.0	9.0	4.1	47
CGA82725 ; linuron	0.28 ; 1.12	5/25; 6/2	7.6	9.0	4.2	56
CGA82725	0.28	5/25	6.0	9.0	4.3	52
Bayes LSD 5%			0.9	1.1	0.5	9

[1/] All treatments involving a grass herbicide included 0.1% crop oil as a surfactant in the solution.

WEED CONTROL IN DILL

Robert J. Precheur and Nancy L. Garrabrants[1/]

ABSTRACT

Ethalfluralin applied PPI or pre-emergence at 1.25 kg/ha produced dill fresh weight and plant height significantly greater than trifluralin with sethoxydim plus bentazon, and pre or post applications of linuron. Bentazon applied post caused burned, unmarketable foliage.

INTRODUCTION

Minor crop acreage increases each year on New England small farms. A commodity in great demand is fresh cut herbs for farmers markets, restaurants and local supermarkets. Dill, one of the most common, is cut fresh for bunching, sold dried or used as dillweed oil. Several herbicides are registered for use in dill. However, stoddard solvent, for example, has become too expensive in normal usage. Other herbicides do not provide adequate control or are phytotoxic to young dill. The objective of this study was to determine the efficacy of new pre and post emergent herbicides in dill.

MATERIALS AND METHODS

Dill was direct seeded with a Planet Junior into one row plots 1 m x 6 m. The experiment was conducted as a randomized complete block design with 3 replications per treatment. Pre-plant incorporated and pre-emergence treatments were applied on August 3, 1982 and post-emergence treatments on September 3, 1982. Chemicals were applied with a backpack CO_2 sprayer delivering 450 l/ha at 2.3 kg/cm^2. Ethalfluralin (N-ehtyl-N-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluromethyl) benezenamine at 1.25 kg/ha was applied pre plant incorporated

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and pre-emergence. Other pre-emergence treatments consisted of DCPA (dimethyl-tetrachloroterephthalate and linuron (3-(3,4-dichlorophynyl)-1-methoxy-1-methylurea). The post emergent herbicides were linuron, sethoxydim (chemistry not available) and bentazon (3-isopropyl-H-2, 1, 3 benzothiadiazin-4 (3H)-one 2,2-dioxide. All post treatments received a pre plant incorporated treatment of tirfluralin (a, a, a-trifluro-2,6-dinitro-N, N-dipropyl-P-toluidine. Herbicide treatments were evaluated on September 12, 1982 for crop phytoxicity and weed control. Weed populations measured included: redroot pigweed (Amaranthus retroflexus L.), lambsquarter (Chenopodium album L.) and purslane (Portulaca olerica L.) Dill plant height, fresh weight and dry weight were measured on September 30, 1982 at harvest. In this experiment, dill was grown and cut for fresh market and not for seed.

RESULTS AND DISCUSSION

Greatest yield of fresh cut and dried dill occurred when ethalfluralin was applied pre-plant incorporated or pre-emergence at a rate of 1.25 kg/ha (Table 1).

Table 1. Effect of PPI, pre and post emergence herbicides on plant height, fresh weight and dry weight in dill.

Treatment	Rate (kg/ha)	Method	Height (cm)	Fresh wt. (g/plot)	Dry wt. (g/plot)
ethalfluralin	1.25	PPI	14.7ab[1]	698.2a	38a
ethalfluralin	1.25	Pre	17.6a	715.0a	37.9a
DCPA	8.9	Pre	14.2ab	650.9ab	36ab
trifluralin plus diclofop	1.12 1.12	PPI Post	17.1a	656.4ab	34ab
trifluralin plus sethoxydim	1.12 0.22	PPI Post	15.9a	556.5ab	29.4ab
trifluralin plus sethoxydim plus bentazon	1.12 0.2 0.8	PPI Post Post	9.8bc	295.8cd	16.9cd
linuron	0.56	Pre	7.5c	279.5cd	15.3cd
linuron	0.56	Post	7.5c	152.8d	9.5d
trifluralin plus linuron	1.12 0.56	PPI Post	9.9bc	417.7bc	24.11bc
Untreated	-	-	18.2a	248.6cd	13.7cd
Cultivated	-	-	13.7ab	531.5ab	30.1ab

[1] Mean separation by Duncan's multiple range test, 0.05. Means followed by the same letter are not significantly different.

The pre-plant incorporated ethalfluralin treatment provided better control of redroot pigweed and lambsquarter, however, ethalfluralin applied pre-emergence provided better control of purslane (Table 2).

Table 2. Effect of PPI, pre, and post herbicide treatments on weed control and phytoxicity in dill.

Treatment	Rate (kg/ha)	Method	Weed Control[1]	Crop injury[2]	Weed Control[3] (#/m^2)		
					RRP	LQ	PUR
ethalfluralin	1.25	PPI	8.0	8.8	7	14	18
ethalfluralin	1.25	Pre	6.8	9.1	22	32	0
DCPA	8.9	Pre	6.8	9.3	14	7	0
trifluralin plus diclofop	1.12 1.12	PPI Post	7.3 7.0	9.5 9.5	11	25	25
trifluralin plus sethoxydim	1.12 0.22	PPI Post	7.1 5.6	9.3 9.5	14	29	0
trifluralin plus sethoxydim plus bentazon	1.12 0.2 0.8	PPI Post	6.0 6.0	6.0 6.0	18	39	7
Linuron	0.56	Pre	9.2	5.9	0	7	0
Linuron	0.56	Post	1.0	10.0	32	61	36
trifluralin and inuron	1.12 0.56	PPI Post	8.3 9.5	9.3 8.6	7	14	7
Untreated	-	-	0.0	10.0	39	57	22
Cultivated	-	-	10.0	10.0	0	0	0

[1] Weed control: 0 = no control; 7 = commercially acceptable; 10 = perfect control

[2] Crop injury: 0 = complete kill; 6 = injury with slight yield reduction; 10 = no injury.

[3] Weed count: RRP = redroot pigweed; LQ = lambsqquarter; PUR = purslane.

Fresh weight of dill in DCPA, trifluralin plus diclofop and trifluralin plus sethoxydim treatments equaled yield in ethalfluralin treatments.

Trifluralin in combination with bentazon, linuron or linuron alone resulted in yields significantly lower than ethalfluralin, DCPA and trifluralin plus diclofop (Table 1). Plant height responded in a similar fashion. Pre-emergence linuron treatments stunted the dill while post emergent bentazon plus sethoxydim was phytotoxic and produced burned, unmarketable foliage (Table 2). Sethoxydim alone was not phytotoxic.

Ethalfluralin was an effective herbicide for fresh market dill. Post emergent candidates for use in dill include sethoxydim and diclofop. These herbicides were not phytotoxic but there effectiveness on weed control could not be adequately studied since broadleaf weeds were the predominate species. Linuron applied post did not burn foliage (Table 2) but reduced plant height and yield (Table 1) even when early weed competition was alleviated with trifluralin.

1982 RESULTS OF ONION WEED CONTROL EXPERIMENTS ON MINERAL SOIL -- LONG ISLAND[1/]

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

ABSTRACT

Weed control experiments were conducted at the Long Island Horticultural Research Laboratory to attempt to attain season-long weed control in onions (Allium cepa L.). Both preemergence and postemergence applications of selective herbicides are necessary for the long season of growth and for broad spectrum weed control in onions. The two major weeds present were barnyardgrass (Echinochloa crus-galli (L.) Beauv.) and purslane (Portulaca oleracea L.). Galinsoga (Galinsoga ciliata (Raf.) Blake), was also present to a lesser extent.

DCPA applied preemergence successfully controlled barnyardgrass and purslane early in the season. Postemergence applications of sethoxydim plus chlorpropham and fluazifop-butyl plus chlorpropham provided excellent control of both barnyardgrass and purslane late in the season. Postemergence combinations of sethoxydim plus chloroxuron and fluazifop-butyl plus chloroxuron provided excellent control of barnyardgrass but were slightly weaker on purslane. These combinations resulted in a moderate amount of leaf burn. Nitrofen provided excellent control of purslane, but was weak on barnyardgrass.

The postemergence combination of diclofop plus chlorpropham resulted in severe phytotoxicity to the onions. Oxyfluorfen caused localized necrosis which did not affect yield.

INTRODUCTION

A limited acreage of onions is grown on the sandy soils of Long Island. Although it is considered a minor crop, it is still an important crop for a number of farmers. Adequate weed control is one of the essential needs for economical production. In 1980, nitrofen was withdrawn from the market. Onion growers had depended on this material very heavily because it was very effective when applied at low rates on newly emerged weeds. This experiment was conducted to look at a number of herbicide treatments as alternatives to obtain this needed control.

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MATERIALS AND METHODS

The experiment 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 2, 1982 using a Stan Hay planter with three rows per bed which was 1.7 meters wide. Seed was placed five centimeters apart. The treatments were approximately six meters long with a harvest data taken from the center row of approximately five meters. Preemergence applications were made on April 14 and first postemergence applications on June 11 and 16. Second postemergence applications were made on July 23. All applications of herbicides were made with a tractor-mounted sprayer delivering 449 l/ha at 2.5 g/cm^2.

Ratings were made on June 3 and all plots were hand weeded and then cultivated on June 4. Heavy rains on June 4 and 5 resulted in approximately 20 cm of rainfall. Postemergence applications applied on June 16 were made when onions were approximately eight inches high with four leaves. Second postemergence applications on July 23 were applied when the onions were 20 inches tall and bulbing had started.

The preemergence applications included DCPA (dimethyl tetrachloroterephthalate) at 6.6 kg/ha and propachlor (2-chloro-N-isopropylacetanilide) at 4.48 kg/ha. Postemergence applications of oxyfluorfen (2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene) at 0.13 and 0.26, sethoxydim at 0.56 plus chloropropham (isopropyl-m-chlorocarbanilate) at 3.36, sethoxydim at 0.56 plus chloroxuron (3-[p-(p-chlorophenoxy)phenyl]-1,-dimethyl-urea) at 1.12, fluazifop-butyl at 0.56 plus chlorpropham at 3.36, fluazifop-butyl at 0.56 plus chloroxuron at 1.12, nitrofen (2,4-dichlorophenyl-p-nitrophenyl ether) at 3.36, diclofop (2-[2,4-dichlorophenoxy)phenoxy]) at 1.4 plus chlorpropham at 3.36, diuron (3-(3,4-dichlorophenyl)-1,1-dimethylurea) at 0.56 and 1.12 kg/ha were applied with and without the preemergence DCPA treatment. Postemergence applications of chloroxuron were not continued after the first date of application due to phytotoxicity. The propachlor preemergence treatments were followed by propachlor at 4.48 or tank mix combination of propachlor plus chlorpropham at 3.36 kg/ha.

All treatments were hand weeded and cultivated prior to the postemergence treatments. Principle weeds present were barnyardgrass, purslane and galinsoga. Other weeds that were present included lambsquarter (*Chenopodium album*), smartweed (*Polygonum pensylvanicum* L.), and pineapple weed (*Matricaria matricarioides* (Less.) Porter).

RESULTS AND DISCUSSION

Weed control and phytotoxicity ratings are listed in Table 1. DCPA applied preemergence provided adequate control of barnyardgrass and purslane at the June 3 rating. Galinsoga control was difficult to measure because of

lack of weed pressure early in the season. In the sethoxydim plus chlorpropham and the nitrofen treatments, galinsoga was more severe in September probably due to lack of competition from other weeds and the lack of control by these herbicides. The combinations of sethoxydim plus chlorpropham or chloroxuron and the combination of fluazifop-butyl plus chlorpropham or chloroxuron provided excellent control of barnyardgrass throughout the season and near perfect control through September 6. The combinations that included chlorpropham also resulted in excellent control of purslane through September. Chloroxuron combinations caused leaf burn. Injury was light to moderate after the first postemergence application. Chloroxuron was not included in the second postemergence applications and the onions recovered with no reduction in yield. Diuron with or without preemergence application of DCPA provided excellent control of purslane and gave acceptable control of barnyardgrass, especially at the 1.12 kg/ha rate. Propachlor and nitrofen provided good to fair control of barnyardgrass, but by the end of the season, barnyardgrass became a problem.

The combination of diclofop plus chlorpropham applied June 11 resulted in severe phytotoxicity and reduction in yield.

Table 1. The effect of twenty herbicide treatments on weed control and onion phytotoxicity and yield.

Treatment Chemical[a/]	Rate (kg/ha)	Timing[b/]	Yield t/ha	Rating[c/] Phyto 6/17	Phyto 7/30	Barnyardgrass 6/3	Barnyardgrass 6/17	Barnyardgrass 7/20	Barnyardgrass 7/30	Barnyardgrass 9/6	Galinsoga 6/3	Galinsoga 7/30	Galinsoga 9/6	Purslane 7/20	Purslane 7/30	Purslane 9/6
DCPA	6.6	Pre														
(followed by trts 1-11)																
1. oxyfluorfen	0.13	Post	33.6	7.5	7.0	7.5	8.5	6.5	6.0	4.2	8.0	8.5	8.0	8.5	9.0	8.8
2. a) oxyfluorfen	0.26	1st Post														
b) oxyfluorfen	0.12	2nd Post	36.4	6.5	7.8	7.2	8.5	6.5	5.5	4.2	8.2	9.0	8.5	9.0	8.2	9.0
3. sethoxydim	0.56															
+ chlorpropham	3.36	Post	33.9	8.0	8.2	7.5	9.0	7.5	8.2	9.0	8.0	8.0	6.5	8.5	8.8	8.8
4. sethoxydim	0.56															
+ chloroxuron	1.12	Post	27.6	6.8	7.2	7.2	9.0	7.0	7.2	8.2	8.5	9.0	8.8	8.0	7.8	5.2
5. fluazifop-butyl	0.56															
+ chlorpropham	3.36	Post	37.0	8.0	7.8	7.8	9.0	7.8	8.0	8.8	8.2	8.2	7.8	8.8	8.0	8.2
6. fluazifop-butyl	0.56															
+ chloroxuron	1.12	Post	43.0	7.2	8.2	7.0	8.2	8.0	7.2	9.0	7.0	8.8	8.2	8.0	7.8	5.0
7. nitrofen	3.36	Post	35.0	8.5	8.0	8.0	9.0	7.5	7.5	5.8	7.2	6.8	6.0	8.2	9.0	9.0
8. diclofop	1.40															
+ chlorpropham	3.36	1st Post	12.1	2.5	5.8	7.2	9.0	7.5	6.5	3.8	8.8	8.5	7.0	8.5	6.2	6.2
9. diuron	0.56	Post	38.0	8.5	7.8	7.8	8.8	7.5	6.2	6.0	8.2	8.2	9.0	8.8	9.0	8.5
10. diuron	1.12	Post	35.9	8.0	8.2	7.5	9.0	7.8	8.2	7.0	8.5	8.8	9.0	9.0	8.5	9.0
11. DCPA	6.6	Post	34.7	8.2	8.5	7.5	8.5	7.2	7.0	5.2	8.0	7.0	7.2	9.0	9.0	8.8
12. propachlor	4.48	Pre + Post														
+ chlorpropham	3.36	Post	34.7	8.8	7.5	8.0	7.0	7.0	5.8	4.8	8.8	9.0	8.2	8.5	7.5	9.0
13. propachlor	4.48	Pre + Post	34.4	8.0	8.0	8.2	7.8	6.8	5.0	3.2	9.0	8.8	9.0	6.5	6.0	6.2
14. sethoxydim	0.28															
+ chloroxuron	1.12	Post	33.6	7.8	8.0	6.2	8.5	6.2	6.2	7.5	8.2	9.0	9.0	8.0	7.5	5.2
15. sethoxydim	0.56															
+ chloroxuron	1.12	Post	40.0	8.2	8.0	6.0	8.8	7.2	8.2	8.8	7.2	8.5	8.5	8.0	7.5	6.8
16. fluazifop-butyl	0.28															
+ chloroxuron	1.12	Post	37.3	7.0	8.2	6.5	8.8	7.8	7.0	7.2	7.2	7.8	8.2	8.0	8.5	6.5
17. fluazifop-butyl	0.56															
+ chloroxuron	1.12	Post	40.2	7.5	8.0	5.5	7.8	8.0	7.8	8.8	8.5	8.5	9.0	8.2	7.8	5.0
18. diuron	0.56	Post	32.7	8.5	8.0	5.8	7.8	7.2	6.2	6.2	8.2	8.5	9.0	8.8	9.0	9.0
19. diuron	1.12	Post	33.3	7.8	6.8	6.5	7.0	7.8	7.0	7.5	8.0	8.2	9.0	9.0	9.0	9.0
20. no chemical			23.8	8.5	8.8	4.5	6.2	4.0	3.5	2.0	8.5	9.0	8.0	5.8	5.8	5.2
Waller-Duncan (.05)			(14.3)	(1.1)	(1.7)	(0.8)	(1.4)	(0.8)	(2.1)	(1.4)	(1.2)	(1.5)	(1.6)	(0.7)	(1.9)	(1.4)

a/ One percent dilution of Booster Plus E applied in Treatments 3, 4, 5, 6, 14, 15, 16 + 17.

b/ Preemergence treatments applied on 4/14, 1st post emergence applications made on 6/11 and 6/16, 2nd post emergence applications made on 7/23, post designation in table indicates applications were made at both times. Chloroxuron was not applied on 7/23 in treatments 4, 6, 14, 15, 16 and 17.

c/ Ratings made on a scale of 1-9; phototoxicity rating of 9 = no injury, 7 = moderate injury but no yield or quality reduction, 1 = all crop plants killed; weed control rating of 9 = absence of weed species, 7 = a few weeds but commercially acceptable, 1 = complete ground cover with weeds.

GUIDELINES FOR THE USE OF OXYFLUORFEN ON SEEDED MUCK ONIONS

Donald T. Warholic and L.A. Ellerbrock[1]

ABSTRACT

The wettable powder formulation of oxyfluorfen at 0.13 and 0.25 lbs/A with and without the adjuvant triton AG-98 and the EC formulation also at 0.13 and 0.25 lbs/A rate were applied to 1 and 3 leaf Downing Yellow Globe onions (Allium cepa L.). The EC formulation was more injurious to onions at both rates and timings. The addition of the adjuvant to the WP formulation served to increase injury on onions, causing much more injury than the equivalent EC rate. There is evidence to suggest that rates of the EC which exceed 0.125 lb/A at the onion 1 leaf stage can reduce onion stand. Visual injury from the use of this rate and formulation to both 1 and 3 leaf onions can be considerable, although we have yet to document a translation of this injury to reduced onion yield. The EC formulation provides better control of common lambsquarters (Chenopodium album L.) and shepherdspurse (Capsella bursa-pastoris L. Medic) which the WP misses. We will be recommending use rates of 0.0315 to 0.063 lbs/A of the EC formulation beginning at onion 3 leaf stage and repeated as necessary for onions in New York State.

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WEED CONTROL IN POTATOES WITH POSTEMERGENCE GRASS HERBICIDES FOLLOWING PREEMERGENCE HERBICIDES[1/]

C. Kupatt, R.D. Ilnicki and D.B. Vitolo [2/]

ABSTRACT

Recently, there have become available to weed researchers several new herbicides possessing excellent postemergence activity on grasses with little or no effect on broadleaf weeds or crops. Although primarily intended for use in soybeans, we wished to determine whether they could be safely used in white potatoes. This is important since some widely used herbicides, such as dinoseb, do not provide sufficient control of grasses throughout the growing season. It was the objective of this study to determine whether applications of postemergence grass herbicides following two established herbicide treatments could safely control late germinating grasses.

White potatoes (cv. *Superior)* were treated preemergence with dinoseb and with alachlor plus linuron. The latter alone also served as the standard check. Dinoseb treated plots were treated at layby postemergence with CGA82725, sethoxydim, fluazifop, DOWCO 356, and DOWCO 453, each at three rates. Alachlor + linuron-treated plots were also treated with sethoxydim, fluazifop, and CGA82725, each at two rates. Potatoes and weed species were rated using a 0 to 10 rating scale. Weeds in the experimental area included lambsquarters, common ragweed, Pennsylvania smartweed, yellow nutsedge, and barnyardgrass.

Applications of dinoseb alone produced weed control comparable to the uncultivated check. In the dinoseb-treated plots, all the postemergence applications controlled barnyardgrass with the exception of DOWCO 356 and the lowest rate of DOWCO 453. The combination of alachlor + linuron produced intermediate levels of control for all weeds. Values for grass weed control were reflected in the values for total weed control.

In alachlor + linuron plots, only CGA82725 at the 0.38 lb/A rate effected significantly higher yields than the preemergence treatment alone. This was the result of higher levels of grass control obtained from this preemergence treatment. However, dinoseb + postemergence applications of CGA82725 at the 0.38 lb/A rate, and sethoxydim at 0.25 and 0.38 lb/A rates, gave higher yields than dinoseb alone. It should be noted that there was no significant difference in yield between any of the postemergence treatments, with the exception of dinoseb followed by DOWCO 356 at the 0.38 lb/A rate, which produced yields lower than half of the treatments. No significant crop injury was observed with any of the treatments investigated measured as reductions in stand or vigor.

1/ New Jersey Agricultural Experiment Station, Publication No. J-15472-1-82.

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EFFECTS OF TIME AND METHOD OF APPLICATION OF SEVERAL HERBICIDES FOR WEED CONTROL IN BROCCOLI 1/

P. Chitapong, R.D. Ilnicki and C. Kupatt 2/

ABSTRACT

Oxyfluorfen, napropamide, pendimethalin, DCPA, and trifluralin, alone and in two-way combinations at different rates, times, and methods of application were evaluated for weed control in broccoli in New Jersey in 1981 and 1982. Oxyfluorfen gave better weed control than the other herbicides when applied prior to transplanting, with and without soil incorporation. Two-way combinations of incorporated trifluralin or pendimethalin with DCPA, napropamide, or oxyfluorfen improved weed control and broccoli yield. Improvement varied when time and method of application of oxyfluorfen, napropamide and DCPA was varied. Good to excellent weed control and high broccoli yield were obtained from incorporated trifluralin in combination with DCPA regardless of time and method of application and with oxyfluorfen surface applied. Incorporated pendimethalin gave good weed control and high yield when combined with either DCPA or napropamide. Lambsquarters, pigweed, ragweed, purslane and grasses were readily controlled with many herbicide combinations. Smartweed was controlled to acceptable levels with incorporated trifluralin combined with surface applied oxyfluorfen.

INTRODUCTION

For many years the standard herbicides for transplanted broccoli *(Brassica oleracea* L. var. *botrytis)* were DCPA (dimethyl tetrachloroterephthalate) and trifluralin (α,α,α-trifluoro-2,6-dinitro-*N*,*N*-dipropyl-*p*-toluidine) (4). These two herbicides have been effective on annual grassy weeds but ineffective on certain broadleaved weeds such as redroot pigweed *(Amaranthus retroflexus* L.), common lambsquarters *(Chenopodium album* L.), common ragweed *(Ambrosia artemisiifolia* L.) and galinsoga *[Galinsoga ciliata(*Rat.)Black] (3,4). These weeds have plagued areas where broccoli is grown in New Jersey and in the Northeast.

Attempts have been made to find effective herbicides for reducing these problem weeds in broccoli. Napropamide [2-(α-naphthoxy)-*N*,*N*-diethyl propionamide], alachlor [2-chloro-2,6-diethyl-*N*-(methoxymethyl)acetanilide], and metolachlor [2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)acetamide] have been reported to be effective against these problem weeds (1,3,4). Napropamide applied preemergence and incorporated at low rates did not control these problem weeds, but when combined with trifluralin excellent control of these species, except ragweed, could be obtained (3). Without incorporation, higher rates of napropamide are needed to suppress these weeds (1). The advent of some new herbicides present an opportunity to control these problem weeds,

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as well as other existing weeds in cole crops. In studies with cabbage, Sanok et al (2) obtained good long-term control of lambsquarters and purslane (*Portulaca oleracea* L.) by using pendimethalin [*N*-(1-ethylpropyl)-3,4 dimethyl 2,6-dinitrobenzenamine) at 1.68 kg/ha.

It is well documented that effectiveness of many herbicides is affected by time and method of application. Prior studies using napropamide in broccoli support this observation (1,3). The objectives of this study, therefore, were: i) to evaluate some of the newer herbicides (napropamide and pendimethalin), alone and in combination with some older herbicides, and ii) to determine the potential of varied time and methods of application on the effectiveness of these herbicides alone and in combinations for weed control in broccoli. Another new herbicide included in this study was oxyfluorfen [2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene]. Pretransplanting and posttransplanting (preemergence to weeds) comprised the time, incorporation and surface applied comprised the method of application referred to in this study.

MATERIALS AND METHODS

This study was conducted at the Adelphia Research Center, New Jersey Agricultural Experiment Station, Adelphia, New Jersey, in 1981 and 1982. Plots were established on a Sassafras loam soil with 1.5% organic matter and a pH of 5.7.

During seedbed preparation, 1120 kg/ha of a 10-20-10 and 840 kg/ha of 10-10-10 soluble fertilizers were broadcast and disked into the soil in 1981 and 1982, respectively. In both years, 1.8 by 5.5 m treatment plots with two rows per plot were established in a randomized complete block design with three replications. All herbicide treatments (Table 1) were applied with water as the carrier using Unijet flat spray tips number 730616 equipped with hand operated backpack CO_2-propelled experimental plot sprayer delivering 374 L/ha at 2.11 kg/cm^2. Pretransplanting incorporated and pretransplanting surface-applied treatments were sprayed on July 7, 1981, and July 19, 1982. Herbicide combinations for pretransplant incorporated treatments were applied separately to avoid herbicide interaction in the tank mixes. Trifluralin and pendimethalin were applied only as pretransplant incorporated treatments. Incorporation was made by rotary disking to a depth of 7.6 cm immediately after application.

'Atlantic' and 'Waltham 29' broccoli cultivars were used in 1981 and 1982, respectively. Five week old seedlings of broccoli were transplanted into all experimental plots consisting of ten plants per plot on July 8, 1981, and July 19, 1982. Plots were irrigated with approximately 1.27 cm of water immediately after transplanting in both years. Posttransplanting treatments were not applied in 1981, but were applied on July 22, 1982, for DCPA following trifluralin or pendimethalin. In both years, at the time the pretransplanting treatments were applied, the soil surfaces were dry with ample moisture below. When posttransplanting treatments were applied in 1981, the soil was relatively sticky due to irrigation and rain.

About three weeks after transplanting in both years, plots were top dressed with 168 kg/ha of urea (45% N) fertilizer and irrigated. Weed species dominant in experimental areas in both years were common lambsquarters, redroot pigweed,

and grasses [a combination of fall panicum (*Panicum dichotomiflorum* Michx.) and large crabgrass (*Digitaria sanguinalis* (L.) Scop.)]. Other weeds found in experimental areas were common ragweed and ladysthumb smartweed (*Polygonum persicaria* L.) in 1981, and purslane in 1982. Plots were rated for weed control and crop tolerance on September 1, 1981, and August 30, 1982. Five harvests were made each year: September 10, 21; October 1, 7, 30, 1981; and September 8, 15, 29; and October 4, 15, 1982. Total yields were converted to kilograms per hectare. Analysis of variance and mean comparisons using Least Significant Difference at probability 0.05 were performed on total percent control and yields. Comparisons were made within herbicides alone, within trials of combinations at different rates, times and methods of applications, and among every treatment in the experiments.

RESULTS AND DISCUSSION

Weed control and crop tolerance ratings and yield of broccoli as affected by herbicide treatments and rate, time and methods of application are summarized in Table 1.

Within herbicides used alone, the degree of weed control from napropamide and pendimethalin was not significantly different from that of DCPA at the highest rate and trifluralin. Oxyfluorfen at the high rate produced significantly greater control than napropamide and DCPA in 1982. When incorporation and surface applied treatments were compared for oxyfluorfen, incorporation greatly reduced control efficiency when a low rate of oxyfluorfen was used. Considering control of the individual weed species, good to excellent weed control was obtained from all single herbicide treatments on most weeds with the exception of trifluralin on smartweed, DCPA on lambsquarters, pigweed and smartweed, napropamide on smartweed, and oxyfluorfen on grasses. Control of grassy weeds by oxyfluorfen, however, was somewhat improved if this herbicide was not incorporated. Slight injury to broccoli could be observed from many herbicides in 1981, but this was not as evident in 1982. This difference may be due to the variety of broccoli. There was no significant difference in yields due to treatment in 1981. However, in 1982 there were reductions in yield from oxyfluorfen at the low rate, incorporated, DCPA and napropamide. Yield reduction was primarily due to weed competition rather than from injury due to herbicide treatment. This was evident from plots where yield was not reduced in spite of visual crop injury, when adequate weed control was obtained.

When applied in combination with either DCPA, napropamide, or oxyfluorfen, at different times and methods of application, trifluralin and pendimethalin provided improved weed control and yield, especially in 1982.

Combinations of trifluralin with DCPA provided good to excellent weed control regardless of time and method of application. However, surface-applied DCPA provided excellent weed control only if pretransplanting incorporated trifluralin was applied at a high rate. It is interesting to note that DCPA applied at a low rate after transplanting produced significantly better weed control than when applied prior to transplanting incorporated. However, yield

Table 1. Weed control and crop tolerance ratings and yield of broccoli in 1981 and 1982 growing seasons.

Herbicide	Time and Method[1]	Rate, kg a.i./ha	Weed Control Rating (Stand)[2] Lambsquarters 1981	Lambsquarters 1982	Pigweed 1981	Pigweed 1982	Grasses 1981	Grasses 1982	Smartweed 1981	Ragweed 1981	Purslane 1982	Total Control (%) 1981	Total Control (%) 1982	Broccoli Vigor[2] 1981	Broccoli Vigor[2] 1982	Yield kg/ha x 10^2 1981	Yield kg/ha x 10^2 1982
trifluralin	pti	0.84	8.3	9.8	9.9	9.8	5.3	9.8	6.3	9.3	8.3	78	75	0.7	0.0	37.8	63.9
pendimethalin	pti	0.84	7.8	-	8.3	-	6.7	-	7.5	8.7	-	78	-	3.0	-	27.2	-
		1.12	7.5	10.0	9.3	9.9	6.0	10.0	7.0	7.0	8.5	74	73	1.0	0.0	31.6	68.0
		1.96	-	10.0	-	9.8	-	10.0	-	-	8.8	-	79	-	0.0	-	65.2
DCPA	pti	6.72	3.0	-	8.3	-	2.3	-	1.0	8.7	-	47	-	0.3	-	29.2	-
		8.40	7.3	6.0	9.3	6.3	6.3	9.0	3.3	10.0	9.0	72	55	0.0	0.2	34.3	44.2
		10.08	7.8	6.0	6.7	5.8	7.3	6.6	5.5	10.0	7.6	75	43	0.7	0.2	30.6	48.5
napropamide	pti	1.12	3.3	9.1	9.7	7.8	6.7	9.8	3.7	10.0	8.1	67	58	0.7	0.2	26.5	49.9
		2.24	8.5	9.3	10.0	6.1	9.0	10.0	2.7	9.3	8.6	79	57	1.0	0.0	39.6	48.1
oxyfluorfen	pti	0.28	3.7	4.3	6.5	3.8	6.0	5.5	5.7	7.3	8.6	58	38	0.3	0.2	33.0	45.4
		0.43	6.0	9.5	8.6	9.6	7.0	6.6	5.3	10.0	9.5	75	83	0.0	0.2	35.2	61.7
		0.56	6.2	-	9.2	-	3.0	-	7.0	10.0	-	73	-	0.7	-	42.9	-
oxyfluorfen	ptsa	0.28	-	9.8	-	10.0	-	6.8	-	-	10.0	-	93	-	0.0	-	57.6
		0.43	-	10.0	-	10.0	-	8.6	-	-	10.0	-	97	-	0.0	-	65.4
LSD 0.05 for herbicides alone												21	22			NS	8.7
trifluralin	pti	0.56 + 6.72	-	10.0	-	9.8	-	10.0	-	-	9.3	-	87	-	0.0	-	62.1
+ DCPA	pti	0.56 + 8.40	-	9.9	-	9.3	-	10.0	-	-	9.9	-	95	-	0.3	-	52.6
		0.56 + 10.0	-	10.0	-	9.9	-	10.0	-	-	9.7	-	94	-	0.0	-	66.5
+ DCPA	ptsa	0.56 + 6.72	8.7	-	9.7	-	3.3	-	7.7	9.9	-	79	-	1.0	-	32.3	-
		0.56 + 8.40	8.3	-	6.3	-	6.0	-	4.7	9.7	-	70	-	1.3	-	40.4	-
		0.84 + 8.40	9.9	-	9.6	-	9.3	-	7.4	10.0	-	92	-	1.3	-	35.7	-
+ DCPA	post	0.56 + 6.72	-	10.0	-	10.0	-	10.0	-	-	10.0	-	99	-	0.0	-	72.3
		0.56 + 8.40	-	10.0	-	10.0	-	10.0	-	-	10.0	-	92	-	0.0	-	60.3
		0.89 + 10.0	-	10.0	-	10.0	-	10.0	-	-	10.0	-	100	-	0.0	-	68.8

Table 1 (cont'd.)

Herbicide	Time and Method[1]	Rate, kg a.i./ha	Weed Control Rating (Stand)[2] Lambsquarters 1981	Lambsquarters 1982	Pigweed 1981	Pigweed 1982	Grasses 1981	Grasses 1982	Smartweed 1981	Ragweed 1981	Purslane 1982	Total Control (%) 1981	Total Control (%) 1982	Broccoli Vigor[2] 1981	Broccoli Vigor[2] 1982	Yield kg/ha x 10^2 1981	Yield kg/ha x 10^2 1982
LSD 0.05 for trifluralin pti + DCPA												16	10			NS	NS
trifluralin	pti	0.56 + 0.56	6.9	8.6	9.9	9.8	6.3	10.0	4.0	6.7	9.4	68	77	0.3	0.3	41.4	49.1
+ napropamide	pti	0.56 + 1.22	7.8	9.3	9.8	9.8	6.7	10.0	6.7	9.3	8.8	81	77	0.3	0.0	39.7	49.5
+ napropamide	ptsa	0.56 + 0.56	5.8	7.8	10.0	9.5	7.3	10.0	5.3	6.7	8.6	70	76	0.7	0.2	30.2	55.8
		0.56 + 1.12	6.9	8.2	8.0	9.8	6.8	9.8	2.3	9.7	9.1	67	73	1.3	0.2	23.1	46.3
LSD 0.05 for trifluralin pti + napropamide												NS	NS			16.4	NS
trifluralin	pti	0.56 + 0.14	-	9.8	-	9.8	-	9.8	-	-	6.4	-	88	-	0.3	-	61.7
+ oxyfluorfen	pti	0.56 + 0.28	8.8	9.8	10.0	9.6	4.7	9.5	4.7	10.0	9.8	76	88	0.0	0.3	36.2	64.1
		0.56 + 0.43	6.8	10.0	9.9	9.9	4.3	10.0	2.7	7.7	9.9	63	88	1.3	0.0	26.5	73.1
		0.56 + 0.56	6.5	-	10.0	-	4.7	-	6.7	7.3	-	70	-	0.7	-	33.3	-
+ oxyfluorfen	ptsa	0.56 + 0.14	-	9.5	-	10.0	-	10.0	-	-	9.9	-	97	-	0.2	-	69.4
		0.56 + 0.28	7.7	10.0	9.8	10.0	5.7	10.0	6.5	5.0	10.0	69	100	0.3	0.3	38.5	65.9
		0.56 + 0.43	8.3	10.0	10.0	10.0	5.0	10.0	9.7	7.7	10.0	81	100	1.0	2.3	31.0	-
		0.56 + 0.56	9.5	-	10.0	-	7.0	-	9.3	10.0	-	92	-	2.3	-	26.9	-
LSD 0.05 for trifluralin pti + oxyfluorfen												25	NS			NS	NS
pendimethalin	pti	1.12 + 6.72	-	10.0	-	10.0	-	10.0	-	-	9.6	-	91	-	0.0	-	52.7
+ DCPA	pti	1.12 + 8.40	-	10.0	-	9.8	-	10.0	-	-	9.9	-	94	-	0.0	-	60.3
+ DCPA	ptsa	1.12 + 6.72	10.0	-	10.0	-	10.0	-	8.5	9.2	-	90	-	0.0	-	41.6	-
		1.12 + 8.40	9.9	-	9.9	-	9.7	-	9.3	9.9	-	97	-	0.7	-	48.7	-
		1.12 + 10.0	9.9	-	9.8	-	7.3	-	7.0	9.9	-	88	-	3.7	-	33.7	-
+ DCPA	post	1.12 + 6.72	-	10.0	-	9.8	-	10.0	-	-	10.0	-	96	-	0.0	-	61.7
		1.12 + 8.40	-	10.0	-	10.0	-	9.9	-	-	10.0	-	99	-	0.0	-	74.7
LSD 0.05 for pendimethalin pti + DCPA												NS	5			NS	9.2

Table 1 (cont'd.)

Herbicide	Time and Method[1/]	Rate, kg a.i./ha	Weed Control Rating (Stand)[2/] Lambsquarters 1981	Lambsquarters 1982	Pigweed 1981	Pigweed 1982	Grasses 1981	Grasses 1982	Smartweed 1981	Ragweed 1981	Purslane 1982	Total Control (%) 1981	Total Control (%) 1982	Broccoli Vigor[2/] 1981	Broccoli Vigor[2/] 1982	Yield kg/ha x 10^2 1981	Yield kg/ha x 10^2 1982
pendimethalin	pti	1.12 + 0.56	7.7	9.9	9.3	9.3	8.3	10.0	6.7	9.8	9.6	84	91	1.7	0.0	28.2	60.5
+ napropamide	pti	1.12 + 1.12	8.5	9.9	9.9	9.4	7.3	9.9	5.7	6.7	9.1	76	83	1.7	0.2	22.7	51.6
+ napropamide	ptsa	1.12 + 0.56	8.3	9.8	8.7	9.4	8.0	9.9	6.7	8.0	9.5	79	89	0.7	0.6	40.7	57.0
		1.12 + 1.12	9.2	9.8	9.7	9.2	9.5	10.0	4.1	8.3	9.6	82	88	1.7	0.5	35.9	-
		1.68 + 1.12	9.8	-	9.3	-	9.4	-	7.7	9.3	-	92	-	2.0	-	46.5	-
LSD 0.05 for pendimethalin pti + napropamide												NS	6			NS	NS
Check - cultivated			-	10.0	-	10.0	-	10.0	-	-	10.0	-	100	-	0.7	-	53.4
Check - uncultivated			0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	6	0	2.3	0.3	13.4	41.4
LSD 0.05 (overall)												21	16			25.8	17.9

[1/] pti = Pretransplanting incorporation
ptsa = Pretransplanting surface applied
post = Postransplanting (preemergence to weeds)

[2/] Based on scale of 0 to 10, where 0 = no effect on weed or crop and 10 = complete kill.

differences due to rate, time and method of application of trifluralin + DCPA were not significant in both years.

When trifluralin was combined with napropamide, rate, time and method of application of napropamide did not significantly affect weed control in both years. Yield reduction due to low control of smartweed was significant when napropamide was surface applied in 1981.

Trifluralin combined with oxyfluorfen produced good and excellent weed control in 1981 and 1982, respectively. Surface-applied oxyfluorfen exhibited better weed control but had more crop injury at the high rate than the incorporated application. Plants exhibiting stunting due to herbicide injury, however, recovered at harvest time as indicated by the relatively high yield. At the higher rate of oxyfluorfen (0.56 kg/ha), however, plants did not recover from stunting as observed in 1981.

When DCPA was used with pendimethalin, excellent weed control with no crop injury was achieved from every treatment. Significant reductions in weed control and yield, however, were found when DCPA was used at low rates and incorporated in 1982.

Unsuccessful control of smartweed was again found when pendimethalin was combined with napropamide, regardless of rate, time and method of application. For other weeds, this combination provided good to excellent control. Moderate injury to broccoli was observed, but broccoli recovered later in the season.

When an overall comparison of all treatments was made, they were significantly different among treatments for weed control and yield for both years. Weed control was improved with many herbicide combination treatments. Greatest percent weed control was obtained in 1982 from combinations of trifluralin with posttransplanting DCPA and of trifluralin with pretransplanting surface-applied oxyfluorfen. Acceptable levels of weed control was exhibited from combinations of pendimethalin or trifluralin with DCPA. Napropamide effected significantly higher percent control when combined with pendimethalin than with trifluralin. Control of lambsquarters, pigweed, ragweed, purslane and grasses was improved with herbicide combinations, but smartweed exhibited resistance to most treatments except to trifluralin combined with oxyfluorfen surface applied. Broccoli yield was significantly increased with increasing weed control efficiency.

LITERATURE CITED

1. Grenoble, D.W. and D.A. Ferretti. 1981. Weed control for cabbage, cauliflower and broccoli using alachlor and napropamide. Proc. Northeastern Weed Sci. Soc. 35:175-176.

2. Sanok, W.J., J.B. Sieczka, and J.F. Creighton. 1981. Herbicide evaluation in cabbage on Long Island. Proc. Northeastern Weed Sci. Soc. 35:172-174.

3. Stamm, G.K. and R.A. Ashley. 1980. Weed control in transplanted cabbage, cauliflower, and broccoli. Proc. Northeastern Weed Sci. Soc. 34:201-203.

4. Sweet, R.D., A.R. Bonando, D.T. Warholic, and P.L. Minotti. 1980. Alachlor for transplanted vegetables. Proc. Northeastern Weed Sci. Soc. 34:170.

SAFENING OF DINITROANALINE HERBICIDES IN CUCUMBERS AND MUSKMELONS

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ABSTRACT

Two field experiments were conducted in 1982 at the Homer C. Thompson Vegetable Research Farm in Freeville, New York to determine the safening potential of activated charcoal or plastic strips for direct seeded cucumbers and transplanted muskmelons treated with incorporated or surface applied dinitroanaline herbicides. The soil type was a Howard Gravelly Loam with a pH of 5.9, and organic matter content of 3 percent and a cation exchange capacity of 11 meq/100g. The weeds present included pigweed species (Amaranthus retroflexus L. and Amaranthus powelli S.WATS), common lambsquarters (Chenopodium album L.), common purslane (Portulaca oleracea L.), and large crabgrass (Digitaris sanguinalis (L.) Scop.).

Dipping the roots of muskmelon transplants into an activated charcoal slurry just prior to field setting reduced injury to muskmelons. Safening was also achieved by placing a 30 cm. black plastic strip over the row just prior to herbicide application and transplanting. With respect to both preemergence and preplant incorporated applications of ethalfluralin; these safening treatments resulted in muskmelon yields comparable to those in clean cultivated check plots and up to twice those in plots without the safening treatments. Similar but less dramatic results were obtained with trifluralin.

In the cucumber experiment coating the seeds with charcoal did not reduce the injury from preplant incorporated treatments of ethalfluralin and extensive yield reductions occured. However, preemergence applications of ethalfluralin at rates of 1.40 and 1.96 kg/ha did not reduce cucumber yields and provided excellent weed control. Again, with regard to crop safety, a similar pattern was observed with trifluralin.

Under the conditions of these experiments ethalfluralin provided more satisfactory control of the weeds present than did trifluralin.

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Table 1. Muskmelon yield and weed control ratings for the transplanted muskmelon experiment.

	kg ai/ha	timing	safening treatment	No. fruit (1000/ha)	Wt. fruit (Metric tons/ha)	Crop injury rating[b] 7/9	Crop injury rating[b] 7/27	Weed control[c] rating 7/27 Pwsp	Colq	Copu	Lacz
1. Ethalfluralin	1.40	pre	none	9.17	8.29	4.0	6.7	7.7	8.0	8.0	8.0
2. Ethalfluralin	1.96	pre	none	9.58	9.79	4.3	7.3	8.0	8.0	8.7	9.0
3. Ethalfluralin	1.40	ppi	none	6.67	6.33	4.3	6.3	7.0	8.0	9.0	8.7
4. Ethalfluralin	1.96	ppi	none	8.33	7.37	4.0	5.7	8.7	9.0	8.3	9.0
5. Ethalfluralin	1.40	pre	charcoal	17.92	14.92	6.7	8.7	8.0	9.0	9.0	9.0
6. Ethalfluralin	1.96	pre	charcoal	15.42	13.79	5.3	8.0	8.3	9.0	9.0	9.0
7. Ethalfluralin	1.40	ppi	charcoal	19.58	19.50	6.0	7.3	7.0	8.3	9.0	8.7
8. Ethalfluralin	1.96	ppi	charcoal	10.00	9.67	4.3	6.3	7.7	7.0	7.3	9.0
9. Ethalfluralin	1.40	pre	plastic	19.17	16.96	8.0	9.0	7.7	8.0	8.3	8.7
10. Ethalfluralin	1.96	pre	plastic	22.50	21.29	7.7	9.0	8.0	8.0	8.0	9.0
11. Trifluralin	0.42	pre	none	10.83	10.50	7.3	9.0	4.7	4.7	7.7	7.3
12. Trifluralin	0.84	pre	none	12.92	10.46	5.3	8.3	7.0	7.0	8.3	7.3
13. Trifluralin	0.42	ppi	none	15.00	14.17	7.0	8.3	6.0	7.7	8.7	7.7
14. Trifluralin	0.84	ppi	none	17.50	16.62	7.0	9.0	7.3	7.3	8.3	8.3
15. Trifluralin	0.42	pre	charcoal	15.42	14.04	7.3	9.0	5.0	5.7	7.0	7.7
16. Trifluralin	0.84	pre	charcoal	19.17	17.04	6.7	8.3	6.3	6.7	9.0	8.0
17. Trifluralin	0.42	ppi	charcoal	15.83	14.04	8.3	9.0	6.3	7.0	8.3	9.0
18. Trifluralin	0.84	ppi	charcoal	18.75	16.79	7.3	9.0	7.0	6.7	7.7	8.3
19. Trifluralin	0.42	pre	plastic	13.33	11.50	8.7	9.0	6.0	6.3	8.3	8.3
20. Trifluralin	0.84	pre	plastic	15.00	14.38	8.0	9.0	5.3	6.3	7.7	7.3
21. Weed free check	-	-	none	17.50	15.79	9.0	9.0	9.0	9.0	9.0	9.0
22. Weed free check	-	-	charcoal	21.67	18.92	9.0	9.0	9.0	9.0	9.0	9.0
23. Weed free check	-	-	plastic	18.75	18.25	9.0	9.0	9.0	9.0	9.0	9.0
24. Weedy check	-	-	none	7.50	7.04	9.0	9.0	2.7	2.7	6.0	6.7
25. Weedy check	-	-	charcoal	4.17	3.88	9.0	9.0	2.0	3.3	6.0	6.3
26. Weedy check	-	-	plastic	7.92	7.54	9.0	9.0	2.7	4.3	6.0	5.0
			(LSD .05)[a]	7.45	7.18	1.3	1.1	1.1	1.9	0.9	1.3

Table 2. Cucumber yield and weed control ratings for the direct seeded cucumber experiment.

	kg ai/ha	timing	safening treatment	No. fruit (1000/ha)	Wt. fruit (metric tons/ha)	Crop injury rating[b] 7/9	Crop injury rating[b] 7/27	Weed control rating[c] 7/27 Pwsp	Colq	Copu	Lacz
1. Ethalfluralin	1.40	pre	none	104.2	26.62	8.3	8.3	7.3	8.0	8.7	8.7
2. Ethalfluralin	1.96	pre	none	89.6	25.00	9.0	7.7	7.7	8.3	8.7	8.3
3. Ethalfluralin	1.40	ppi	none	7.5	2.79	2.0	2.0	7.7	8.0	8.3	8.7
4. Ethalfluralin	1.96	ppi	none	10.4	1.67	2.3	1.7	8.0	8.3	8.7	8.7
5. Ethalfluralin	1.40	pre	charcoal	100.8	27.25	7.3	9.0	8.0	8.0	8.3	8.7
6. Ethalfluralin	1.96	pre	charcoal	104.2	28.21	8.3	7.7	8.3	8.0	9.0	9.0
7. Ethalfluralin	1.40	ppi	charcoal	16.2	4.62	3.0	2.7	8.7	9.0	9.0	9.0
8. Ethalfluralin	1.96	ppi	charcoal	15.0	4.38	2.7	2.0	8.3	9.0	9.0	9.0
9. Trifluralin	0.42	pre	none	70.4	19.75	9.0	8.7	5.0	3.3	8.0	8.3
10. Trifluralin	0.84	pre	none	87.5	24.08	8.7	8.0	6.3	6.7	8.3	8.0
11. Trifluralin	0.42	ppi	none	61.7	16.96	4.3	6.0	7.0	8.0	8.7	8.3
12. Trifluralin	0.84	ppi	none	40.4	11.71	4.0	4.7	7.7	8.3	8.3	8.0
13. Trifluralin	0.42	pre	charcoal	81.7	21.67	8.3	9.0	3.3	3.7	7.0	7.3
14. Trifluralin	0.84	pre	charcoal	79.6	21.96	8.3	8.7	5.3	4.7	8.7	8.7
15. Trifluralin	0.42	ppi	charcoal	38.3	10.17	3.7	4.3	7.0	7.0	8.3	8.7
16. Trifluralin	0.84	ppi	charcoal	24.2	5.75	3.0	3.0	7.7	7.7	7.7	8.7
17. Weed free check	-	-	none	97.9	24.58	9.0	9.0	9.0	9.0	9.0	9.0
18. Weed free check	-	-	charcoal	95.4	26.79	9.0	9.0	9.0	9.0	9.0	9.0
19. Weedy check	-	-	none	78.3	20.67	9.0	9.0	5.0	4.7	7.3	6.7
20. Weedy check	-	-	charcoal	50.8	18.21	9.0	9.0	3.7	5.0	5.7	5.7
			(LSD .05)[a]	25.9	8.29	1.0	1.5	0.8	1.1	1.0	1.2

[a] Waller - Duncan k-ratio T test

[b] Rating scale in which 1 = completely killed, 7 = slight but acceptable injury, 9 = no injury

[c] Rating scale in which 1 = no control, 7 = acceptable control, 9 = complete control

1982 RESULTS OF ANNUAL GRASS CONTROL EXPERIMENTS ON POTATOES ON LONG ISLAND[1/]

Joseph B. Sieczka and James F. Creighton[2/]

ABSTRACT

The results of three weed control experiments with the potato cultivar 'Wauseon' and one experiment with the cultivars 'Superior', 'Katahdin', 'Belchip', and 'Rosa' are reported in this paper. A total of 50 weed control treatments were evaluated in the first three experiments and seven in the last one. Parameters evaluated included weed control, crop injury, maturity and yield. Treatments that provided control of barnyardgrass (*Echinochloa crus-galli* (L.) Beauv) were Uniroyal S734 at rates of 0.84, 1.12, and 1.68 kg/ha, metolachlor applied at cultivation and hilling at a rate of 0.84 kg/ha at each application, Mobay 2602 and 2492 at 1.68 and 3.36 kg/ha alone or in combination with metribuzin at 0.56 kg/ha, metolachlor at 2.24 kg/ha in combination with metribuzin at 0.56 kg/ha, EPTC at 5.04 kg/ha in combination with napropamide at 1.68 kg/ha, and fluazifop-butyl at 0.56 kg/ha applied at cultivation and hilling. A slight leaf distortion similar to potato mosaic developed on potato plants sprayed with pendimethalin and oryzalin after cultivation. Phytotoxicity symptoms due to postemergence applications of metribuzin were most severe on 'Superior' and 'Belchip'. 'Rosa' was intermediate in sensitivity while 'Katahdin' showed almost no foliage symptoms. Postemergence applications of metolachlor to the same cultivars had no effect on plant growth. Postemergence applications of metribuzin tended to delay flowering on sensitive varieties. No significant difference in yield was noted due to herbicide treatments in any of the experiments.

INTRODUCTION

Barnyardgrass control in potato fields is becoming an increasing problem in the northeastern United States (1, 2, 3, 7). This weed has been a significant problem on Long Island for many years. The long growing season and the non-competitive nature of widely grown potato cultivars has intensified the problem. Postemergence applications of herbicides at/or immediately after the tillage treatments normally associated with potato production has been advocated as a means of providing season long control (1, 3, 4, 7). However, crop injury has been a major concern from these applications. The differential sensitivity of certain potato cultivars to herbicides such as metribuzin (4-amino-6-tert-butyl-3-(methylthio)-as-triazin-5(4H)-one) and alachlor (2-chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide) has been noted (4, 5, 6). However, low rate applications of herbicides such as metribuzin show potential (8). The purpose of this study was to determine the best weed control program without significant damage to the crop.

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MATERIALS AND METHODS

The experiments were established at the Long Island Horticultural Research Laboratory at Riverhead, New York on Haven sandy-loam soil. Herbicide treatments were applied with a tractor mounted, CO_2-pressurized sprayer delivering 39 l/ha at 2.5 kg/cm^2. The cultivar 'Wauseon' was used in 3 experiments. Plot size for these experiments was 2 rows X 7.6 meters. Yield data were collected from the center 6.1 meters. The experimental design for these experiments was a randomized complete block design with four replications in experiments I and II and three replications in experiment III. A split plot design was employed in experiment IV to determine differential cultivar sensitivity to postemergence applications of metribuzin and metolachlor (2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide). The cultivars tested were 'Superior', 'Katahdin', 'Belchip' and 'Rosa'. Main plots were 4 rows X 7.6 meters and sub plots were 1 row X 7.6 m. Yield data were collected from the center 6.1 meters. Soil incorporated treatments were made with a cultivator and finger weeder or hillers depending on time of treatment except for the preemergence application of napropamide (2-(a-naphthoxy)-N,N-diethylpropionamide) in experiment 1 which was incorporated by raking. Non-incorporated hilling treatments were made as directed sprays after hilling. Nozzles were positioned on the shanks of the hillers to achieve this technique. Non-incorporated cultivation treatments were applied after cultivating, but over the entire plot area (not as directed sprays). Postemergence applications of metribuzin and metolachlor in the experiment to determine cultivar sensitivity to such treatments were applied as blanket applications rather than directed sprays. The post hilling treatments in two of the four replicates however were inadvertently applied as directed sprays. Pertinent data for each of the experiments are as follows:

		Dates of application					
Exp	Planted	Pre	E Post	Cult	Hilling	Vine Kill	Harvest
I	4/19	5/5	5/20	5/20(5/28)*	6/18	8/27	9/13
II	4/19	5/7	5/20	5/28	6/18	8/27	9/13
III	4/19	5/7	-	-	-	8/27	9/13
IV	4/22	5/6		5/28	6/21	9/14	9/28

*sethoxydim, fluazifop-butyl and CGA 82725 applied on 5/28 when grasses were 2" tall. All other cultivation applications were made on 5/20.

The entire experimental area in experiment I was oversprayed with metribuzin at 0.6 kg/ha, in experiment II with dinoseb (2-sec-butyl-4,6-dinitrophenol) at 3.36 kg/ha, and in experiment IV with linuron (3-(3,4-dichlorophenyl)-1-methoxyl-1-methylurea) at 1.12 kg/ha. All these applications were made prior to ground crack.

Ratings on weed control phytotoxicity and maturity were made on a scale of one to nine. Weed control ratings of one are equivalent to complete ground cover with weeds, at seven a few weeds are present but there is no reduction in yield, quality or harvest efficiency - 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 but no yield or quality reduction, and the rating of nine indicates no crop damage. The maturity scale indicates relative degrees of senescence. Nine infers that plants are dead due to natural senescense, 1 refers to vigorously growing plants.

RESULTS AND DISCUSSION

Barnyardgrass pressure was moderately severe in the experiments I, II, and III. Experiments I, II and IV were cultivated and hilled once. Experiment III was not cultivated or hilled. Weed pressure from broadleaf weeds was light. The primary broadleaf species present was smartweed (Polygonum pensylvanicum L.). The overspray of the preemergence herbicides in 3 of the experiments was in part a reason for the lower pressure. However, pressure was light in the experiment where no overspray herbicide was used. Yield was not significantly affected by any of the herbicide treatments in any of the experiments. The poor initial performance of some of the preemergence applications could be explained by the abnormally dry weather conditions shortly after the preemergence treatments. No appreciable rainfall occurred after these sprays were applied for a period of approximately 2 weeks. Timely rains began approximately May 21 and extended until June 4. Heavy rain deposited approximately 20.3 cm during a two day period on an already moist soil. The remaining growing season was dry with 13.6 cm less precipitation for the months of July, August, September and October than the ten year average. The eratic rainfall is in part responsible for some abnormal weed control. In Table 1 the most effective treatment was a split application of metolachlor applied after cultivation and after hilling at 0.84 kg/ha per application. The hilling application of metolachlor alone resulted in good weed control between rows but weed control was inadequate within the rows. On the other hand, the at cultivation application of metolachlor provided good weed control within rows but poor between rows. Pendimethalin (N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobezenamine) and oryzalin (3,5-dinitro-N^4,N^4-dipropylsulfanilamide) applied at cultivation resulted in leaf distortion. This distortion did not last for a long period of time. However, it resembled potato mosiac and could present a problem in seed growing areas. Pendimethalin applied at hilling gave similar weed control between rows as metolachlor. Sethoxydim, fluazifop-butyl and CGA82725 applied after cultivation provided good initial control. This control was short lived with all 3 materials. The at hilling application of these materials was ineffective in controlling barnyardgrass.

The most effective treatments listed in Table 2 were the 3 rates of S734 applied preemergence to the potato crop. These treatments gave season long control. Another material that approached commercially acceptable control is the post cultivation and post hilling application of fluazifop-butyl. This chemical was applied without the recommended crop oil additive. It provided longer control than a similar material, sethoxydim, which was also applied without crop oil. The combination of EPTC at 5.04 kg/ha and napropamide at 1.68 kg/ha also provided near commercial control throughout the season. The standard labelled herbicides were not effective except in the early season control.

In Table 3 the Mobay 2492 and Mobay 2602 treatments alone or in combination with metribuzin gave season long control of barnyardgrass. The Mobay 2602 treatments however were more effective. The 4E and the 50DG formulations of pendimethalin were equal in performance. However, acceptable weed control only lasted through the early part of June. Metolachlor in combination with metribuzin provided effective control in this experiment where the soil was not tilled after planting.

The results in Table 4 identify cultivar sensitivity to metribuzin applications. Of the clones tested 'Superior' and 'Belchip' were the most sensitive to applications of metribuzin after cultivation. 'Rosa' was intermediate and 'Katahdin' almost insensitive to applications of metribuzin. However, it should be noted that 'Superior' and 'Belchip' plants were most advanced at time of application. Applications of metribuzin at hilling had no effect on any of the varieties. Metolachlor applications at any stage did not produce phytotoxic effects on any of the varieties. Flowering of 'Superior' and 'Belchip' plants was delayed by metribuzin treatments. No significant yield reduction was associated with herbicide treatment in this or the other experiments.

LITERATURE CITED

1. Morrow, L. S. and H. J. Murphy. 1979. A comparison of several herbicide combinations for weed control in 'Katahdin' potatoes. Proc. NEWSS 33:183-186.

2. Murphy, H. J. 1979. Economic losses of potatoes due to weeds. Proc. NEWSS 33:48-51.

3. Murphy, H. J. and T. Gajewski. 1977. The effect of several herbicides applied preemergence at dragoff and layby on weed control in white potatoes. Proc. NEWSS 31:176-178.

4. Selleck, G. W. and S. L. Dallyn. 1978. Herbicide treatments and potato cultivar interactions for weed control. Proc. NEWSS 32:152-156.

5. Sieczka, J. B. 1977. The effect of alachlor and linuron on six potato varieties. Proc. NEWSS 31:189-193.

6. Sieczka, J. B. 1975. The effect of postemergence applications of metribuzin on 6 potato cultivars. Proc. NEWSS 29:308-313.

7. Sieczka, J. B. and J. F. Creighton. 1981. Long Island potato weed control results, 1980. Proc. NEWSS 35:118-123.

8. Yip, C. P., H. H. Hatfield and R. D. Sweet. 1976. Multiple postemergence applications of linuron and metribuzin to potatoes. Proc. NEWSS 30:252-255.

9. Yip, C. P., D. T. Warholic, G. W. Selleck and R. D. Sweet. 1977. Response of potatoes to alachlor and metribuzin. Proc. NEWSS 31:184-188.

Table 1. The effect of time of application of grass control herbicides on barnyardgrass control, 1982. (Exp I)

Treatment[a/]				Barnyardgrass Control Rating[c/]					
				5/19	6/10	7/20	8/26		
								Rows	
Chemical	Rate (kg/ha)	Timing[b/]	Yield (t/ha)				Ave	In.	Betw.
Control			30.7	6.8	5.5	6.3	3.9	4.3	3.5
metolachlor	1.12	Pre	30.6	6.5	7.8	6.8	4.9	5.8	4.0
metolachlor	1.68	Cult	28.0	4.5	8.3	7.5	6.4	7.8	5.0
metolachlor	1.68	Hill	30.6	6.0	5.0	6.3	5.4	3.3	7.5
metolachlor	.84	Cult & Hill	29.3	7.0	8.8	9.0	8.0	7.5	8.5
metolachlor (G)	1.12	Hill	30.0	6.0	5.5	7.5	6.1	5.8	6.5
pendimethalin	1.68	Pre	23.6	7.3	6.5	6.0	2.9	3.0	2.8
pendimethalin	1.68	Cult	26.1	5.5	8.5	6.0	4.6	6.0	3.3
pendimethalin	1.68	Hill	32.3	5.5	5.5	7.0	5.3	3.3	7.3
oryzalin	1.68	Pre	31.2	7.8	7.5	7.5	5.9	6.3	5.5
oryzalin	1.68	Cult	23.7	4.8	7.3	5.5	4.0	5.5	2.5
oryzalin	1.68	Hill	29.2	6.5	5.5	6.3	4.0	4.0	4.0
napropamide	1.68	Pre	27.6	5.5	4.0	5.5	3.5	3.5	3.5
napropamide	1.68	Cult	24.6	5.8	8.0	7.0	5.4	6.3	4.5
napropamide	1.68	Hill	29.1	7.0	5.5	6.8	5.1	4.8	5.5
alachlor	2.0	Pre	31.6	7.0	8.5	6.8	4.3	5.3	3.3
alachlor	2.0	Cult	31.9	5.8	9.0	6.5	4.3	5.0	3.5
alachlor	2.0	Hill	26.0	5.8	5.0	5.5	5.6	3.3	8.0
sethoxydim	0.28	Cult	28.2	5.5	8.8	7.0	4.5	5.3	3.8
sethoxydim	0.28	Hill	31.8	5.0	4.8	5.8	4.9	4.0	5.8
fluazifop-butyl	0.28	Cult	27.7	5.8	7.3	6.0	3.5	3.8	3.3
fluazifop-butyl	0.28	Hill	26.9	5.0	6.3	6.3	3.9	3.5	4.3
CGA 82725	0.28	Cult	31.1	5.3	9.0	6.5	5.4	6.3	4.5
CGA 82725	0.28	Hill	27.4	5.8	5.6	6.3	5.1	3.8	6.5
Waller-Duncan	(.05)		(ns)	(2.4)	(1.5)	(1.9)	(2.0)	(2.4)	(2.1)

a/ Metribuzin was applied as an overspray at a rate of 0.6 kg/ha to entire experimental area.

b/ Preemergence applications were made on May 5th, cultivation treatments on May 20th, and hilling applications on June 18th.

c/ Weed control ratings based on scale of 1-9, 9=absence of weeds, 7=few weeds but commercially acceptable, 1=complete ground cover with weeds.

Table 2. The effect of 14 herbicide treatments on weed control in potatoes, 1982. (Exp II)

Treatment[a/]				Barnyardgrass Control Rating[b/]					
				5/25	6/11	7/20	8/27		
								Rows	
Chemical	Rate (kg/ha)	Timing	Yield (t/ha)				Avg.	In.	Betw.
Control			34.2	4.3	6.0	5.3	4.0	4.0	4.0
fluazifop-butyl	0.56	Cult, Hill	34.0	5.5	9.0	7.7	6.9	6.8	7.0
sethoxydim	0.56	Cult, Hill	29.3	6.3	9.0	7.0	5.0	5.8	4.3
S734	0.84	Pre	29.3	6.3	9.0	8.3	7.3	7.8	6.8
S734	1.12	Pre	29.7	6.0	8.3	9.0	7.9	8.0	7.8
S734	1.68	Pre	32.1	6.8	8.8	9.0	8.4	8.8	8.0
EPTC	5.04	Pre, E Post	34.0	8.5	7.8	6.3	4.8	5.8	3.8
EPTC + extender	5.04	Pre	31.1	6.5	8.3	6.7	4.6	5.3	4.0
EPTC +	5.04	Pre							
napropamide	1.68	Cult	31.9	7.0	9.0	6.3	6.9	7.8	6.0
EPTC	6.72	E Post	34.2	8.3	7.8	7.0	5.6	6.3	5.0
trifluralin	1.12	E Post	30.1	7.5	8.3	6.3	5.4	6.5	4.3
metribuzin	0.28	Pre, Cult, Hill	33.7	6.3	7.5	7.7	5.9	6.0	5.8
metribuzin	0.28	Cult, Hill	32.3	6.3	8.3	6.7	5.5	5.5	5.5
alachlor	1.12	Pre	32.9	6.5	7.3	7.7	4.6	5.3	4.0
Waller-Duncan$_{(.05)}$			(ns)	(1.3)	(1.5)	(1.9)	(1.3)	(1.3)	(1.9)

a/ Rates listed indicate rate/application. Pre treatments applied 5/7/82, E Post-5/20/82, Cult-5/28/82, Hill-6/18/82. Entire experimental area oversprayed with dinoseb at 3.36 kg/ha.

b/ Rating based on scale of 1-9; 9=no weeds, 7=commercial control, 1=complete ground cover with weeds .

Table 3. The effect of two formulations of pendimethalin, and two rates of Mobay 2492 and 2602 on barnyardgrass control and yield of 'Wauseon' potatoes.(Exp. III)

Treatment[a/]				Barnyardgrass control rating[b/]					
Chemical	Form.	Rate (kg/ha)	Yield t/ha	5/25	6/11	7/20		8/27	
							Avg.	In.	Betw.
Control			25.5	4.0	6.7	4.0	3.7	(2.7)	(4.7)
pendimethalin	4E	1.68	28.2	6.7	8.7	6.0	5.7	(5.7)	(5.7)
pendimethalin	50DG	1.68	29.7	7.3	7.3	5.7	5.2	(6.0)	(4.3)
Mobay 2492	50W	1.68	33.5	6.3	9.0	9.0	7.3	(7.7)	(7.0)
Mobay 2492	50W	1.68							
plus metribuzin	75W	0.56	27.8	8.0	9.0	8.3	7.3	(7.7)	(7.0)
Mobay 2492	50W	3.36	29.3	7.0	9.0	9.0	7.2	(7.0)	(7.3)
Mobay 2492	50W	3.36							
plus metribuzin	75W	0.56	28.6	7.7	9.0	8.7	7.0	(7.0)	(7.0)
Mobay 2602	400EC	1.68	30.8	7.0	9.0	9.0	7.8	(8.0)	(7.7)
Mobay 2602	400EC	1.68							
plus metribuzin	75W	0.56	30.7	6.7	9.0	8.3	8.0	(8.0)	(8.0)
Mobay 2602	400EC	3.36	28.8	7.0	9.0	9.0	8.5	(8.3)	(8.7)
Mobay 2602	400EC								
plus metribuzin	75W	0.56	24.1	7.3	9.0	8.0	8.7	(8.7)	(8.7)
metolachlor	8E	2.24							
plus metribuzin	75W	0.56	28.6	8.3	9.0	9.0	7.7	(7.7)	(7.7)
Waller Duncan (0.5)				(1.3)	(0.8)	(1.1)	(1.3)	(1.0)	(1.9)

a/ Herbicide applications made on 5/7/82. Mobay 2492 and 2602 treatments were incorporated with a weeder.

b/ Weed control ratings based on scale of 1-9, 9=absence of weeds, 7=few weeds but commercially acceptable, 1=complete ground cover with weeds.

Table 4. The effect of time of application of metribuzin and metolachlor on phytotoxicity, grass control, maturity and yield of 4 potato cultivars, 1982[a/] (Exp IV)

Treatment[b/]			Superior						Katahdin						Belchip						Rosa					
			Phyto.			Byg	Mat	Yield	Phyto.			Byg	Mat	Yield	Phyto.			Byg	Mat	Yield	Phyto.			Byg	Mat	Yield
Chemical	Rate (kg/ha)	Timing	6/1	6/11	6/23	8/27	8/27	(t/ha)	6/1	6/11	6/23	8/27	8/27	(t/ha)	6/1	6/11	6/23	8/27	8/27	(t/ha)	6/1	6/11	6/23	8/27	8/27	(t/ha)
metribuzin	0.28	P C H	5.5	7.5	8.5	7.8	7.5	32.6	8.3	9.0	8.8	8.8	3.0	49.1	5.8	8.5	8.3	8.2	5.0	43.1	6.5	8.8	8.3	8.5	5.0	34.4
metribuzin	0.28	C	5.5	6.5	8.5	4.0	8.0	31.0	7.8	9.0	8.8	8.8	2.8	48.3	6.0	7.8	8.8	8.0	4.8	47.3	6.5	9.0	8.5	8.2	5.2	38.6
metribuzin	0.28	H	9.0	9.0	8.5	6.0	8.5	30.7	9.0	9.0	8.3	8.2	3.5	46.4	9.0	9.0	9.0	7.0	5.8	41.2	9.0	8.8	8.5	7.5	5.5	35.4
metolachlor	1.12	P C H	9.0	8.5	8.8	9.0	8.2	25.7	9.0	8.5	8.0	9.0	3.5	41.2	9.0	9.0	8.5	9.0	5.2	43.0	9.0	9.0	8.8	9.0	5.8	32.1
metolachlor	1.12	C	9.0	9.0	8.8	7.8	8.0	30.2	9.0	9.0	8.8	8.2	3.2	48.7	9.0	9.0	8.8	8.8	5.2	44.1	9.0	9.0	8.8	8.0	5.0	36.2
metolachlor	1.12	H	9.0	9.0	9.0	6.8	8.8	30.4	9.0	9.0	9.0	8.0	3.5	45.3	9.0	9.0	9.0	9.0	4.5	46.7	8.5	8.5	8.8	8.0	5.0	38.6
control			9.0	9.0	8.8	5.2	8.8	29.7	9.0	8.8	9.0	8.0	3.2	41.4	9.0	9.0	9.0	7.8	5.8	42.3	9.0	9.0	9.0	7.8	5.8	38.1

a/ Ratings based on a scale of 1-9, phytotoxicity rating of 9=no injury, 7=moderate injury but no yield or quality reduction, 1=all crop plants killed; weed control rating 9=absence of weeds, 7=few weeds but commercially acceptable, 1=complete ground cover with weeds; maturity 9=stems and leaves dry, 1=plants green and vigorous; Phyto=phytotoxicity, Byg=barnyardgrass, Mat=maturity.

b/ Rates listed indicate rate/application. Timing abbreviations and dates of application are as follows: P=preemergence (5/6/82), C=cultivation (5/28/82), H=hilling (6/21/82).

THE EFFECT OF VARIOUS FERTILIZER APPLICATIONS ON THE YIELD OF SNAP BEANS GROWN IN A LIVE MULCH.

A.L. Schepps
and
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ABSTRACT

The experiment was conducted during the summer of 1982 at the University of Connecticut Agronomy Research Farm in Storrs to evaluate the effects of various fertilizer treatments on the yield of snap beans cv 'Provider' planted in two live mulches: colonial bentgrass and commom white clover. The soil type was a Woodbridge fine sandy loam and with 3.5-4% organic matter. Fertilizer was broadcasted and incorperated on June 15, 1982 at the time of seeding the mulches or surface broadcasted or banded on July 23, 1982 at the time of bean planting. Fertilizer was applied to the control plots on the earlier date.

Where beans were seeded into a clover mulch yields were significantly reduced where broadcast fertilizer applications were used (Table 1). Banding of fertilizer at the 1120 kg/ha rate resulted in bean yields equivalent to the control. There was no advantage to banded fertilizer applications at the 2240 kg/ha rate.

Yield of beans planted in the grass mulch was not significantly affected by fertilizer treatment as compared to the control although the same trends in yield could be seen as with clover mulch treatments. The lack of significance resulted from poor growth of the bentgrass during the first half of the experiment due to adverse weather conditions and herbicide injury.

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Table 1. Effects of various fertilizer applications on snap beans grown in an established live-mulch. 1/

Fertilizer treatment 2/					Bean yield (g/1.83m row)
No.	Method	Rate(kg/ha) 3/	Date	Mulch	Fresh wgt.
1	broadcast incorp.	1120	6/15/82	no mulch weed free	1757.7
2a	broadcast incorp.	1120	6/15/82	clover	698.3
3a	band	1120	7/23/82	clover	1435.0
4a	band	2240	7/23/82	clover	1145.0
5a	broadcast surface	1120	7/23/82	clover	680.6
LSD 5%					735.0
1	broadcast incorp.	1120	6/15/82	no mulch weed free	1757.7
2b	broadcast incorp.	1120	6/15/82	grass	1181.0
3b	band	1120	7/23/82	grass	2131.0
4b	band	2240	7/23/82	grass	1924.3
5b	broadcast surface	1120	7/23/82	grass	1395.3
LSD 5%					651.1

1/ Mulches were planted 6/15/82; Beans were planted 7/23/82.
2/ Due to excessive precipitation 56kg/ha of N was broadcasted (7/7/82) on all plots.
3/ All fertilizers were a 10-10-10.

POSTEMERGENCE APPLICATIONS OF DICAMBA IN SEVERAL VARIETIES OF SWEET CORN 1/

M.W. Beale, R.D. Ilnicki, Ivalou Detlefsen and D.B. Vitolo 2/

ABSTRACT

Fourteen cultivars of sweet corn, popular in New Jersey and the Northeast, representing maturity seasons of 64 to 90 days were treated with postemergence applications of dicamba at two stages of growth. Sweet corn was in the 3 to 4-leaf stage on the first date and in the 5 to 6-leaf stage on the second date. A preemergence application of alachlor was made to all varieties to reduce competition of grassy weeds and to obtain a better assessment of broadleaf weed control. Dicamba was applied at 0.25 and 0.5 lb/A on the first date in one experiment and at 0.5 lb/A in another experiment. On the second date, in both experiments, the herbicide was applied at 0.25 lb/A to another set of plots previously treated with 0.25 lb and 0.5 lb/A.

It was found that yields for the early season cultivar Blitz (64 days) was reduced by a single application of dicamba at 0.5 lb/A and by an application of 0.5 lb/A followed by an application of 0.25 lb/A. The reduction was due to a decrease in marketable ears.

Yield of Quicksilver (75 days), an early mid-season cultivar, was reduced by the 0.5 lb/A rate and by an application of 0.5 lb/A followed by an additional 0.25 lb/A. The reduction was related to decrease in marketable ears and ear weight. Yield of Merit (80 days), a main season cultivar, was reduced by the 0.25 lb/A rate following an initial application of 0.5 lb/A and this reduction was due to a decrease in ear weight.

From this study we feel that susceptibility of sweet corn to postemergence applications of dicamba is not associated with any specific maturity class but that injury can result to any variety particularly if the rate of herbicide is greater than what is needed for weed control. We feel that little or no injury would result if a single application of 0.25 lb/A is used anytime during early stages of sweet corn development.

INTRODUCTION

The use of dicamba (3,6-dichloro-o-anisic acid) in corn (*Zea mays indentata*) as a postemergence herbicide is gaining more acceptance particularly for the control of broadleaf perennial and late-germinating annual broadleaf weeds. This practice could be effectively used in sweet corn (*Zea mays saccharata*) although the weed problems may not be as troublesome as in field corn since the growing season of sweet corn, regardless of maturities, is much shorter.

1/ New Jersey Agricultural Experiment Station Publication No. J-15173-2-82.

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From preliminary unreported studies conducted at our Station it was observed that yields were reduced in Aztec, an early season cultivar, and in Merit, a late season cultivar by overall postemergence applications of dicamba at rates greater than those normally used for weed control.

It was the objective of this study to determine the effects of over-the-top applications of dicamba to a number of sweet corn cultivars, popular in New Jersey and the Northeast, representing a number of maturity seasons.

MATERIALS AND METHODS

Two experiments were conducted at the Adelphia Research Center, New Jersey Agricultural Experiment Station, Adelphia, New Jersey, in 1982. In one experiment, designated Experiment I, cultivars consisting of ten sweet corn maturities were treated with postemergence dicamba. The cultivars were Blitz, Spring White, Sprite, Earlibelle, Harmony, Quicksilver, Wonderful, Jubilee, Sweet Sal, and Atlantic having maturities of 64, 66, 68, 71, 73, 75, 82, 84, 86, and 90 days, respectively. All cultivars were planted in separate but adjoining areas on May 19 in Freehold sandy loam soil using a randomized complete block design with three replications. Immediately after planting, plots 15' long by 4 rows were established to receive the various herbicide treatments. Alachlor [2-chloro-2',6'-diethyl-*N*-(methoxymethyl)acetanilide] was applied the same day after planting at the rate of 1.5 lb/A in 40 gpa, with water the carrier, using a CO_2-propelled backpack sprayer. Twenty dates later, on June 8, when sweet corn was in the 3 to 4-leaf stage and weeds were in the cotyledonary to early seedling stage and 1 to 2 inches tall, dicamba was applied to predesignated plots at 0.25 and 0.5 lb/A. On June 25, thirty-seven days after planting, another set of plots received dicamba at 0.25 lb/A in addition to the previously applied dicamba and preemergence alachlor. At this time, corn was in the 5 to 6-leaf stage and weeds had 3 to 4 leaves and were 2 to 4 inches tall.

In the second experiment, designated Experiment II, four additional cultivars were planted and treated in the same manner as previously described for Experiment I with two exceptions. Dicamba at 0.25 lb/A early post was omitted and an unweeded check included. The four cultivars were Aztec, Commanche, Merit, and Commander representing maturities of 68, 72, 80, and 86 days respectively.

Throughout the study observations were made on varietal responses and weed control, and detailed ratings on specific weeds were made on July 21 using the scale 0 to 10, where 0 = no effect on weeds or crop and 10 = complete weed control. Weeds in the experimental area were represented by common ragweed (*Ambrosia artemisiifolia* L.), common lambsquarters (*Chenopodium album* L.), and redroot pigweed (*Amaranthus retroflexus* L.).

In addition to the weedy check, alachlor + atrazine (2-chloro-4-ethylamino-6-isopropylamino-s-triazine) at 1.5 and 1.0 lb/A respectively, served as the standard treatment. In the first experiment, no weedy check was included but alachlor and atrazine treatments served as the standard.

When in a marketable condition ears from the two center rows of the 4-row plots were harvested, counted, and weighed. Since each cultivar was harvested at different times, yields in hundredweight/A, number of marketable ears/A, and weight/ear were statistically analyzed separately for each cultivar.

RESULTS AND DISCUSSION

Summarized in Table 1 are the responses of the broadleaf weeds found in the experimental areas, to the various application schedules of dicamba. The infestations were not severe enough to have had a serious detrimental effect on yield; however, they were in sufficient numbers so that an assessment of the control affected by the various treatments could be made. From this table, it can be seen that control increased with increasing rates of dicamba or with an additional increment of the herbicide applied a second time. Since all dicamba treatments received alachlor preemergence, there were little or no grassy weeds in the area to confound the responses of the sweet corn to the dicamba treatments.

For ease of discussion the results from Experiment II will be discussed first. In Table II are summarized yield and related data for each of the four cultivars in the experiment. Yields measured in hundredweights/A were not affected by a single application of dicamba at 0.5 lb/A for any of the four cultivars, Aztec (68 days), Commanche (72 days), Merit (80 days) and Commander (86 days); however, an application of 0.25 lb/A of dicamba as a sequential to the previously-applied dicamba at 0.5 lb/A did affect yield of Merit (80 days) slightly. This decrease in yield was not the result of a decrease in numbers of marketable ears but to a decrease in ear weight. That the application of an additional 0.25 lb/A of dicamba following the initial 0.5 lb/A could have a detrimental effect was also manifested in the slight reduction in ear weight of Commanche (72 days) but was not of sufficient magnitude to affect total yield/acre.

In Table III are summarized yield and related data for the additional ten cultivars studied in Experiment I. From these data it can be seen that there were some significant differences in total yield of some cultivars which were related to herbicide treatment. Yields of Blitz (64 days) were reduced by a single application of dicamba at 0.5 lb/A but only slightly reduced by the two applications of 0.25 lb/A each. Yield reduction from one application of 0.5 lb/A and an additional 0.25 lb/A at a later time were comparable to the reduction effected by a single application of 0.5 lb/A applied early. These reductions were not due to reductions in ear weight but to a reduction in numbers of marketable ears.

There were no reductions in yield or number of ears of the other early season cultivars which included Spring White (66 days) and Sprite (68 days) or the early main season cultivars Earlibelle (71 days) and Harmony (73 days), however, Quicksilver (75 days) was affected by a single application of dicamba at 0.5 lb/A and by an application of the herbicide at 0.5 lb/A followed by an additional application of 0.25 lb/A. It is interesting to note that there was no significant reduction in yield from two applications of 0.25 lb/A. It is

obvious that rate on the first application date was an important factor. Reductions in yield of Quicksilver were related to number of marketable ears and ear weight. Ear weight reduction was also observed in Sprite (66 days), Earlibelle (71 days) and Harmony (73 days); however, they were not great enough to reduce total yield/acre.

In considering the responses of the main season and late main season cultivars some interesting observations can be made. No rate or application schedule of dicamba had any significant effect on yield or numbers of marketable ears of Wonderful (82 days), Jubilee (84 days), Sweet Sal (86 days) and the late main season cultivar Atlantic (90 days); however, there were slight reductions in ear weight from all treatments of dicamba either as a single application of 0.5 lb/A, two applications of 0.25 lb/A each, or an application of 0.5 lb/A followed by an additional application of 0.25 lb/A but these reductions in ear weight were not great.

SUMMARY

Applications of dicamba were made postemergence to a number of sweet corn cultivars representing several maturity seasons. Some cultivars were affected by these applications. Yields of Blitz (64 days) and Quicksilver (75 days) were reduced by a single application of 0.5 lb/A, an additional 0.25 lb/A reduced yields of Quicksilver (75 days) and Merit (80 days). Yield reduction was not associated with any specific maturity class.

Table 1. Weed control in sweet corn with preemergence alachlor followed by postemergence dicamba.

Herbicice(s)	Rate, lb/A	Weed control[1]		
		Common ragweed	Common lambsquarters	Redroot pigweed
alachlor (pre) followed by dicamba (E. post)	1.5 pre 0.25 E. post	9.6	9.3	9.3
	1.5* pre 0.5 E. post	9.5	9.8	9.4
alachlor (pre) followed by dicamba (E. post) followed by dicamba (L. post)	1.5 pre 0.25 E. post 0.25 L. post	9.9	9.8	9.9
	1.5* pre 0.5 E. post 0.25 L. post	10.0	10.0	10.0
alachlor + atrazine (pre)	1.5 + 1.0	8.7	10.0	9.8
weedy check	*	0.0	0.0	0.0

1. Based on scale 0 to 10 where 0 = no control and 10 = complete control

*Included only in Experiment II.

Table 2. Effects of some herbicide treatments on ears/acre, weight/ear and yield in hundred weight/acre of four sweet corn cultivars (Exp. II)

Cultivars	Herbicide treatments														
	1.5 lb/A alachlor + 0.50 lb/A dicamba			1.5 lb/A alachlor + 0.5 lb/A dicamba 0.25 lb/A dicamba			1.5 lb/A alachlor + 1.0 lb/A atrazine			weedy check			Av.		
	Cwt/A	Ears/A x 100	Wt/Ear	Cwt/A	Ears/A x 100	Wt/Ear	Cwt/A	Ears/A x 100	Wt/ear	Cwt/A	Ears/A x 100	Wt/Ear	Cwt/A	Ears/A x 100	Cwt/Ear
Aztec (68)[1]	110a	210a	.52ab	87a	173a	.50 ab	97a	173a	.56a	27b	58b	.45b	80	154	.51
Commanche (72)	138a	272a	.50b	144a	282a	.51b	109a	183b	.59a	44b	91c	.48b	109	207	.52
Merit (80)	132a	195a	.68a	94b	160a	.60a	119ab	160a	.75a	62b	84b	.74a	102	150	.69
Commander (86)	126a	170a	.74a	130a	186a	.70a	170a	213a	.79a	42b	64b	.69a	117	158	.73

[1] Numbers in parenthesis represent days to maturity

[2] Letters denote Duncan's Multiple Range Test; yields and yield components cannot be compared between varieties; means followed by the same letter are not significantly different at .05 level.

Table 3. Effects of some herbicide treatments on ears/acre, weight/ear, and yield in cwt/acre of ten sweet corn cultivars (Exp. I).

Cultivars	Herbicide Treatments																	
	1.5 lb/A alachlor + .25 lb/A dicamba			1.5 lb/A alachlor + .50 lb/A dicamba			1.5 lb/A alachlor + .25 lb/A dicamba + .25 lb/A dicamba			1.5 lb/A alachlor + .50 lb/A dicamba + .25 lb/A dicamba			1.5 lb/A alachlor + 1.0 lb/A atrazine			Av.		
	Cwt/A	Ears/A x 100	Wt/Ear	Cwt/A	Ears/A x 100	Wt/Ear	Cwt/A	Ears/A x 100	Wt/Ear	Cwt/A	Ears/A x 100	Wt/Ear	Cwt/A	Ears/A x 100	Wt/Ear	Cwt/A	Ears/A x 100	Wt/Ear
Blitz (64)[1]	77a	139a	.55a	39c	82b	.47a	63ab	114 ab	.56a	56abc	111ab	.51a	101ab	91b	.57a	58	108	.54
Spring White (66)	109a	216a	.50a	97a	198a	.49a	98a	200a	.49a	95a	203a	.47a	153a	207a	.49a	98	201	.49
Spite (68)	154a	334ab	.46b	165a	365a	.45b	153a	329ab	.46b	151a	328ab	.46b	152a	292b	.52a	154	327	.47
Earlibelle (71)	161a	371a	.43ab	149a	370a	.40ab	149a	346ab	.43ab	109a	341ab	.32b	145a	282b	.51a	143	339	.42
Harmony (73)	181a	326ab	.55b	188a	375a	.50c	162a	322ab	.50c	162a	326ab	.50c	193a	306b	.63a	176	327	.54
Quicksilver (75)	200a	365a	.54b	170b	321b	.53b	175ab	329a	.53b	161b	318b	.50b	180ab	299b	.60a	174	318	.55
Wonderful (82)	91a	176a	.51ab	107a	220a	.49b	95a	193a	.49b	87a	175a	.51ab	98a	173a	.57a	94	184	.52
Jubilee (84)	92a	160a	.59b	106a	205a	.52c	100a	181a	.55b	80a	160a	.51c	103a	155a	.67a	96	170	.57
Sweet Sal (86)	152a	264b	.58bc	136a	260a	.52c	127a	232a	.55c	132a	254 a	.51c	148a	235a	.63a	139	247	.56
Atlantic (90)	135a	193a	.70a	145a	222a	.65a	116a	190a	.61a	130a	208a	.64a	155a	220a	.70a	135	205	.66

[1]Numbers in parenthesis represent days to maturity

[2]Letters denote Duncan's Multiple Range Test; yields and yield components cannot be compared between cultivars; means followed by the same letter are not significantly different at .05 level.

EFFECT OF FIVE GRASS HERBICIDES ON YIELD, CROP INJURY, AND WEED CONTROL IN WHITE POTATOES

Hugh J. Murphy and Leigh S. Morrow[1]

ABSTRACT

Dinoseb plus dalapon as a preemergence treatment controlled wild radish in white potatoes significantly better than metribuzin plus alachlor preemergence or any of the preemergence metribuzin treatments with alachlor, fluazifop-butyl, metolachlor, or sethoxydim applied at layby.

Metribuzin plus alachlor plus glyphosate as a preemergence tank mix provided the best control of quackgrass. Metribuzin in combination with most of the grass herbicides controlled quackgrass also but not particularly better than two cultivations alone and no herbicide.

Yields were not significantly affected by any of the chemical treatments in this test nor was there any evidence of permanent crop injury to the potato plants.

INTRODUCTION

There are many post emergence grass herbicides in various stages of development at this time and a few labeled compounds such as alachlor [2-chloro-2',6'-diethyl-*N*-(methoxymethyl)acetanilide] and metolachlor [2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)acetamide] available for grass control. All of these compounds must be used in combination with broadleaf herbicides for broad spectrum weed control in the white potato (*Solanum tuberosum* L. 'Katahdin'). For this study to determine particularly which combinations might be most efficacious for grass and broadleaf weed control, metribuzin [4-amino-6-*tert*-butyl-3-(methylthio)-*as*-triazin-5(4*H*)-one] and glyphosate [*N*-(phosphonomethyl)glycine] were used as the preemergence herbicides for broadleaf weed control. The standard treatment in this test was dinoseb [2-*sec*-butyl-4,6-dinitrophenol] plus dalapon [2,2-dichloropropionic acid]. Crop injury ratings, yields, and weed control ratings for several weed species were obtained.

MATERIALS AND METHODS

The test site was located on a Perham gravelly loam soil with a 2.8 percent organic matter content. Plot size was a single row, 20 feet in length, arranged in a randomized block design with six replicates. Herbicides were applied with a compressed air sprayer equipped with a two-nozzle hand-held boom. Delavan raindrop nozzles were used with No. 33974-3

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tips. Applications were made in 80 gallons of water using 40 psi. Application dates and rates are presented in Table 1. Weed counts were made in the uncultivated check plots in July, as reported in Table 1.

RESULTS AND DISCUSSION

Yields were not significantly affected by herbicide treatments compared to the standard of dinoseb plus dalapon, except for the metribuzin preemergence treatment followed by metolachlor at layby which was significantly lower in yield than the standard and equal to the cultivated check plots. Crop injury ratings were made but no permanent phytotoxicity data recorded for any of the treatments in Table 1.

Lambsquarters (*Chenopodium album* L.) and several other broadleaved weeds were adequately controlled by all treatments in this study. The standard treatment of dinoseb plus dalapon applied preemergence gave the best control of wild radish (*Raphanus raphanistrum* L.) followed by metribuzin plus alachlor at preemergence, and then metribuzin preemergence with a layby application of CGA-82725 (chemistry not disclosed). Glyphosate combinations applied preemergence in this study did not provide satisfactory control of wild radish. It would appear from the data presented in Table 1 that metribuzin alone at preemergence or followed by grass herbicides at layby all gave poor control of wild radish.

Quackgrass (*Agropyron repens* L.) was controlled best by a combination of metribuzin plus alachlor plus glyphosate applied as a preemergence treatment. Metribuzin plus alachlor at preemergence with another layby treatment of alachlor gave good control of quackgrass. Other treatments that provided fair control of quackgrass were metribuzin preemergence with layby treatments of fluazifop-butyl [butyl 2-{4-(6-trifluoromethyl-2-pyridyl oxy) phenoxy} propionate] or sethoxydim [2{1-ethoxyimino-butyl}-5-{2-(ethylthio)-propyl}-3-hydroxy-2-cyclohexen-1-one]. It is also worth noting that the 'no treatment' which received two cultivations only did a fair job of controlling quackgrass.

Table 1. Effect of metribuzin in various combinations with alachlor, metolachlor, glyphosate, and other post emergence grass herbicides on yield and weed control in Katahdin potatoes. Maine - 1982.

Treatments (Lbs. a.i. per Acre)[a]	Yield Cwt./A.	Weed Control Ratings[b]			
		Quackgrass		Wild Radish	
		6-21	8-10	6-21	8-10
No treatment (no herbicide and no cultivation)	129	6.7	6.3	4.8	3.2
No treatment (no herbicide)	270	7.0	7.7	5.3	5.0
4.5 Dinoseb + 5.0 Dalapon, PE	305	6.8	7.3	8.2	8.3
0.5 Metribuzin[c], PE	283	6.3	6.2	5.8	6.5
0.5 Metribuzin + 2.5 Alachlor, PE	295	6.3	6.5	6.2	7.0
0.5 Metribuzin + 2.5 Alachlor, PE + 2.0 Alachlor, LB	313	7.2	7.7	6.5	6.7
0.5 Metribuzin, PE + 2.0 Alachlor, LB	276	6.7	6.8	6.3	6.3
0.5 Metribuzin, PE + 0.5 Fluazifop-butyl, LB[d]	310	6.3	7.7	6.0	6.5
0.5 Metribuzin, PE + 0.25 CGA-82725, LB[d]	296	6.7	7.0	5.8	7.0
0.5 Metribuzin + 0.25 CGA-82725, PE	286	6.8	7.0	6.2	6.3
0.5 Metribuzin + 2.0 Metolachlor, PE	265	6.5	7.3	6.0	6.2
0.5 Metribuzin, PE + 2.0 Metolachlor, LB	270	6.8	7.2	5.8	6.0
0.5 Metribuzin, PE + 0.2 Sethoxydim, LB[e]	287	6.7	7.7	6.0	6.0
0.5 Metribuzin + 2.5 Alachlor + 1.5 Glyphosate, PE	289	7.3	8.0	6.5	6.5
1.5 Glyphosate, PE + 2.5 Alachlor + 0.25 Metribuzin, LB	296	7.5	7.7	5.5	6.3
Waller Duncan L.S.D. (0.05)	34				

[a]Planted - May 24; killed - September 14; harvested - September 30, 1982.

Preemergence (PE) treatments applied - June 3. Temperature - 60F., partly cloudy; soil - moist; wind - 12-15 mph, west.

Layby (LB) treatments applied - July 14. Temperature - 82F., clear; soil - dry; wind - 2-5 mph, north.

[b]Rating code: 9 = complete absence of weeds and perfect crop.

1 = complete ground cover of weeds and all crop plants killed.

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

Agropyron repens - 4.0

Raphanus raphanistrum - 16.8

[c]Formulation 75% D.F.

[d]Plus 3% non-ionic surfactant.

[e]Plus 3% BASF crop oil.

EFFECT OF SEVERAL PREEMERGENCE AND POST EMERGENCE HERBICIDE TREATMENTS ON QUACKGRASS AND WILD RADISH CONTROL IN WHITE POTATOES

Hugh J. Murphy and Leigh S. Morrow[1]

ABSTRACT

Several combinations of dinoseb applied preemergence followed by post-emergence applications of diclofop, fluazifop-butyl, sethoxydim, and CGA-82725 were tested for quackgrass control in white potatoes. Dinoseb plus dalapon, dinoseb plus fluazifop-butyl, and glyphosate gave full-season quackgrass control in potatoes. The dinoseb plus dalapon treatment provided excellent wild radish control. Dinoseb plus sethoxydim, metribuzin, paraquat, linuron, and glyphosate gave only fair control of wild radish. Alachlor, trifluralin, and metolachlor did not control wild radish in potatoes grown in Maine during 1982.

INTRODUCTION

In Maine, there has been an increase in quackgrass (*Agropyron repens* L.) and wild radish (*Raphanus raphanistrum* L.) weed populations in white potato (*Solanum tuberosum* L. 'Katahdin') fields in Maine. In an attempt to stop, delay, or reverse the increase in wild radish, several preemergence and post-emergence herbicide combinations were applied. All combinations were compared to our standard preemergence treatment of dinoseb (2-*sec*-butyl-4,6-dinitrophenol) and dalapon (2,2-dichloropropionic acid). Yields, crop injury, and weed control ratings were made for all weed species present but only the weed control ratings for quackgrass and wild radish are presented in this paper. Essentially, none of the treatments injured the potato crop and all treatments controlled lambsquarters (*Chenopodium album* L.) and several other broadleaf weeds. There was negligible annual barnyardgrass (*Echinochloa crus-galli* (L.) Beauv.) in this study.

MATERIALS AND METHODS

The test site was located on a gravelly silt loam with 3.5 percent organic matter. Plot size was a single row, 20 feet in length, arranged in a randomized block design with six replicates. Herbicides were applied with a compressed air sprayer equipped with a two-nozzle hand-held boom. Delavan raindrop nozzles were used with No. 33974-3 tips. Applications were made at 40 psi at the rate of 80 gallons of mixture per acre. Pertinent dates of application and when ratings were made are reported in Table 1.

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RESULTS AND DISCUSSION

Yields were not significantly different between the various herbicide treatments but the uncultivated check was significantly lower in yield than all other treatments including the cultivated check probably due to weed pressure, lack of proper moisture, or a combination of both. Dinoseb plus dalapon preemergence, dinoseb plus fluazifop-butyl [butyl 2-{4-(6-trifluoromethyl-2-pyridyl oxy) phenoxy} propionate] pre- and post-emergence, and glyphosate [*N*-(phosphonomethyl)glycine] applied preemergence provided the best full season control of quackgrass. All other treatments such as dinoseb plus CGA-82725 (chemistry not disclosed) pre- and post-emergence, dinoseb plus sethoxydim [2{1-ethoxyimino butyl}-5-{2-(ethylthio)-propyl}-3-hydroxy-2-cyclohexen-1-one] pre- and post-emergence, and dinoseb plus diclofop (2[4-(2,4-dichlorophenoxy)phenoxy] propanoic acid) pre- and post-emergence did not provide full season quackgrass control. Other grass herbicides such as metolachlor [2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)acetamide] and alachlor [2-chloro-2',6'-diethyl-*N*-(methoxymethyl)acetanilide] did not control quackgrass as well as the dinoseb-dalapon standard treatment.

Dinoseb plus dalapon as the standard treatment in this study gave the best control of wild radish. Metribuzin [4-amino-6-*tert*-butyl-3-(methylthio)-*as*-triazin-5(4*H*)-one], pendimethalin [*N*-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine], linuron [3-(3,4-dichloropheny1)-1-methoxy-1-methylurea], and paraquat [1,1'-dimethyl-4,4'-bipyridinium ion] as preemergence applications provided some degree of wild radish control but better control was desired for commercial acceptability.

Table 1. Effect of several preemergence and post emergence herbicides on yield and weed control in Katahdin potatoes. Maine - 1982.

Treatments (Lbs. a.i. per Acre)[a]	Yield Cwt./A.	Weed Control Ratings[b]					
		Quackgrass			Wild Radish		
		6-21	7-13	8-10	6-21	7-13	8-10
No treatment (no herbicide and no cultivation)	145	5.7	6.7	5.3	4.8	5.2	3.0
No treatment (no herbicide)	300	5.5	7.2	7.0	4.2	7.3	6.0
4.5 Dinoseb + 5.0 Dalapon, PE	329	6.7	8.0	7.8	9.0	8.3	8.5
1.5 Dinoseb, PE + 0.5 Fluazifop-butyl, Post[c]	314	5.2	7.8	7.8	6.3	8.0	7.5
1.5 Dinoseb, PE + 0.25 CGA-82725, Post[c]	296	5.2	6.7	6.2	6.7	7.3	7.5
1.5 Dinoseb, PE + 0.25 Sethoxydim, Post[d]	335	5.7	7.8	6.0	6.3	7.7	7.3
1.5 Dinoseb, PE + 1.0 Diclofop, Post[c]	297	5.8	7.2	5.8	6.5	8.2	7.2
2.0 Metolachlor, PE	274	5.5	7.2	6.0	4.5	7.0	5.8
1.5 Pendimethalin	303	5.7	7.3	6.2	5.3	7.7	7.2
0.5 Metribuzin, PE	290	4.8	7.0	6.3	5.8	7.8	6.8
0.5 Linuron, PE	329	6.2	7.8	6.3	6.3	7.8	7.2
2.0 Alachlor, PE	314	5.3	7.3	6.5	5.2	7.2	6.2
0.5 Paraquat, PE	273	5.8	7.8	7.2	5.2	7.5	6.0
1.5 Glyphosate, PE	316	6.8	7.8	7.8	5.3	7.8	7.0
1.0 Trifluralin, PE	286	5.3	7.2	6.3	4.8	7.3	6.5
0.5 Metribuzin, PE	324	5.7	7.2	6.7	5.7	7.8	7.0
Waller Duncan L.S.D. (0.05)	60						

[a]Planted - May 24; killed - September 14; harvested - September 30, 1982.

Preemergence (PE) treatments applied - June 4. Temperature - 68F., clear; soil - moist; wind - 6-8 mph, southwest.

Post emergence (Post) treatments applied - June 30. Temperature - 70F., partly cloudy; soil - moist; wind - 8-12 mph, west.

[b]Rating code: 9 = complete absence of weeds and perfect crop; 1 = complete ground cover of weeds and all crop plants killed.

Number and species of weeds per square foot (average of 6 replicates): *Agropyron repens* - 10.0
Raphanus raphanistrum - 16.1

[c]Plus 0.3% non-ionic surfactant.

[d]Plus 0.3% BASF crop soil

EFFECT OF CGA-82725 AND METOLACHLOR COMBINATIONS WITH METRIBUZIN ON WEED CONTROL IN KATAHDIN POTATOES

Leigh S. Morrow and Hugh J. Murphy[1]

ABSTRACT

Combination treatments of metribuzin with either CGA-82725 or metolachlor were applied in a white potato (*Solanum tuberosum* L. 'Katahdin') crop. Plots were examined several times during the season for treatment effects on broad spectrum weed control. This trial was conducted at Aroostook Farm; Presque Isle, Maine in 1982. Results indicate that potato yields were unaffected by herbicide treatment and crop phytotoxicity was not a problem. While herbicide treatments suppressed some of the barnyard grass (*Echinochloa crus-galli* (L.) Beauv.) population, most treatments had little effect on perennial quackgrass (*Agropyron repens* L.) growth.

INTRODUCTION

Since CGA-82725 (chemistry not disclosed) and metolachlor [2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)acetamide] are mainly grass herbicides, their effective use should involve a combination treatment with a broadleaf herbicide. Preemergence applied metribuzin [4-amino-6-*tert*-butyl-3-(methylthio)-*as*-triazin-5(4*H*)-one] is evaluated here with CGA-82725 and metolachlor for broad spectrum weed control in white potatoes. CGA-82725 was applied post emergence at two rates with or without a non-ionic surfactant, while metolachlor was applied preemergence or at layby prior to the last hilling. One treatment consisted of a preemergence tank mix of dinoseb (2-*sec*-butyl-4,6-dinitrophenol) plus metolachlor. Other treatments in this trial included an uncultivated check, a cultivated check, and preemergence dinoseb plus dalapon (2,2-dichloropropionic acid) as the standard. Data were kept on crop yield and injury and weed control of barnyard grass, quackgrass, lambsquarters (*Chenopodium album* L.), mustard (*Brassica sp.*), and other broadleaf weeds in general.

MATERIALS AND METHODS

Herbicide applications were made on test plots on a Caribou gravelly silt loam soil with organic matter content approximately 3.5 percent. Plot size was one row by 20 feet arranged in a randomized block design with six replicates. Herbicides were applied with a compressed air sprayer at 40 psi at the rate of 80 gallons of water per acre. Delavan raindrop nozzles with No. 33974-3 tips were used on a two-nozzle hand-held boom. Preemergence, delayed preemergence, post emergence, and layby applications followed planting by 9, 14, 36, and 50 days, respectively. All rows were first cultivated on June 21, immediately following the first ratings. When final cultivation and hilling was done in July, the uncultivated check plots were by-passed.

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In addition to rating crop injury and weed control on three occasions, weed counts were made in the uncultivated plots on July 8, and are reported in Table 1.

RESULTS AND DISCUSSION

Mean yields for all treatments were statistically similar. Plots treated with dinoseb and metolachlor just prior to emergence had a few potato plants with slight signs of phytotoxicity on June 21. The symptoms were not long-lasting and these plots produced the highest yield value.

Annual barnyardgrass and quackgrass were the most prevalent weeds at the test location. It is apparent that on June 21 the standard treatment and the preemergence metribuzin applications had controlled barnyardgrass growth at an acceptable level. At that date, the delayed preemergence application of dinoseb and metolachlor surpassed all others by eliminating barnyardgrass in those plots. In July and August, cultivation practices reduced the barnyardgrass pressure enough that post emergence herbicide applications are difficult to evaluate. It appears though that when combined with metribuzin, the layby application of metolachlor was not as effective as the preemergence application.

Quackgrass growth was unacceptable in all plots and created problems with sod at harvest. Although the differences are slight, the 0.25 lb. a.i./A. rate of CGA-82725 performed better in July and August than the 0.125 lb. a.i./A. rate.

Broadleaf weeds were of little importance in this field and tables are not included for lambsquarters and mustard species since cultivations removed the few that were present. Other broadleaf weed ratings in Table 2 indicate that the small populations were easily kept in check by cultivations, metribuzin, and quackgrass pressure.

Table 1. Effect of CGA-82725 and metolachlor in combination with metribuzin on yield, crop injury, and weed control in Katahdin potatoes. Maine - 1982.

Treatments (Lbs. a.i. per Acre)[a]	Yield Cwt./A.	Crop Injury and Weed Control Ratings[b]					
		Crop Injury			Barnyardgrass		
		6-21	7-13	8-10	6-21	7-13	8-10
No treatment (no herbicide and no cultivation)	358	9.0	9.0	9.0	6.3	8.7	8.2
No treatment (no herbicide)	381	9.0	9.0	9.0	6.5	9.0	8.8
4.5 Dinoseb + 5.0 Dalapon, PE	385	9.0	9.0	9.0	7.7	9.0	8.5
0.25 Metribuzin, PE + 0.125 CGA-82725, Post[c]	364	9.0	9.0	9.0	8.0	8.8	8.5
0.25 Metribuzin, PE + 0.125 CGA-82725, Post[c]	345	9.0	9.0	9.0	7.8	9.0	8.8
0.25 Metribuzin, PE + 0.25 CGA-82725, Post[c]	382	8.7	9.0	9.0	7.8	9.0	8.7
0.25 Metribuzin, PE + 0.25 CGA-82725, Post[c]	370	9.0	9.0	9.0	7.3	9.0	8.8
0.25 Metribuzin + 2.0 Metolachlor, PE	368	8.0	9.0	9.0	7.2	9.0	8.8
0.25 Metribuzin, PE + 2.0 Metolachlor, LB	359	8.8	9.0	9.0	7.0	8.8	8.3
0.50 Metribuzin, PE + 2.0 Metolachlor, LB	376	9.0	9.0	9.0	8.3	9.0	8.8
3.0 Dinoseb + 2.0 Metolachlor, Delayed PE	387	8.5	9.0	9.0	9.0	9.0	9.0
Waller Duncan L.S.D. (0.05)	N.S.						

[a]Planted - May 25; killed - September 14; harvested - October 1, 1982.

Preemergence (PE) treatments applied - June 3. Temperature - 60F., partly cloudy; soil - moist; wind - 12-15 mph, west.

Delayed preemergence treatment applied - June 8. Temperature - 65F., clear; soil - dry; wind - 2-4 mph, north.

Post emergence (Post) treatments applied - June 30. Temperature - 70F., partly cloudy; soil - moist; wind - 8-12 mph, west.

Layby (LB) treatments applied - July 14. Temperature - 75F., clear; soil - dry; wind - 2-5 mph, north.

[b]Rating code: 9 = perfect crop or weeds absent; 1 = all crop plants killed or weeds cause crop abandonment. Less than 7 = unacceptable crop injury or weed control.

Number and species of weeds per square foot (average of 6 replicates): *Echinochloa crus-galli* - 4.5
Agropyron repens - 12.2

[c]Plus 0.3% non-ionic surfactant.

Table 2. Effect of CGA-82725 and metolachlor in combination with metribuzin on quackgrass and other broadleaf weed control in Katahdin potatoes. Maine - 1982.

Treatments (Lbs. a.i. per Acre)[a]	Weed Control Ratings[b]					
	Quackgrass			Other Broadleaf Weeds		
	6-21	7-13	8-10	6-21	7-13	8-10
No treatment (no herbicide and no cultivation)	5.7	7.0	5.3	8.0	8.0	8.5
No treatment (no herbicide)	5.8	7.3	5.2	8.8	8.7	8.8
4.5 Dinoseb + 5.0 Dalapon, PE	6.2	7.7	6.2	8.2	8.5	8.8
0.25 Metribuzin, PE + 0.125 CGA-82725, Post	6.3	7.3	5.8	8.7	8.7	8.7
0.25 Metribuzin, PE + 0.125 CGA-82725, Post[c]	5.7	7.5	5.5	8.7	8.0	8.3
0.25 Metribuzin, PE + 0.25 CGA-82725, Post	6.7	7.7	6.3	8.2	8.5	8.5
0.25 Metribuzin, PE + 0.25 CGA-82725, Post[c]	6.3	7.8	6.0	8.8	8.5	9.0
0.25 Metribuzin + 2.0 Metolachlor, PE	6.0	7.5	5.6	8.7	8.5	9.0
0.25 Metribuzin, PE + 2.0 Metolachlor, LB	6.2	7.7	5.8	8.8	8.7	8.7
0.50 Metribuzin, PE + 2.0 Metolachlor, LB	5.7	7.3	6.0	8.7	8.7	9.0
3.0 Dinoseb + 2.0 Metolachlor, Delayed PE	6.5	7.8	6.3	8.3	8.5	8.7

Footnotes a, b, c - See Table 1.

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

Agropyron repens -12.2

Other broadleaf weeds - 0.10

THE EFFECT OF SELECTED HERBICIDE COMBINATIONS ON SEEDED AND TRANSPLANTED CABBAGE[1/]

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

ABSTRACT

Barnyardgrass (Echinochloa crus-galli (L.) Beauv.), crabgrass (Digitaria sanguinalis (L.) Scop) and purslane (Portulaca oleracea L.) were effectively controlled in a cabbage seedbed experiment by preemergence applications of alachlor at 1.6 kg/ha and metolachlor at 1.6 kg/ha. Propachlor applied at 3.36 kg/ha provided good control of barnyardgrass and approached commercial control of crabgrass, but was poor on purslane. Commercial control of barnyardgrass in transplanted crucifer experiments was achieved by preplant incorporation treatments of alachlor at 2.24 kg/ha and a combination of pendimethalin applied preplant incorporated at 1.68 kg/ha followed by an early postplant application of nitrofen at 3.36 kg/ha. Good crabgrass control was achieved with the use of a wide range of chemicals in 1982. Almost perfect control of purslane was achieved by applications of nitrofen at 3.36 kg/ha, oxyfluorfen at 0.11 kg/ha, and chlorpropham at 3.36 kg/ha used alone or in combination with DCPA at 6.72 kg/ha or trifluralin at 0.84 kg/ha. Phytotoxicity was observed by early postplant applications of oxyfluorfen and to a lesser extent nitrofen. Plants grew out of the phytotoxicity and produced normal heads. The phytotoxic effects of oxyfluorfen were limited to cabbage. Damage was not evident on cauliflower.

INTRODUCTION

Approximately 4,000 acres of crucifers are grown on eastern Long Island. About half that acreage is cabbage and the other half is cauliflower. Almost all the acreage is transplanted with plants grown in seedbeds on the individual farms. A wide range of weeds can present problems in seedbeds and in commercial fields. The most important of which are barnyardgrass, crabgrass, purslane, smartweed (Polygonum pensylvanicum L.) and lambsquarters (Chenopodium album L.) The standard program for weed control in the past has been the use of preplant incorporated trifluralin (a,a,a-trifluoro-2,6-dinitro-N-N-dipropyl-p-toluidine) followed by a postplant application of nitrofen. This has been effective program, however, the loss of nitrofen has created a void in labeled herbicides. The object of this study is to identify herbicide combinations that will effectively control these weeds without damage to the crop. Another objective is to identify which herbicide materials can be most effectively used in seedbeds without causing damage to the young plants.

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MATERIALS AND METHODS

Experiments were conducted at the Long Island Horticultural Research Laboratory at Riverhead, New York on a Haven loam soil. The seedbed experiment was planted on June 30, 1982. Plots were two rows wide (86 cm between rows) by 6.1 meters long. The variety Danish Ballhead was used. Prior to planting trifluralin was applied to randomly selected plots at a rate of 0.84 kg/ha. The entire area was lightly disked to incorporate the material. Two days after planting applications of alachlor (2-chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide), metolachlor (2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxyl-1-methylethyl)acetamide) and propachlor (2-chloro-N-isopropylacetanilide) treatments were applied. No incorporation took place. The experiment was designed as a randomized complete block with 3 replications. A transplant crucifer experiment was initiated in 1981. Preplant incorporation treatments were applied immediately prior to planting on July 24. The variety Abbott and Cobb No. 5 was spaced at 46 cm within the row and 86 cm between rows. Plots were two rows wide by 6.1 meters long. Four replications were used in a randomized complete block design. In 1982 three replications were used in a similar experiment. However, two of those replications were planted to cabbage and one was planted with cauliflower.

All applications were made with a tractor-mounted CO_2 pressurized sprayer delivering 449 l/ha at 2.5 g/cm^2. Ratings for phytotoxicity and weed control were made on a scale of one to nine. Weed control ratings of nine indicate a complete absence of weeds, seven refers to a few weeds present in general commercially acceptable control and no loss in yield or harvest efficiency and one refers to complete ground cover with weeds. Phytotoxicity rating of nine indicates no crop injury, seven indicates moderate injury, but no yield or quality reduction and one implies all crop plants are killed.

RESULTS AND DISCUSSION

The most effective herbicide treatments in the cabbage seedbed experiment were alachlor and metolachlor applied preemergence at 1.68 kg/ha. Propachlor at 3.36 kg/ha applied preemergence was effective in the control of barnyardgrass and crabgrass, but did not provide adequate control of purslane. Trifluralin was substantially better than the no chemical treatment, however, it was inferior to the other three herbicides tested.

In 1981 alachlor applied at 2.24 kg/ha preplant incorporated and the combination of pendimethalin at 1.68 kg/ha applied preplant incorporated followed by a early postplant application of nitrofen at 3.36 gave season long control of barnyardgrass. These treatments also suppressed broadleaf weeds, especially smartweed. Alachlor at 1.12 kg/ha gave reasonably good control of smartweed, but did not adequately control barnyardgrass. In 1982 barnyardgrass pressure was not as severe as in the 1981 experiment. Crabgrass was the predominant annual grass. All herbicide treatments tested gave better than commercial control of crabgrass. Purslane was a substantial problem in 1982. Treatments that were effective in the control of purslane are: metolachlor at 2.24 kg/ha, nitrofen at 3.36 kg/ha, oxyfluorfen at 0.11 kg/ha and chlorpropham at 3.36 kg/ha. Lambsquarter ratings are presented in table, however, pressure was light. Phytotoxic effects of postemergence applications of oxyfluorfen was observed in 1981 and 1982. To a lesser extent nitrofen also caused some

leaf distortion. Phytotoxicity was only noticeable on cabbage. Cauliflower appears to have higher tolerance to these materials. In both years the plants outgrew the initial injury and produced normal appearing heads. Yield or time of harvest did not appear to be affected.

Table 1. Results of 1982 weed control experiments in cabbage seedbed.

Treatment			Rating[b/]					
			Byg		Crab		Purs	
Chemical	Rate kg/ha	Timing[a/]	7/20	8/3	7/20	8/3	7/20	8/3
No chemical			3.3	1.0	4.0	1.3	1.0	1.0
alachlor	1.68	pre	7.7	6.7	8.0	7.0	8.7	7.0
metolachlor	1.68	pre	7.7	8.0	8.3	8.3	7.7	6.7
propachlor	3.36	pre	7.7	7.7	7.3	6.7	6.7	4.7
trifluralin	0.84	PPI	6.3	6.3	6.3	6.7	6.0	5.0

a/ Abbreviations and times of application are as follows: pre = preemergence but postplant (7/2/82), PPI = preplant incorporated (6/30/82).

b/ Weed control ratings based on scale of 1-9, 9=absence of weeds, 7=few weeds but commercially acceptable, 1=complete ground cover with weeds; Byg=barnyardgrass, Crab=crabgrass, Purs=purslane.

Table 2. 1981 Cabbage herbicide results, Riverhead, New York.

Treatment			Rating[b/]					
Chemical	Rate (kg/ha)	Timing[a/]	Barnyardgrass			Smartweed		
			8/20	9/9	10/8	8/20	9/9	10/8
No chemical			2.0	1.8	1.8	7.8	8.0	7.3
alachlor	1.12	PPI	5.8	5.8	5.5	7.8	7.3	6.3
alachlor	2.24	PPI	7.0	7.0	7.0	8.0	7.8	7.3
metolachlor	1.11	PPI	5.5	5.5	5.8	7.5	6.0	5.8
metolachlor	2.24	PPI	6.5	6.5	6.5	8.3	6.8	6.3
propachlor	2.24	PPI	5.0	4.8	4.8	8.0	6.5	6.0
propachlor	4.48	PPI	6.5	6.5	6.8	8.0	6.8	6.8
DCPA	6.72	PPI	4.0	3.8	3.8	7.5	7.0	6.5
plus:								
nitrofen	3.36	EP	6.5	6.0	6.0	8.5	8.5	8.3
oxyfluorfen	0.11	EP	5.0	4.5	4.5	8.0	7.3	6.5
chlorpropham	3.36	EP	6.5	6.5	6.5	9.0	9.0	9.0
trifluralin	0.85	PPI	5.3	5.9	4.8	7.8	7.0	7.8
plus:								
nitrofen	3.36	EP	6.5	6.5	6.5	8.8	8.0	7.5
oxyfluorfen	0.11	EP	6.3	6.3	6.3	8.0	8.0	7.8
chlorpropham	3.36	EP	6.8	6.3	6.3	9.0	9.0	9.0
pendimethalin	1.68	PPI	5.8	5.8	6.0	7.5	6.8	6.3
plus:								
nitrofen	3.36	EP	7.3	7.0	7.0	9.0	8.3	8.0
oxyfluorfen	0.11	EP	5.0	5.0	4.5	8.3	7.8	7.5
chlorpropham	1.68	EP	6.0	6.3	6.3	9.0	9.0	9.0

a/ Timing applications and dates of application are as follows: PPI=preplant incorporated (7/24/81), EP=early post (7/28/81).

b/ Weed control rating based on scale of 1-9, 9 = absence of weeds, 7 = a few weeds but commercially acceptable, 1 = complete ground cover with weeds.

Table 3. Results of crucifer weed control experiment 1982.

Treatment			Ratings[b/]						
	Rate		Phyto.	Crabgrass		Purslane		Lambsquarters	
Chemical	kg/ha	Timing[a/]	(8/5)	8/9	9/9	8/9	9/9	8/9	9/9
no chemical			9.0	6.0	5.3	4.7	5.3	7.3	6.7
alachlor	2.24	PPI	9.0	8.7	8.0	5.3	4.7	7.3	7.0
metolachlor	2.24	PPI	9.0	9.0	9.0	8.3	8.0	7.3	6.7
propachlor	5.60	PPI	9.0	8.0	7.3	5.0	5.0	7.7	6.0
DCPA	6.72	PPI	8.7	7.7	7.3	7.3	6.7	8.3	8.0
trifluralin	0.84	PPI	9.0	8.3	7.7	6.0	6.0	8.3	8.0
napropamide	1.12	PPI	8.7	7.7	7.7	6.3	7.3	8.3	8.3
pendimethalin	2.24	PPI	9.0	8.7	8.7	7.7	8.0	9.0	9.0
nitrofen	3.36	EP	8.7	9.0	8.7	9.0	8.7	8.7	8.7
oxyfluorfen	0.11	EP	6.7	8.3	8.3	9.0	8.7	8.3	8.3
chlorpropham	3.36	EP	7.3	8.7	8.3	7.0	8.7	9.0	8.3
DCPA	6.72	PPI							
plus:									
nitrofen	3.36	EP	9.0	8.7	8.7	9.0	8.3	8.0	8.3
oxyfluorfen	0.11	EP	7.0	8.7	8.3	9.0	8.3	8.0	8.7
chlorpropham	3.36	EP	7.7	9.0	8.3	7.7	8.7	8.3	8.3
fluazifop-butyl	0.39	LP	9.0	7.3	9.0	5.7	6.3	7.7	7.0
sethoxydim	0.39	LP	9.0	7.7	8.7	6.3	7.3	7.3	6.7
trifluralin	0.84	PPI							
plus:									
nitrofen	3.36	EP	9.0	9.0	8.7	9.0	9.0	9.0	9.0
oxyfluorfen	0.11	EP	6.3	9.0	8.3	9.0	8.7	8.0	8.7
chlorpropham	3.36	EP	7.7	9.0	9.0	9.0	9.0	9.0	9.0
fluazifop-butyl	0.39	LP	8.3	8.7	9.0	7.0	7.3	8.7	8.0
sethoxydim	0.39	LP	8.7	7.7	8.7	6.0	6.3	8.0	7.7
Waller-Duncan (.05)			(1.1)	(0.4)	(1.0)	(1.4)	(1.4)	(ns)	(1.8)

a/ Abbreviations and time of application are as follows: PPI=pre plant incorporated (7/26), EP=early post (7/30), LP=late post (8/24).

b/ Ratings made on a scale of 1-9; phototoxicity rating of 9 = no injury, 7 = moderate injury but no yield or quality reduction, 1 = all crop plants killed; weed control rating of 9 = absence of weed species, 7 = a few weeds but commercially acceptable, 1 = complete ground cover with weeds.

EFFECT OF PRE AND POST PLANTING ETHALFLURALIN APPLICATIONS IN TRANSPLANTED SUMMER SQUASH

Robert J. Precheur[1]

ABSTRACT

Pre-transplant ethalfluralin applications were phytoxic and significantly reduced growth. The number of early summer squash produced in post transplant ethalfluralin at 1.25 kg/ha was significantly higher then all pre-transplant ethalfluralin applications. Highest total fruit number and yield occurred with post transplant ethalfluralin treatments at 1.25 kg/ha and significantly greater than pre-transplant ethalfluralin at 1.68 kg/ha.

INTRODUCTION

The selection of herbicides that provide effective and prolonged weed control has been limited in vine crops. Recently, the use of ethalfluralin (N-ethyl-N-(2-methyl-2 propenyl) -2,6-dinitro-4-(trifluoromethyl) benezenamine) has been shown to give improved weed control in direct seeded cucurbits. However, the use of transplants in Massachusetts and New England is a common practice in the production of summer squash in order to capture the high prices of the early market. Many growers, prior to transplanting, will completely fit the field which usually includes herbicide application. The use of clear plastic mulch for early squash production also requires herbicide application prior to the laying of the plastic mulch. Little information is available on the use of ethalfluralin with cucurbit transplants. Therefore, the objectives of this study were to determine the efficacy of the use of ethalfluralin with summer squash transplants and also to evaluate the most appropriate time for application.

MATERIALS AND METHODS

Seeds of summer squash cultivar Lemondrop were germinated and grown to the appearance of the second true leaf prior to transplanting on June 9, 1982. Ethalfluralin was applied

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pre-transplanting at rates of 1.25 and 1.68 kg/ha. These treatments were repeated but applied after transplanting and sprayed directly over the plants. An additional treatment consisted of the standard squash herbicide bensulide (O,O-diisopropyl phosphorodithioate S-ester with N-(2-mercaptoethyl) benzenesulfonamide at the rate of 6.72 kg/ha for comparison. The experiment was conducted as a randomized complete block with 3 replications. Plot size was 1.8 m x 6.1 m with an in row spacing of 0.6 m between transplants. Chemicals were applied with a CO_2 backpack sprayer delivering 450 l/ha at 2.3 kg/cm^2. Visual ratings of phytotoxicity, weed control and weed populations were made on June 16, 1982. Early fruit number and yield were based on the first four harvests and began on July 5, 1982. Total fruit number and yield consisted of 12 harvests from July 5 to August 6, 1982. Pre-plant incorporated and ethalfluralin treatments were applied on June 9, 1982.

RESULTS AND DISCUSSION

Pre-transplanting ethalfluralin treatments were extremely phytotoxic (Table 1) and stunted the young seedlings. Total fruit number and yield from pre-transplant ethalfluralin at 1.68 kg/ha were significantly lower than all other treatments except for the untreated check.

Highest early and total fruit number and total yield occurred in ethalfluralin treatments applied post-transplanting at 1.25 kg/ha and not significantly different than bensulide or the cultivated check (Table 2). Early fruit number and yield from pre-transplant ethalfluralin at 1.68 kg/ha were significantly lower than all post transplant ethalfluralin treatments (Table 2).

The predominate weed species present were redroot pigweed (*Amaranthus retroflexus* L.), lambsquarters (*Chenopodium album* L.) and large crabgrass (*Digitaria sanguinalis* L.). Overall, weed control ratings for ethalfluralin at 1.25 kg/ha were superior to bensulide (Table 1). Broadleaf weed populations (Table 1) for ethalfluralin at 1.25 kg/ha were half that of bensulide treatments.

It was apparent from this study that transplanting either by hand or machine moves a sufficient amount ethalfluralin applied pre transplanting near the root zone to cause significant growth reduction. However, post transplanting ethalfluralin applications, prior to transplant establishment were not phytotoxic and produced high yield when applied at 1.25 kg/ha.

Table 1. Effect of pre and post-transplanting ethalfluralin treatments on weed control, crop injury and weed populations.

Treatment	Rate kg/ha	Method	Weed Control[1]	Crop Injury[2]	Weed Count[3] (#/m^2)		
					RRP	LQ	CRG
ethalfluralin	1.25	Pre-transplant	8.3	6.8	17.2	14.3	10.7
ethalfluralin	1.68	Pre-transplant	9.2	5.6	3.5	10.7	14.3
ethalfluralin	1.25	Post-transplant	8.8	8.8	10.7	10.7	14.3
ethalfluralin	1.68	Post-transplant	9.2	7.5	3.5	7.1	0
bensulide	6.72	PPI	8.0	9.1	21.5	25.1	10.7
Cultivated	--	--	10.0	9.5	--	--	--
Untreated	--	--	2.6	10.0	32.3	43.0	35.8

1. Weed Control: 0 = no control, 7 = commercially acceptable, 10 = perfect control

2. Crop Injury: 0 = complete kill, 6 = injury with slight yield reduction, 10 = no injury

3. Weed Count: RRP = redroot pigweed, LQ = lambsquarters, CRG = crabgrass

Table 2. Effect of pre and post-transplanting ethalfluralin treatments on early and total yield.

Treatment	Rate kg/ha	Method	Early Yield[1] Fr No(1000's)/ha	Early Yield[1] mT/ha	Total Yield Fr No(1000's)/ha	Total Yield mT/ha
ethalfluralin	1.25	Pre-transplant	17.6 bc	5.5 bc	76.2 cd	28.6 bc
ethalfluralin	1.68	Pre-transplant	9.8 c	2.3 c	53.2 e	16.5 d
ethalfluralin	1.25	Post-transplant	32.3 a	9.5 ab	107.2 ab	40.1 ab
ethalfluralin	1.68	Post-transplant	25.3 ab	7.9 ab	86.9 bc	30.6 bc
bensulide	5.72	PPI	34.3 a	10.9 a	111.2 a	39.3 ab
Cultivated	--		34.3 a	12.5 a	121.5 a	46.5 a
Untreated	--		18.2 bc	5.6 bc	54.6 de	19.9 cd

1. Mean separation by Duncan's multiple range test 0.05. Means followed by the same letter are not significantly different.

WEED CONTROL IN VINE CROPS WITH GLYPHOSATE, SC-0545 AND SC-0224

Richard A. Creager[1/]

ABSTRACT

Cucumbers and cantaloupes were seeded in 1982 following preplant spray applications of glyphosate and SC-0545. Glyphosate and SC-0224 also were applied later in the growing season as wick wipes on the same two crops. Early emergence of cucumber plants were reduced by 9.0 kg/ha glyphosate and 4.5 kg/ha SC-0545. Later emergence was also reduced by 9.0 kg/ha glyphosate and 1.1 and 2.2 kg/ha SC-0545. The plants were shorter in the plots that received 1.1, 4.5, or 9.0 kg/ha glyphosate and 9.0 kg/ha SC-0545. There were significantly fewer weeds in all preplant treatments when first evaluated, but not thereafter. No significant visible phytotoxicity was apparent early, but at the final evaluation there was more visible injury in the 2.2 kg/ha glyphosate plots than in the unweeded control, or in the 1.1 and 9.0 kg/ha glyphosate and 4.5 kg/ha SC-0545 plots. Cantaloupe emergence was not affected by herbicide applications. Early weed control in cantaloupe was significantly better in all preplant treatments than in either the weeded or unweeded control. All later weed control was significantly poorer in all preplant treatments than in handweeded plots. Phytotoxicity in herbicide-treated plots was significantly more than in the unweeded control, but did not rate more than 1.5. Wipe applications of herbicides provided good weed control in cucumber and cantaloupe immediately after application, but the weeds soon regrew. Significantly more crop visible phytotoxicity was apparent in the wipe plots just after application. Throughout the growing season significantly more cucumbers were produced in the weeded control plots than in any other treatments. Generally there were no significant differences between glyphosate and SC-0545 preplant spray or glyphosate and SC-0224 wick wipe treatments in emergence, plant height, weed control or phytotoxicity for both crops. Yields of cucumbers also did not indicate any difference between herbicides.

INTRODUCTION

Weed control in vine crops is a continuing problem and few herbicides are effective without causing some crop injury (1, 2). The limited tolerance of most food crops to glyphosate necessitates application to early annual and perennial weeds in the absence of a crop. Hence applications must be made before planting or crop emergence, selectively directed, or following crop harvest (3). Previous work indicated that weeds might be controlled in cucurbits by using glyphosate as preplant sprays or as wick wipe applications (4). Comparisons of glyphosate and SC-0545 as preplant spray applications and glyphosate and SC-0224 as wick wipe applications were made to determine if there were any differences in activity between these compounds of similar action.

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MATERIALS AND METHODS

Cucumbers and cantaloupes were seeded in 1982 following preplant spray applications of glyphosate and SC-0545. Also later in the growing season glyphosate and SC-0224 were applied as wick wipes on the same two crops. The glyphosate and SC-0545 preplant sprays were applied after early germinating annual and perennial weeds had become established. Both herbicides were applied at rates of 1.1, 2.2, 4.5, and 9.0 kg/ha on an active ingredient basis and the vine crop seeds were planted the next day. Forty-seven days after the cucumbers and cantaloupes were planted, the wick wipe treatments of both glyphosate and SC-0224 as 33% by volume solutions were applied over the crop on the taller weeds. Crop emergence, crop heights, weed control, crop phytotoxicity and yield were evaluated throughout the growing season. Unweeded controls and controls that were handweeded monthly were included in the randomized block designed experiment, which contained 4 replications.

RESULTS AND DISCUSSION

Preplant spray applications of 9.0 kg/ha glyphosate and 1.1 or 4.5 kg/ha SC-0545 reduced early emergence of cucumber plants significantly more than did 4.5 kg/ha glyphosate (Table 1). At the 13 day emergence evaluation the weeded control and 4.5 kg/ha glyphosate contained significantly more crop plants than did the 9.0 kg/ha glyphosate and 1.1 and 2.2 kg/ha SC-0545 treatments. The plants in the unweeded controls were significantly taller than in the 1.1, 4.5, and 9.0 kg/ha glyphosate and 2.2 and 9.0 kg/ha SC-0545 plots. Crop height was also significantly greater in the weeded controls than in the 9.0 kg/ha SC-0545 plots. The first monthly weed evaluation indicated a significant reduction in weeds in all preplant treated plots, but later evaluations failed to show this. There was no significant difference between glyphosate and SC-0545 treatments at any rate at the time of any weed control evaluation. There were no significant differences between treatments during the first and second phytotoxicity evaluations. At the final phytotoxicity evaluation, more injury was visible in the 2.2 kg/ha glyphosate plots than in the unweeded control, or in the 1.1 and 9.0 kg/ha glyphosate or 4.5 kg/ha SC-0545 plots.

Preplant applications of glyphosate and SC-0545 were not significantly different from either control for cantaloupe at both emergence counts. Cantaloupe heights were not evaluated. In the first monthly weed control evaluation all preplant treatments were significantly less weedy than was either control (Table 2). In all later weed control evaluations the weeded control had significantly fewer weeds than any preplant treatment or the unweeded control. There was no significant difference in weed control between glyphosate and SC-0545 preplant applications. The crop phytotoxicity was not different among treatments early in the season. There was no visible injury in the weeded controls at the end of the season, but slight injury was evident in the preplant and the unweeded control treatments.

Cucumber emergence, height, weed control, and injury did not differ significantly before wick wipe treatments. Three weeks and 6 weeks after

the wipe applications there were significantly fewer weeds in the weeded control than in the wick wipe and unweeded control plots (Table 3). There were also significantly fewer weeds in the wick wipe treatments than in the unweeded control 3 weeks after treatment. After the wick wipe applications there was no significant difference between glyphosate and SC-0224 in weed control. There was significantly more crop injury after wick wipe applications, but no significant difference between the glyphosate and SC-0224 applications.

There were no significant differences in cantaloupe emergence, weed control, or crop phytotoxicity before wick application. Three weeks after wick application both wipes and the weeded control were significantly less weedy than was the unweeded control. The weeded control was significantly less weedy than either wipe application or the unweeded control at the final evaluation. Also at the final weed evaluation there were significantly fewer weeds in the glyphosate wipe than in the SC-0224 wipe or the unweeded control. This was the only statistically significant difference between the two herbicides when applied in wick wipers. There was significantly more visible injury 3 weeks after wick applications in the wipe plots than in either control, but no significant differences between the glyphosate and the SC-0224 applications.

Early yields (1, 2, and 3 weeks after production had begun) and season long yields of cucumber were significantly greater in the weeded control than in any other treatment. There were no significant cucumber yield differences between glyphosate or SC-0545 spray treatments, or the glyphosate and SC-0224 wipe treatments. Total cucumber yields were reduced by a severe hail storm, but the production was proportionally equivalent among treatments to those obtained the previous year.

Cantaloupe yields were greatly reduced by a severe hail storm and no comparisons were undertaken. The hail (the size of golf balls) destroyed early leaves and plants, the plants later recovered, but yielded little.

LITERATURE CITED

1. Beste, C. E. 1979. Herbicide evaluations for cucumbers. Proc. Northeast. Weed Sci. Soc. 33:157.

2. Beste, C. E. 1980. Cucumbers respond to diclofop. Proc. Northeast. Weed Sci. Soc. 34:285.

3. Selleck, G. W. and D. D. Baird. 1981. Antagonism with glyphosate and residual herbicide combinations. Weed Sci. 29:185-190.

4. Creager, R. A. 1981. Evaluation of glyphosate for weed control in cucurbits. Proc. Northeast. Weed Sci. Soc. 36:188-189.

Table 1. Effect of preplant sprays of glyphosate and SC-0545 on cucumber emergence, plant height, weed control and crop phytotoxicity.

Treatment	Rate (kg/ha)	Emergence[1] (days) 8	13	Hgts[1] cm	Weed control evaluations[2] (months after treatment) 1	2	3	4	Phytotoxicity[3] evaluation 3 months
Unweeded control	-	5.0ab[4]	8.8ab	6.0a	3.0b	1.0b	1.0b	1.0b	0.8b
Weeded control	-	5.5ab	11.2a	5.8ab	2.5b	3.5a	7.0a	8.8a	1.2ab
Glyphosate	1.1	5.2ab	9.8ab	3.8bc	7.8a	1.0b	1.0b	1.0b	0.8b
	2.2	4.8ab	8.8ab	4.0abc	7.2a	1.0b	1.0b	1.0b	3.2a
	4.5	6.5a	12.0a	3.8bc	7.8a	1.2b	1.0b	1.0b	1.0ab
	9.0	2.5b	7.0b	3.8bc	8.0a	1.2b	1.0b	1.0b	0.8b
SC-0545	1.1	2.8b	6.5b	4.0abc	7.5a	1.5b	1.0b	1.0b	1.2ab
	2.2	4.2ab	9.8ab	3.8bc	8.0a	1.0b	1.0b	1.0b	1.0ab
	4.5	2.8b	6.2b	4.8abc	6.2a	1.2b	1.0b	1.0b	0.8b
	9.0	3.8ab	8.8ab	3.5c	8.2a	1.2b	1.0b	1.0b	1.5ab

[1]Means for 4 replications.
[2]0 = Total weed coverage; 10 = no weed coverage.
[3]0 = No visible injury; 1-3 = slight; 4-9 = moderate to extreme; 10 = kill.
[4]Mean separation in columns by Duncan's multiple range test, 5% level.

Table 2. Effect of preplant sprays of glyphosate and SC-0545 on weed control and crop phytotoxicity in cantaloupe.

Treatment	Rate (kg/ha)	Weed control evaluations[1] (months after treatment) 1	2	3	4	Phytotoxicity[2] evaluation/ 3 months
Unweeded control	-	4.2b[3]	1.0c	2.2b	1.0b	1.0a
Weeded control	-	3.0b	6.0a	5.2a	8.8a	0.0b
Glyphosate	1.1	7.8a	1.8bc	1.0b	1.0b	1.2a
	2.2	7.2a	1.8bc	2.5b	1.0b	1.5a
	4.5	7.2a	1.5bc	1.0b	1.0b	1.0a
	9.0	7.5a	1.2bc	1.0b	1.0b	1.2a
SC-0545	1.1	7.0a	1.2bc	1.0b	1.0b	1.2a
	2.2	8.5a	2.0b	1.0b	1.0b	1.5a
	4.5	7.2a	1.2bc	1.0b	1.0b	1.0a
	9.0	7.0a	1.5bc	1.0b	1.0b	1.5a

[1]0 = Total weed coverage; 10 = no weed coverage.
[2]0 = No visible injury; 1-3 = slight; 4-9 = moderate to extreme; 10 = kill.
[3]Mean separation in columns by Duncan's multiple range test, 5% level.

Table 3. Effect of wick wipe applications of glyphosate and SC-0224 on weed control and crop phytotoxicity in cucumber and cantaloupe.

Treatment	Cucumber			Cantaloupe		
	Weed control eval.[1] (mos. after plnt) 3	4	Phyto-toxicity[2] eval/3 mos	Weed control eval.[1] (mos. after plnt) 3	4	Phyto-toxicity[2] eval/3 mos
Unweeded control	1.0c[3]	1.0c	0.8b	1.0b	1.0c	1.0b
Weeded control	7.0a	8.8a	1.2b	6.5a	8.8a	0.0b
Glyphosate wipe	5.0b	1.8b	3.8a	7.0a	3.0b	2.5a
SC-0224 wipe	5.0b	1.2b	3.0a	6.2a	1.2c	2.8a

[1]0 = Total weed coverage; 10 = no weed coverage.
[2]0 = No visible injury; 1-3 = slight; 4-9 = moderate to extreme; 10 = kill.
[3]Mean separation in columns by Duncan's multiple range test, 5% level.

HERBICIDE EVALUATION IN TART CHERRY ORCHARDS

Warren C. Stiles and James C. Civiletto[1/]

ABSTRACT

Herbicides were applied in May, 1982 to determine suitability for use in cherry orchards on light-textured soil. Combinations of oxyfluorfen with napropamide or simazine, napropamide with norflurazon, and oryzalin with dinoseb or norflurazon have potential for use under these conditions. No visible signs of phytotoxicity to the trees were noted with any of the materials used.

INTRODUCTION

Sensitivity of tart cherry (Prunus cerasus L. cv. Montmorency) to many commonly used orchard herbicides is frequently encountered on light-textured soils. It was, therefore, deemed desirable to examine the effectiveness of possible alternative herbicides and herbicide combinations for use on this crop.

MATERIALS AND METHODS

This experiment was conducted in an eight-year-old orchard located in Albion, NY. The trees consisted of Montmorency on Mahaleb (Prunus mahaleb L.) rootstocks. The soil at this site is classified as Arkport very fine sandy loam.

A total of 14 treatments were applied on May 11, 1982 in a randomized complete block design with five replications. Plots were approximately 2.4m by 12m in size and each included 2 trees.

Herbicides employed included: dinoseb (2-sec-butyl-4,6-nitrophenol); fluazafop-butyl[(+-butyl 2-[4-[[5-(trifluoromethyl)-2-phridinyl]oxy]phenoxy] propanoate]; napropamide[2-(a-naphthoxy)-N,N-diethylpropionamide]; norflurazon [4-chloro-5-(methylamino)-2-(a, a, a-trifluro-m tolyl)-3-(2H)-pyridazinone]; oryzalin (3,5-dinitro-N^4, N^4-dipropylsulfanilamide); oxyfluorfen [2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene]; and simazine [2-chloro-4,6-bis(ethylamino)-s-triazine]. Rates of application of these materials were as indicated under results.

All treatments were applied in water at 374 l/ha using a back-pack sprayer equipped with a single TeeJet ¼T-OC08 nozzle. Surfactant WK was added to all treatments at 2.5 ml/l.

Weed control was evaluated visually as the percentage of weed-free surface on August 31, 1981. Presence and extent of coverage by individual weeds was also recorded.

RESULTS AND DISCUSSION

Total weed control and prevalence of selected weeds are summarized in table 1.

Table 1. Percent total weed control and prevalence of selected weeds as influenced by spring-applied herbicides, rated 8/31/82.

Treatment	Rate (kg/ha)	Total area weed free (%)	Annual grasses: Large Crabgrass (%)	Annual grasses: Barnyard grass (%)	Annual grasses: Fall panicum (%)	Annual broadleaf weeds (%)	Perennial broadleaf weeds (%)
1. non-treated		14 c[1/]	35a[2/]	9a[1/]	12	10a[2/]	16a
2. oxyfluorfen	1.12	41 b	28ab	3 bc	18	3 b	5 b
3. oxyfluorfen	2.24	59ab	15 cd	8ab	8	2 b	7 b
4. oxyfluorfen + oryzalin	1.12 2.52	69ab	tr e	tr c	22	2 b	4 b
5. oxyflurofen + napropamide	1.12 4.48	88a	tr e	0 c	2	1 b	9ab
6. oxyflurofen + oryzalin	2.24 2.52	71ab	tr e	2 c	18	tr b	4 b
7. oxyfluorfen + napropamide	2.24 4.48	61ab	tr e	0 c	32	0 b	8 b
8. oxyfluorfen + simazine	0.56 1.12	55ab	24abc	5abc	13	0 b	2 b
9. oxyfluorfen + simazine	1.12 1.12	84a	9 de	5abc	0	tr b	2 b
10. norflurazon + oryzalin	2.69 2.52	74ab	tr e	tr c	13	2 b	3 b
11. norflurazon + napropamide	2.69 4.48	84a	tr e	tr c	0	9a	5 b
12. oxyfluorfen + fluazafop-butyl	1.12 0.23	67ab	18 bcd	3 bc	4	2 b	5 b
13. oxyfluorfen + fluazafop-butyl	1.12 0.45	76a	8 de	3 bc	0	3 b	9ab
14. dinoseb + oryzalin	2.52 2.52	84a	tr e	2 c	8	2 b	3 b

1/Values within a column followed by a common letter do not differ significantly at odds of 19:1.
2/Values within a column followed by a common letter do not differ significantly at odds of 99:1.

All herbicides resulted in significant total weed control in comparison to the non-treated control treatment. Although not statistically better than most other treatments, combinations of oxyfluorfen (1.12 kg/ha) with napropamide or simazine, norflurazon plus napropamide, and dinoseb with oryzalin provided 84% or greater total weed control.

Observed responses agree with previously reported (1, 2, 3) improvement of weed control by the use of herbicide combinations.

Most of the weed pressure consisted of annual grasses, notably large crabgrass (Digitaria sanguinalis (L.) Scop.), barnyard-grass (Echinochloa crusgalli (L.) Beauv.), and fall panicum (Panicum dichotomiflorum Michx.). Treatments that included either napropamide or oryzalin provided greatest control of crabgrass and barnyard grass. Fall panicum was absent from plots treated with oxyfluorfen (1.12 kg/ha) plus simazine, oxyfluorfen plus fluazafop-butyl (0.45 kg/ha), and norflurazon plus napropamide, but differences among treatments were not statistically significant.

Perenniel grasses accounted for 3% or less of the total weed cover and were not considered to be a significant factor in this test.

Annual broadleaf weeds consisted primarily of lambsquarters (Chenopodium album L.) and redroot pigweed (Amaranthus retroflex L.). All herbicide treatments effected significant control of these species with the exception of norflurazon plus napropamide.

Perenniel broadleaf weeds were primarily horseweed (Conyza canadensis (L). Cronq.) and dandelion (Taraxacum officinale Weber.). Differences in prevalence of perenniel broadleaf weeds were small but reflected significant reductions by all treatments except oxyfluorfen (1.12 ka/ha) plus napropamide (4.48 kg/ha) and oxyfluorfen (1.12 kg/ha) plus fluazafop-butyl (0.45 kg/ha). The generally low-level and non-uniformity of distribution of broadleaf weeds among plots in this test indicates a need for further testing of these responses.

No visual symptoms of phytotoxicity of herbicides were observed on the trees in this test.

These observations indicate that several tank-mix combinations of herbicides might be developed to provide acceptable weed control while also reducing the potential of injury to cherries grown on coarse-textured soils.

LITERATURE CITED

1. Grenoble, D. W. 1982. Herbicide treatments for bearing apples. Proc. Northeastern Weed Sci. Soc. 36:181-182.

2. Teasdale, J. R., G. J. Galletta and A. D. Draper. 1982. Blackberry herbicide evaluations. Proc. Northeastern Weed Sci. Soc. 36:177-180.

3. Young, R. S. and W. V. Welker. 1981. Oryzalin alone and in combination for culture of fruit trees. Proc. Northeastern Weed Sci. Soc. 35:138-142.

HERBICIDE COMBINATIONS AND TIMINGS FOR APPLE ORCHARDS.

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ABSTRACT

Herbicides and herbicide combinations were applied in October, 1981 or May, 1982 to determine effectiveness of weed control achieved in a young apple orchard. Terbacil provided comparable control with both times of application. Simazine, oryzalin and napropamide were more effective when applied in October. Paraquat plus 2,4-D improved effectiveness of simazine treatments applied in May.

INTRODUCTION

Effective weed control in orchards is complicated by the wide range of weed species and soil types that may be involved and by tree age-related sensitivity to herbicides. The use of tank mixes of herbicides at lower rates is becoming a common practice in attempts to reduce phytotoxicity to trees while also widening the spectrum of weed control (1, 2, 3, 4). This study was initiated to determine the main effects and interactions among some herbicides commonly recommended for use in apple orchards when applied alone or in tank mixes in the fall or early spring.

MATERIALS AND METHODS

The experiment was conducted in a young apple (Malus domestica Borkh.) orchard located at Sodus, NY. Soil in the test area is classified as Williamson silt loam. A spring application of simazine and subsequent applications of paraquat had been used to maintain weed control during the 1981 season. Weeds present in the fall of 1981 consisted of occasional plants of dandelion, broadleaf dock, chickweed, nutsedge and quackgrass in the herbicided strips.

Herbicides chosen for study were designated as primary, secondary, or tertiary components and factorially combined to provide a series of 24 treatments. These components were as follows:

Primary components: non-treated control; simazine [2-chloro-4, 6 bis (ethylamino-)-s-triazine] at 1.8 kg/ha; terbacil (3-tert-butyl-5-chloro-6-methyluracil) at 1.8 kg/ha; and a combination of terbacil at 1.8 kg/ha plus diuron [3-(3,4-dichlorophenyl)-1,1-dimethylurea] at 1.8 kg/ha.

Secondary components: non-treated control; oryzalin (3,5-dinitro-N^4, N^4-dipropylsulfanilamide) at 2.5 kg/ha; and napropamide [2-(a-naphthoxy)-N, N-diethylpropionamide] at 4.5 kg/ha.

Tertiary components: non-treated control; and 2,4-D [(2,4-dichlorophenoxy) acetic acid] at 0.56 kg/ha plus paraquat (1,1'-dimethyl-4,4'=bipyridinium ion) at 0.56 kg/ha.

Primary and secondary components were applied alone or as tank mixes.

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The tertiary component was applied as an overspray. Surfactant WK was included in all sprays at 2.5 ml/l. Treatments were applied at the rate of 374 l/ha using a back-pack sprayer equipped with a single TeeJet ¼T-0C06 nozzle.

A separate randomized block design employing five replications was used for the fall-applied (October 28-29, 1981) and spring-applied (May 5-6, 1982) treatments. Plots included 3 trees each and were approximately 2m by 9m in size.

Weed control was evaluated on June 23-25 and again on July 28-29, 1982 by visually estimating the percentage of weed-free surface in the plot. Area covered by individual weed species was also estimated.

Data were subjected to an analysis of variance. Duncan's new multiple range test was used in determining the significance of differences among means.

RESULTS AND DISCUSSION

Fall application. Total weed control estimates on June 23-25, 1982 indicated significant differences among primary components and a significant interaction between these and secondary components, table 1.

Table 1. Percent weed control as influenced by fall-applied herbicides, rated 5/23-25/82.

Secondary Component	Primary component: none	simazine	terbacil	diuron + terbacil	Means
none	52d[1/]	81abc	87ab	95a	79
oryzalin	71 c	74 bc	95a	92a	83
napropamide	74abc	90ab	87ab	95a	88
Means	68 c[2/]	82 b	90ab	94a	

[1/] Values followed by a common letter do not differ at odds of 19:1.

[2/] Values followed by a common letter do not differ at odds of 99:1.

At this time, the main effects of simazine and terbacil were comparable, as were those of terbacil and terbacil plus diuron. The effects of oryzalin and napropamide were significant only when applied in the absence of a primary herbicide. The addition of diuron to terbacil did not result in a significant improvement of weed control.

Evaluation of weed control on July 28-29, 1982 indicated significant independent main effects of primary and secondary components, table 2.

Table 2. Percent weed control as influenced by fall-applied herbicides, rated 7/28-29/82.

Secondary Component	Primary component: none	simazine	terbacil	diuron + terbacil	Means
none	28	48	77	93	62 b[1/]
oryzalin	57	68	95	87	77a
napropamide	56	75	90	94	79a
Means	47c[2/]	64b	87a	92a	

[1/] Values followed by a common letter do not differ at odds of 19:1.

[2/] Values followed by a common letter do not differ at odds of 99:1.

Simazine produced significant weed control but was not as effective as treatments that included terbacil. As with the earlier evaluation, the addition of diuron to terbacil did not improve overall weed control in this test. Oryzalin and napropamide contributed significantly to total weed control except when diuron plus terbacil was used as the primary component.

The additional application of 2,4-D plus paraquat resulted in a significant increase in weed control as rated in July. This effect was independent of other treatment components, table 3.

Table 3. Percent weed control as influenced by fall-applied herbicides, rated 7/28-29/82.

Tertiary Component	Primary component: none	simazine	terbacil	diuron + terbacil	Mean
none	43	58	82	90	68b[1/]
2,4-D + paraquat	51	71	93	93	77a
Means	47c[2/]	64b	87a	92a	

[1/] Values followed by a common letter do not differ at odds of 19:1.

[2/] Values followed by a common letter do not differ at odds of 99:1.

Spring Application. Total weed control ratings of spring applied treatments were similar at both times of evaluation. The simazine effect was significant in comparison to the control, but was not comparable to that obtained with treatments that included terbacil, table 4.

Table 4. Percent weed control as influenced by spring-applied herbicides, rated 7/28-29/82.

Secondary Component	Primary component: none	simazine	terbacil	diuron + terbacil	Means
none	10	38	98	99	61
oryzalin	18	32	92	96	59
napropamide	22	42	95	99	64
Means	16c[1/]	38b	95a	98a	

[1/] Values followed by a common letter do not differ at odds of 99:1.

Neither oryzalin nor napropamide contributed significantly to weed control in these treatments.

Application of the 2,4-D plus paraquat component resulted in significantly greater weed control when used without a primary component or with simazine, table 5.

Table 5. Percent weed control as influenced by spring applied herbicides, rated 7/28-29/82.

Tertiary Component	Primary component: none	simazine	terbacil	diuron + terbacil	Means
none	7d[1/]	31c	95a	98a	58
2,4-D + paraquat	25c	44b	95a	97a	65
Means	16c[2/]	38b	95a	98a	

[1/] Values followed by a common letter do not differ at odds of 19:1.

[2/] Values followed by a common letter do not differ at odds of 99:1.

Summary comparisons. Results from this trial indicate that a combination of terbacil plus diuron produced comparable total weed control when applied either in October or in May. Terbacil applied alone in May or in combination with either oryzalin or napropamide in October resulted in control equal to that obtained with terbacil plus diuron treatments.

October applications of oryzalin and napropamide resulted in significant weed control whereas May applications of these materials were ineffective. This difference is considered to be attributable to lack of rainfall following the May applications and/or that the May timing was too late to allow adequate penetration of these materials into the soil before weed seed germination began.

Application of the low-rate combination of 2,4-D plus paraquat in October or May contributed significantly to total weed control, particularly with treatments that did not include terbacil as a primary component.

1. Grenoble, D. W. 1982. Herbicide treatments for bearing apples. Proc. Northeastern Weed Sci. Soc. 36:181-182.

2. Meade, J. A. and W. V. Welker. 1980. Problems associated with herbicide use in orchards on light soils. Proc. Northeastern Weed Sci. Soc. 34:293-295.

3. Young, R. S. 1980. Oryzalin-simazine-paraquat for peach trees. Proc. Northeastern Weed Sci. Soc. 34:299.

4. Young, R. S. and W. V. Welker. 1981. Oryzalin alone and in combination for culture of fruit trees. Proc. Northeastern Weed Sci. Soc. 35:138-142.

WEED CONTROL IN NEW STRAWBERRY PLANTINGS

Ed Kee [1]

ABSTRACT

Strawberry plantings for pick-your-own harvest are increasing in Delaware. Competition from annual grasses and broadleaf weeds can adversely affect the establishment of young plants and their subsequent development. Costs to growers for strawberry plants are currently in the $450 to $600/A range. This type of investment demands the protection of good weed control systems.

A study was established in the fall of 1981 to evaluate herbicides on newly planted strawberries. The plot was fumigated by injecting metam-sodium at 55 gallons/A through the irrigation system on November 4, 1981. Soil temperatures were at 55° - 60° F at the 4-inch depth. The soil type is a Norfolk loamy sand.

The following seven varieties of strawberries were planted on March 24, 1982: Earliglow, Redchief, All Star, Surecrop, Midway, Delite and Guardian. The plots were hand hoed and cultivated prior to each treatment.

All herbicide treatments were applied to weed-free plots. Treatments applied were: (1) terbacil at .2 lb/A on June 2 (10 weeks from planting) and terbacil repeated at .2 lb/A on July 20, (2) terbacil at .2 lb/A and napropamide at 1 lb/A on July 20, (3) napropamide at 1 lb/A on July 20, and (4) an unsprayed but cultivated check. No irrigation was applied after treatments. A .40" rain fell on July 20 after treatments were sprayed.

There were no phytotoxic symptoms on any of the varieties nor inhibition or runner development. The first application of terbacil alone held the broadleaves but grasses began to emerge 4 weeks after planting. The second application held the grasses and weeds for the remainder of the season. The other combinations did an acceptable job of grass and weed control.

Both terbacil and napropamide have potential to be used safely and effectively on new plantings of strawberries. Further work and cooperation between industry and university researchers is needed to bring these materials to the growers.

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RESPONSE OF WEEDS AND LOWBUSH BLUEBERRIES TO HEXAZINONE AND NITROGEN APPLICATION

A.A. Ismail, D.E. Yarborough and S.P. Skinner[1/]

ABSTRACT

Initial studies with hexazinone for weed control in lowbush (Vaccinium angustifolium) fields showed considerable promise. However, a need existed to determine the efficacy of hexazinone under the varied field conditions encountered in Maine's wild blueberry growing regions. Experimental sites on 13 locations in four counties were established to test the effect of hexazinone by nitrogen application on certain weed species and the growth and yield of lowbush blueberries. In May 1981 hexazinone was applied preemergent after pruning at 0, 0.6, 1.1 or 2.2 kg/ha and nitrogen (from urea) at 0,50, or 100 kg/ha. The experimental design was a split block with locations serving as replications. The effects of treatments on weeds and blueberry growth were determined in 1981 and on blueberry yield in 1982. A highly significant reduction in grass, goldenrod (Solidago sp.), meadowsweet (Spiraea latifolia) and an increase in injury to blueberries were attributed to increases in hexazinone rate. Increasing the rate of hexazinone resulted in a greater number of blueberry stems and flower buds per stem. Nitrogen application increased the number of goldenrod stems but had no effect on meadowsweet stems. Nitrogen increased blueberry stem length, but had no effect on stem numbers or flower buds.

Large variations in blueberry yields were found between locations due to variations in plant stand and productivity as well as climatic and edaphic factors. Increasing the nitrogen rate resulted in a significant reduction in blueberry yield. Conversely, hexazinone application caused a significant quadratic increase in blueberry yield.

Results from this study, along with others, will provide a basis for statewide recommendations for the use of hexazinone for weed control in Maine's native lowbush blueberry fields.

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ECONOMIC ANALYSIS OF HEXAZINONE USE IN LOWBUSH BLUEBERRY PRODUCTION

J. J. Hanchar, S. P. Skinner, A. A. Ismail, and D. E. Yarborough[1/]

ABSTRACT

The economic impact of hexazinone's use for weed control in lowbush blueberry (Vaccinium angustifolium) fields was analyzed using partial budgeting. This technique determines the expected change in net income for a proposed change in the farm business. In this case, the proposed change was the use of hexazinone at various rates.

Experimental testing of hexazinone has shown it to be effective in controlling numerous weeds common to native lowbush blueberry fields. The importance of obtaining efficacy data for the purposes of its registration and use is evident. Information regarding the economic feasibility of its use and the optimum input application rate is needed to assess its economic impact in blueberry production.

The partial budget analysis used yield data obtained from a statewide study of the efficacy and interaction of hexazinone and nitrogen on weeds, blueberry growth, and yields in Maine from 1981-1982. In the study, hexazinone at 0, 0.6, 1.1, or 2.2 kg/ha and nitrogen (from urea) at 0, 50, or 100 kg/ha were applied to several field locations in May 1981 after pruning and before plant emergence. Experimental design was a randomized complete block with locations serving as replications. Yield data were obtained in July and August of 1982 from 10 sites dispersed across the blueberry growing region in Eastern Maine. The economic feasibility of hexazinone use as well as its profit maximizing level to be used in combination with nitrogen fertilizer was determined.

Results presented here are based on a fertilizer application rate of 50 kg/ha which is the standard recommended application for most blueberry fields (Table 1). Average blueberry yields obtained from the 0, 0.6, 1.1, and 2.2 kg/ha hexazinone applications were 1956, 3060, 3612, and 3518 kg/ha, respectively. Yields associated with the 0.6, 1.1, and 2.2 kg/ha applications were significantly greater than that obtained from the 0 kg/ha application of hexazinone. Specifically, yield resulting from the 1.1 kg/ha rate was 1656 kg/ha greater than the yield from the 0 kg/ha rate. This yield increase resulted in added income of $1639 with blueberries priced at $.99/kg (Table 1). The change in net income was then calculated by comparing the added income which resulted from increased yield to the added costs incurred. All applications of hexazinone resulted in a positive change to net income. Therefore, it is concluded that hexazinone application at 0.6, 1.1, or 2.2 kg/ha for weed control in Maine's blueberry fields is economically feasible. In particular the 1.1 kg rate resulted in the largest increase to net income

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followed closely by the 2.2 kg rate. Since the above results were based on average yield data obtained from 10 field locations the profit maximizing hexazinone level may vary from field to field.

Table 1. Changes in Net Income Per Hectare Associated With Hexazinone Applications in Maine Lowbush Blueberry Fields[a]

	Hexazinone (kg/ha)		
	0.6	1.1	2.2
Added income ($/ha)			
Income from additional yield ($.99[b] /kg x added yield[c])	1092.96	1639.44	1546.38
Added costs ($/ha)			
Pre-harvest:			
Hexazinone[d]	26.40	48.40	96.80
Herbicide application	12.36	12.36	12.36
Interest on pre-harvest costs (10% for 15 months)	4.85	7.60	13.65
Harvest:			
Cost of harvesting additional yield ($.26[e] /kg x added yield[c])	287.04	430.56	406.12
Summary			
Total added income	1092.96	1639.44	1546.38
- Total added costs	- 330.65	- 498.92	- 529.01
Change in net income	762.31	1140.52	1017.37

a/Yield data was collected from experiments conducted on ten different sites in Maine during the 1981-1982 crop production cycle.

b/Price of blueberries in the field after harvest was assumed to be $.99/kg (based on the past 5 years averaged field price).

c/The change in yield (kg/ha) was calculated as the difference in yields between the 0 rate of hexazinone and the 0.6, 1.1, or 2.2 kg/ha rates at the 50 kg/ha application of nitrogen.

d/Cost of hexazinone was $44.00/kg.

e/Cost of harvesting estimated at $.26/kg. It was assumed that growers pay $2.50/box (11.34 kg) to rakers and a $.50/box charge for supervision.

AERIAL APPLICATION OF HEXAZINONE FOR WEED CONTROL IN LOWBUSH BLUEBERRY FIELDS

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

ABSTRACT

Hexazinone at 2.2 kg/ha was applied preemergent by helicopter to 6 commercial lowbush blueberry fields in Maine in May 1982. Visual ratings indicate an increase in area covered with blueberries and a decrease in total weed cover. Plant stand counts showed a reduction in goldenrod, aspen and rose populations on the treated versus the non treated sites. At one location sweetfern and bracken fern were reduced but other locations showed no significant reduction. Aerial application of hexazinone at 2.2 kg/ha provided adequate control of weeds commonly found in Maine's lowbush blueberry fields.

INTRODUCTION

Several studies (2,3,4,5,8,9) have shown that ground application of hexazinone [3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5,-triazine-2,4(1*H*,3*H*-dione] is effective in controlling many woody and herbaceous weeds found in Maine's lowbush blueberry (Vaccinium angustifolium) fields. Lowbush blueberries in Maine are managed on wild or native stands. Much of the terrain is rough and uneven and many fields have large rocks from natural glaciation which makes it unsuitable for ground application of herbicides. In addition, several growers have large holdings of land (7) which would make it economically unfeasible to treat the number of acres in their holdings with ground equipment in the limited time available in the spring before plant emergence. Many growers with small acreage do not own or have access to ground spraying equipment and must rely on commercial blueberry applicators for pesticide application. Successful results of aerial application of hexazinone (6) have been obtained in forest vegetative management, controlling many species which also occur in lowbush blueberry fields. Since aerial application requires large blocks and several sites were needed to adequately assess the effect of hexazinone an experimental use permit was granted by EPA for this experiment.

The objective of this study was to determine the efficacy of aerial application of hexazinone for control of woody and herbaceous weeds in lowbush blueberry fields.

MATERIALS AND METHODS

Hexazinone [2/] at 2.2 kg/ha in 19 L/ha water was applied to commercial blueberry fields ranging in size from 2 to 8 ha in six locations in Aurora, Franklin, Deblois and T-18 M.D. on May 22. 1981. The herbicide was applied

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[2/] Velpar 2L Formulation, E.I. duPont deNemours and Company, Wilmington, DE, 19898

with a helicopter equipped with Raindrop RD-4 nozzles[3/], which give a mean droplet size of 600 microns, to reduce the potential of drift. The helicopter maintained a speed of 80 km/hr and an approximate height of 3-4 meters off the ground. Applications were made in early to late morning with calm wind conditions.

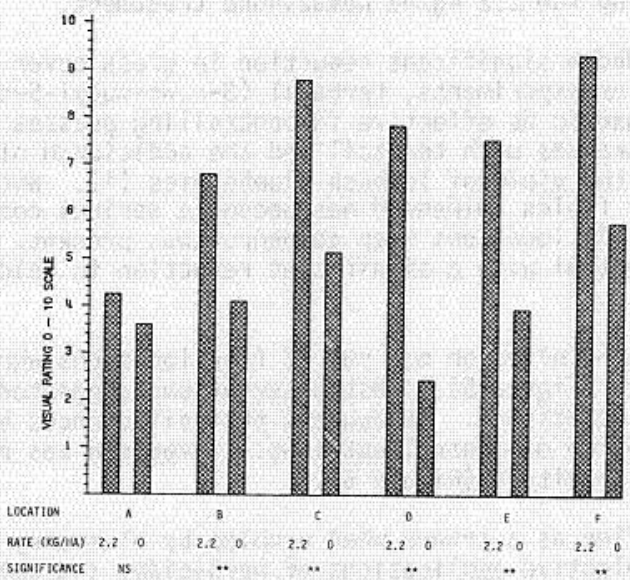
Evaluation of the efficacy of the treatment was made on August 25-26, 1981. Two transects were taken accross treated and adjacent non-treated blocks. Twenty samples were obtained from both treated and non-treated sites at each of the six locations. A chain with two pins which encompassed a $1M^2$ area was used to delineate the sample plot boundaries along the transects. Blueberry, weed and grass cover were visually assessed using a 0-10 scale with 0 = none and 10 = 100% cover. In addition, counts of prominant weeds including goldenrod (Solidago sp.), bracken fern (Pteridium aquilinum), sweetfern (Comptonia peregrina), quaking aspen (Populus tremuloides) and wild rose (Rosa virgina) were also made. Statistical analysis was based on a randomized complete block using an F test with a single degree of freedom to determine the level of significance.

RESULTS AND DISCUSSION

Visual assessment of blueberry plant cover (Figure 1) show a highly significant increase associated with hexazinone application. Conversely, a highly significant decline in weed cover was found due to hexazinone application at all locations (Figure 2).

FIGURE 1

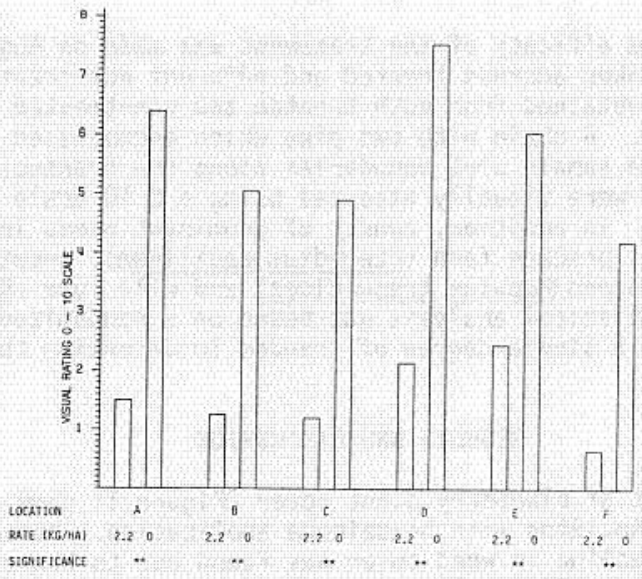
EFFECT OF AERIAL APPLICATION OF HEXAZINONE ON BLUEBERRY PLANT COVER



3/ Delevan Manufacturing Co., West Des Moines, IA 50265.

FIGURE 2

EFFECT OF AERIAL APPLICATION OF HEXAZINONE ON WEED COVER



Weed cover declined from an average of 5.7 in the untreated fields to 1.5 for the areas receiving the 2.2 kg/ha hexazinone treatment.

Hexazinone provided a significant reduction in grass cover on all sites (Figure 3). In earlier experiments, terbacil (3-*tert*-butyl-5-chloro-6-methyluracil) was found to be effective in controlling grasses in blueberry fields. Control of grasses with terbacil and the addition of nitrogen has resulted in doubling the yield of lowbush blueberries (1). With the use of terbacil in blueberry fields goldenrod has become a serious competitor to blueberries (8). In all locations when goldenrod was present, hexazinone provided excellent control with a significant reduction in goldenrod (Figure 4).

Braken fern was controlled on one out of five locations where it occured in significant numbers (Figure 5). Past observations suggested that bracken fern is resistant to hexazinone. It appears that differences between sites will influence the degree of control obtained. Sweetfern was reduced from 23 stems per M^2 to 1 on site A (Figure 6).

Aspen was identified as a severe weed problem by blueberry growers (7). Recent trials with selective applications of herbicides indicated some degree of control could be obtained with wiper applicators (10) but no preemergent control method was available. In two fields, B and E, aspen stand was reduced from an average of 4 to less than 0.5 stems per M^2 with hexazinone

FIGURE 3

EFFECT OF AERIAL APPLICATION OF HEXAZINONE ON GRASS COVER

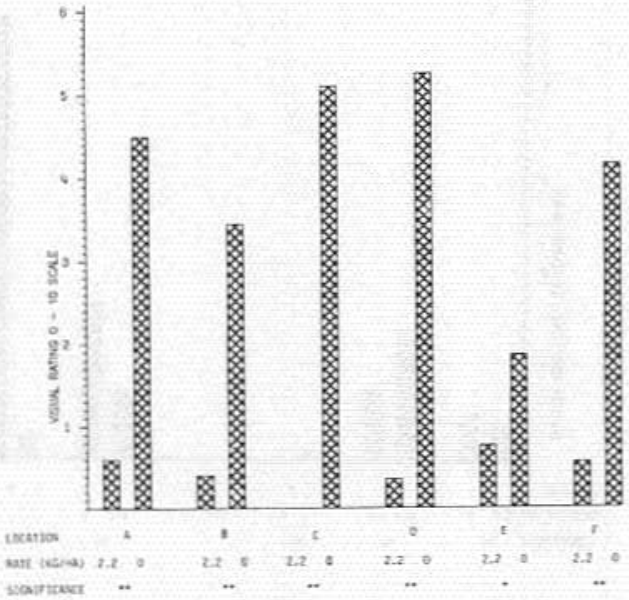


FIGURE 4

EFFECT OF AERIAL APPLICATION OF HEXAZINONE ON GOLDENROD STAND

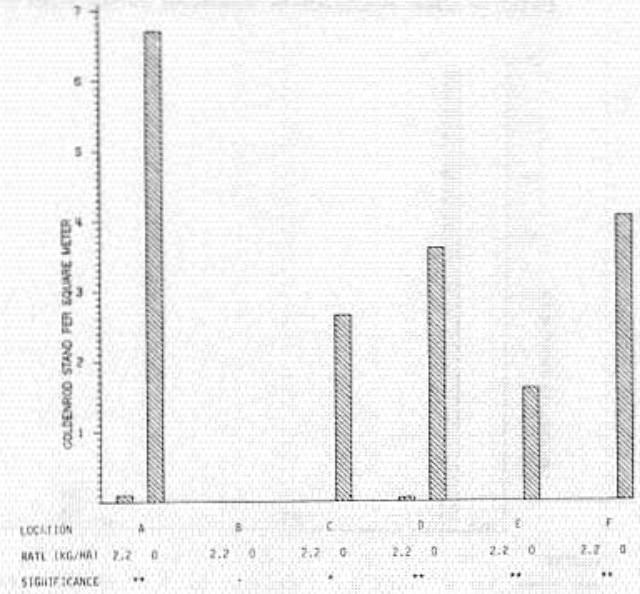


FIGURE 5

EFFECT OF AERIAL APPLICATION OF HEXAZINONE ON BRACKEN FERN STAND

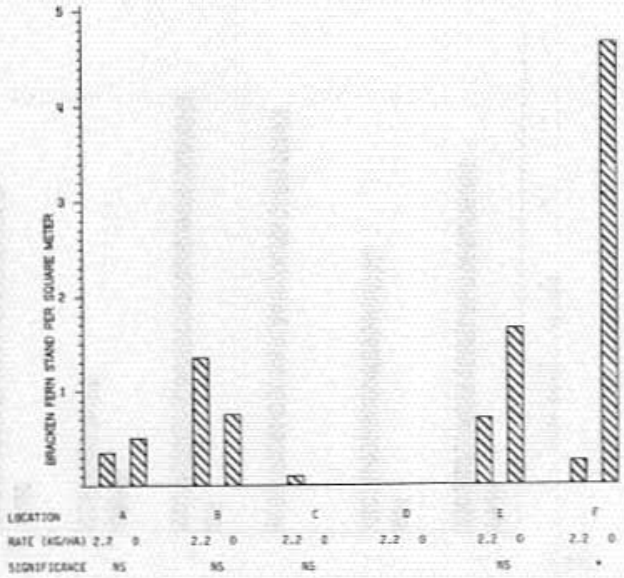
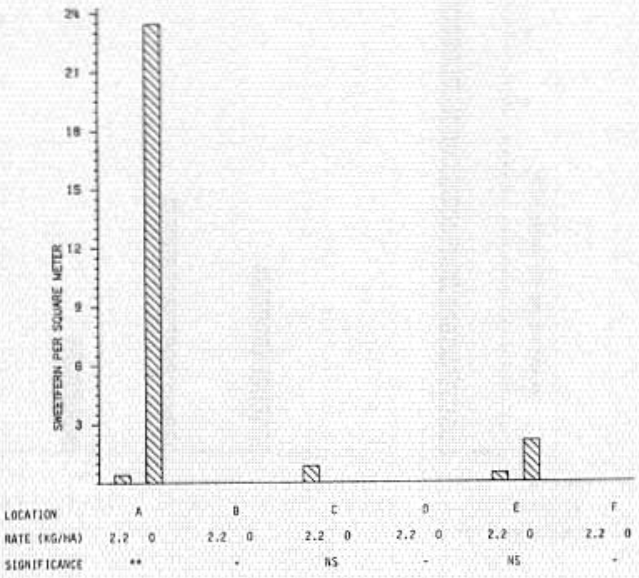


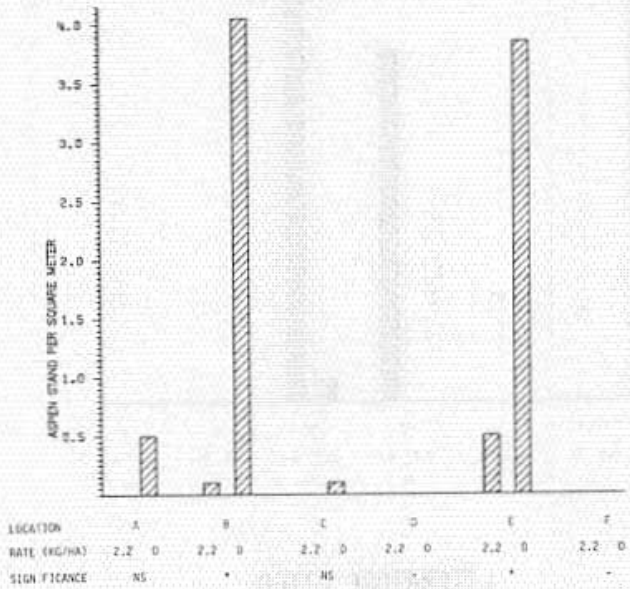
FIGURE 6

EFFECT OF AERIAL APPLICATION OF HEXAZINONE ON SWEETFERN STAND



treatment representing an 88% reduction in aspen stand (Figure 7). This is better control than that obtained with glyphosate [N-(phosphonomethyl)glycine] applied post-emergent by a wiper in a previous experiment (10).

FIGURE 7
EFFECT OF AERIAL APPLICATION OF HEXAZINONE ON ASPEN STAND



Wild rose constitutes a serious weed problem in certain blueberry fields due to the hinderance to harvesting of the berries which is done with hand held rakes and the adulterating effect of the hips which must be removed when processing the berries. Excellent control of rose bushes was obtained on the two sites where they were present (Figure 8).

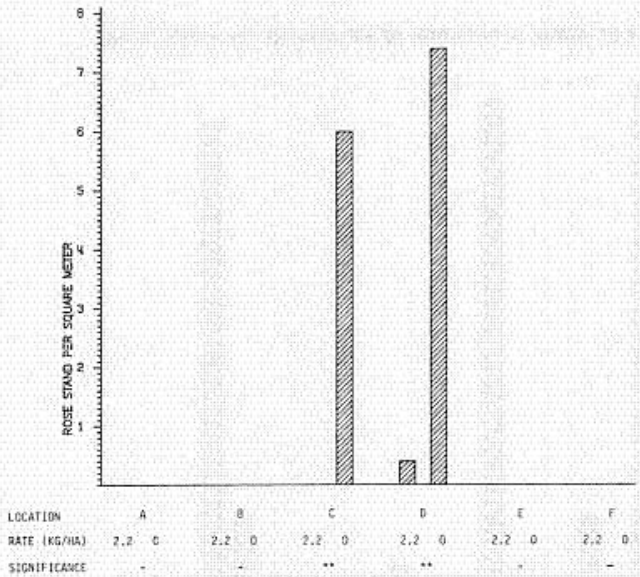
Other weed species were observed but insufficient numbers were present in the sampling for statistical analysis of the data. Species observed to be adequately controlled include sheep laurel (Kalmia latifolia), bush honeysuckle (Diervilla lonicera), and Northern dewberry (Rubus flagellaris). Weeds observed not to be controlled include bunchberry (Cornus canadensis), red maple (Acer rubrum), black huckleberry (Gaylussacia baccata), and spotted St. Johnswort (Hypericum perforatum). With the decline in competition from grasses and other woody weeds, species that were not controlled could become future weed problems.

Aerial application of hexazinone will provide excellent control of many woody and herbaceous weeds common to Maine's lowbush blueberry fields. This method will provide a practical means of application of hexazinone in fields with poor accessability, excessive rocks, and irregular terrain as well as enable large tracts of land to be treated in a relatively short period of time. However, due to the effectiveness of hexazinone, extreme care must be exercised with aerial application to assure proper placement on target

sites and prevent drift into non target areas.

FIGURE 8

EFFECT OF AERIAL APPLICATION OF HEXAZINONE ON ROSE STAND



LITERATURE CITED

1. Ismail, A.A. 1974. Terbacil and Fertility Effects on Yield of Lowbush Blueberry. HortSci. 9:457.

2. Ismail, A.A. and D.E. Yarborough. 1982. Hexazinone and Nitrogen for Control of Goldenrod and Meadowsweet in Blueberries. (Abstr.) Proc. NEWSS 36:185.

3. Ismail, A.A. and D.E. Yarborough. 1982. Hexazinone for Weed Control in Lowbush Blueberry Fields. (Abstr.) Proc. NEWSS 36:186.

4. Jensen, K.I.N. 1981. Hexazinone, a Promising Herbicide for Highbush Blueberries. HortSci. 16:315-316.

5. Jensen, D., D. Doohan, and J. Thompson. 1981. Weed Control in Lowbush Blueberries with Hexazinone (Abstr.) Proc. NEWSS 35:147.

6. McCormack, M., E. Sprague and T. Grau. 1982. Forest Vegetation Management by Aerial Hexazinone Treatments. (Abstr.) Proc. NEWSS 36:234.

7. Metzger, H.B. and A.A. Ismail. 1976. Management Practices and Cash Operating Costs in Lowbush Blueberry Production. University of Maine Life Sci. Agr. Expt. Sta. Bul. 723.

8. Yarborough, D.E. and A.A. Ismail. 1982. Effect of Hexazinone on Meadowsweet in a Lowbush Blueberry Field. NEWSS 36:190-192.

9. Yarborough, D.E. and A.A. Ismail. 1981. Hexazinone Pellets for Spot Treatment of Woody Weeds in Lowbush Blueberry Fields. Proc. NEWSS 35:148-151.

10. Yarborough, D.E. and A.A. Ismail. 1982. Selective Application of Herbicides for Aspen Control in Lowbush Blueberries. Proc. NEWSS 36:193-198.

EFFICACY AND ECONOMICS OF MECHANICAL AND CHEMICAL CONTROL OF FIVE WEED SPECIES IN NATIVE LOWBUSH BLUEBERRY FIELDS

A.A. Ismail, D.E. Yarborough and S.P. Skinner[1/]

ABSTRACT

Woody weeds occuring in discrete clumps in Maine's lowbush blueberry (Vaccinium angustifolium) fields have been traditionally controlled by cutting and spraying with 2,4-D in #2 fuel oil. This study was conducted to determine the efficacy of mechanical cutting, cutting plus 2,4-D in oil, and 10% hexazinone pellets.[2/]

Red maple (Acer rubrum), cherry (Prunus sp.), willow (Salix sp.) aspen (Populus Sp.) and birch (Betula Sp.) were treated in July of 1981. Treatments consisted of cutting 0,1,2 or 3 times with one month intervals between cuts, or cutting plus a stump spray of 0, 0.5, 2 or 4% of 2,4-D in oil (v/v), or 0,1,2, or 4 hexazinone pellets. The experimental design was completely randomized at three locations. Efficacy was determined by counting the number of stems before treatment and one year after treatment. A visual evaluation of plant vigor was also obtained at the same time.

In all species, except willow, the 2,4-D treatment provided the best overall control with cutting and gridballs being equally effective. Willow was equally controlled by all treatments. The number of cherry, willow, aspen, and birch stems declined significanlty with an increase in rates for all treatments. Cutting or hexazinone pellets did not reduce maple stand. In all species, plant vigor declined with an increase in rate of treatment.

Per acre costs of applications were calculated for each treatment on a 1,10 and 100 acre basis. The cost of treatments increased with frequency of cutting and rate of herbicide applied but declined as the size of the operation increased.

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[2/] Velpar gridballs, E.I. duPont deNemours and Company, Wilmington, DE 19898.

A COMPARISON OF SOD AND CONVENTIONALLY PLANTED PEACH TREES

W. V. Welker, Jr.[1/]

ABSTRACT

Many questions regarding the influence of various management practices on the growth of newly planted peach trees remain unanswered. A study was established in the spring of 1982 to investigate the influence of several pre- and post-planting treatments upon the growth of young peach trees. The cultivar, New Jersey 230 on Halford rootstock, was planted in hand-dug holes. Comparisons were made between the following treatments:

1) Planted in 1-year-old Kentucky 31 sod

   a. area maintained in mowed sod
   b. area treated immediately after planting with glyphosate followed by a residual herbicide treatment;

2) Planted in area plowed and tilled for 1 year before planting

   a. maintained weed-free with cultivation and hand hoeing
   b. maintained weed-free with glyphosate and residual herbicide treatment as above.

Data collected included trunk diameter, tree height, canopy height, canopy width, and total growth. Significant differences were found between each treatment when comparing trunk diameter, canopy width, and total growth.

The greatest growth was obtained when the trees were planted in a sod which had been killed and maintained with a residual herbicide. The second largest growth was obtained from trees planted in bare soil which was maintained with cultivation and hand hoeing. Planting in bare soil and maintaining the area with herbicides was ranked third, while trees planted in sod and maintaining with mowing at lawn height was the poorest. The growth of the peach trees maintained in sod was so limited that it is questionable whether they will survive the winter. The growth of those trees raised in killed sod was significantly superior to all other treatments.

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GLYPHOSATE PLUS ADJUVANTS

Roger S. Young[1/]

ABSTRACT

Postemergence applications of glyphosate at 0.56, 1.12 and 2.24 kg/ha with 0.5% v/v adjuvant tank mixed and sequentially applied with 3.36 kg/ha simazine to established apple (Malus domestica Borkh.) resulted in increasing weed control as the rate of glyphosate increased whether applied 112 L/ha or 374 L/ha diluent rate. The seven adjuvants used at 0.5% v/v with 0.56 kg/ha glyphosate and 3.36 kg/ha simazine controlled weeds less than one month.

INTRODUCTION

Herbicidal activity has been shown to be altered by the addition of adjuvants (1, 2, 6). The diluent volume at which the herbicide is applied also influences its performance (3, 6). Glyphosate [N-(phosphonomethyl)glycine] as low as 0.28 and 0.56 kg/ha has influenced plant growth of potato (Solanum tuberosum L.) and quackgrass (Agropyron repens (L.) Beauv.) (4, 5).

This orchard study was initiated to investigate the effect of glyphosate on various weeds as related to diluent volumes and added adjuvants.

MATERIALS AND METHODS

Experiments were conducted in a 'Golden Delicious' apple orchard planted 6.1 m by 6.1 m in 1980 on a Hagerstown Frederick cherty silt loam with 2.5% organic matter, pH of 5.8 and a volunteer vegetative ground cover consisting of 20% large crabgrass (Digitaria sanguinalis (L.) Scop.), 20% fall panicum (Panicum dichotomiflorum Michx.), 20% nimblewill (Muhlenbergia schreberi J. F. Gmel.), 20% dandelion (Taraxacum officinale Weber), 5% broadleaf plantain (Plantago major L.), 5% white clover (Trifolium repens L.), 3% yellow foxtail (Setaria lutescens (Weigel) Hubb.), 2% hairy vetch (Vicia villosa Roth), 5% other weeds [common ragweed (Ambrosia artemisiifolia L.), ladysthumb (Polygonum persicaria L.), horsenettle (Solanum carolinense L.), prostrate knotweed (Polygonum aviculare L.), green foxtail (S. viridis (L.) Beauv.), yellow woodsorrel (Oxalis stricta L.), redroot pigweed (Amaranthus retroflexus L.), aster (Aster spp.), barnyardgrass (Echinochloa crus-galli (L.) Beauv.), broadleaf dock (Rumex obtusifolius L.), lambsquarters (Chenopodium album L.), tall redtop (Triodia flava (L.) Smyth.), smooth crabgrass (D. ischaemum (Schreb) Muhl.), common chickweed (Stellaria media (L.) Cyrillo), horseweed (Conyza canadensis (L.) Cronq.), onion (Allium canadense L.)].

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Postemergence applications were made June 15, 1982 using a boom with TeeJet flat fan OC nozzle on the end and an 110° nozzle spaced 25 cm apart. The boom was mounted to a 4-wheel drive vehicle traveling 4.0 km/hr (2.5 mph). Two diluent volumes were used: 1) 374 L/ha (OC08 and 11008 nozzle tips at 2.8 kg/sq cm pressure) and 2) 112 L/ha (OC04 and 11004 nozzle tips at 1.4 kg/sq cm pressure). The change in pressure was used to acquire a lower diluent rate. Herbicides used were glyphosate and simazine (2-chloro-4,6-bis (ethylamino)-s-triazine). Adjuvants used included Nufilm-P (Pinolene) (poly-1-p Menthen-B, 9-diyl), Surfactant WK (Trimethylnonylpolyethoxy-ethanol), Regulaid (Polyoxyethylenepolypropoxypropanol, Alkyl 2-ethoxy-ethanol), Triton AG 98 (Alkyl aryl polyoxyethylene glycols), Widespread (Alky aryl polyoxethylene ether), X-77 (Alky aryl polyoxyethylene glycols, Free fatty acids, Isopropanol), Prime (Non-ionic coconut amine).

Tank mix (Table 1) and sequential (Table 2) glyphosate-simazine treatments were compared with glyphosate being applied at three rates (2.24 kg/ha, 1.12 kg/ha and 0.56 kg/ha) plus the addition of 0.5% v/v X-77 adjuvant and simazine at 3.36 kg/ha.

The adjuvants (Table 3) Nufilm-P, Prime, Regulaid, Triton AG 98, Wide-spread, WK and X-77 added at the rate of 0.5% v/v to 0.56 kg/ha glyphosate were applied sequentially with Simazine, 3.36 kg/ha at the diluent rate of 374 L/ha.

Climatological conditions during application were: temperature 24° to 28°C, relative humidity 50% to 70%, wind 0 to 9.6 km/hr under clear sky. A thirty minute precipitation (1.95 cm) occurred 40 hours following the herbi-cide application. The next precipitation (4.1 cm) occurred 19 days following treatment during which 3.81 cm fell within 15 minutes.

Weed control was evaluated on July 15 and August 25 (4 and 10 weeks following application) using a percentage rating system of 0 to 100 where 0 is no control and 100 is complete control. The percent following the name of the weed is based upon total weed population. Weeds listed with no per-centage figure make up the remaining percentage to 100 percent of the weed population.

RESULTS AND DISCUSSION

Tank mixtures of glyphosate 2.24 kg/ha and simazine 3.36 kg/ha (Table 1) at the 374 L/ha diluent rate gave 40% better weed control ten weeks after treatment than the applications at 112 L/ha. Fall panicum (63%) was the major weed found, followed by large crabgrass (14%). Other grasses included yellow foxtail, nimblewill and barnyardgrass. Dandelion was the only broad-leaf weed found in all treatments Redroot pigweed and prostrate knotweed were found in most treatments.

Observations made at the ten-week period (8/25) indicate the following

weed population (in percent) for each treatment listed in Table 1.

1. Field bindweed (Convolvulus arvensis L.) (40%), fall panicum (25%), large crabgrass (20%), other weeds (15%) [yellow foxtail, redroot pigweed, dandelion, knotweed, lambsquarters].
2. Fall panicum (60%), large crabgrass (20%), other weeds (20%) [yellow foxtail, nimblewill, smooth crabgrass, dandelion, lambsquarters, knotweed].
3. Fall panicum (65%), large crabgrass (25%), other weeds (10%) [smooth crabgrass, dandelion, redroot pigweed, chickory (Cichorium intybus L.)].
4. Fall panicum (70%), large crabgrass (20%), other weeds (10%) [smooth crabgrass, yellow foxtail, dandelion, poison ivy (supressed)].
5. Fall panicum (80%), other weeds (20%) [large crabgrass, yellow foxtail, dandelion].
6. Fall panicum (80%), other weeds (20%) [large crabgrass, barnyardgrass, redroot pigweed, dandelion, onion, horsenettle, prickly lettuce (Lactuca serriola L.)].

Table 1. Weed control from glyphosate applied with 0.5% X-77 plus 3.36 kg/ha simazine applied as a tank mixture at 374 L/ha and 112 L/ha on June 15, 1982.

Treatment	Glyphosate	Simazine	Diluent	Weed control 7/16/82	Weed control 8/25/82
	(kg/ha)		(L/ha)	(%)	
1	2.24	3.36	374	100	90
2	1.12	3.36	374	98	65
3	0.56	3.36	374	90	65
4	2.24	3.36	112	98	50
5	1.12	3.36	112	95	25
6	0.56	3.36	112	88	20

Sequential treatments of glyphosate and simazine (Table 2) indicate greater weed control for the 112 L/ha diluent rate. Glyphosate 0.56 kg/ha gave poor weed control. Observations made at the ten week period (8/25) indicate the weed population (in percent) for each treatment as listed in Table 2.

1. Redroot pigweed (90%), other weeds (10%) [dandelion, large and smooth crabgrasses, fall panicum, yellow foxtail].
2. Fall panicum (50%), smooth crabgrass (30%), yellow foxtail (5%), redroot pigweed (5%), other weeds (10%) [large crabgrass, dandelion, lambsquarters, prostrate knotweed].
3. Fall panicum (80%), large crabgrass (10%), other weeds (10%) [yellow foxtail, nimblewill, prostrate knotweed, hedge bindweed (Convolvulus sepium L.), hedge smartweed (Polygonum scandens L.), dandelion].

4. Smooth crabgrass (90%), other weeds (10%) [fall panicum, yellow foxtail, dandelion, redroot pigweed].
5. Fall panicum (60%), large crabgrass (35%), other weeds (5%) [nimblewill, yellow foxtail, dandelion, poison ivy].
6. Fall panicum (70%), large crabgrass (10%), yellow foxtail (10%), dandelion (5%), other weeds (5%) [smooth crabgrass, nimblewill, redroot pigweed].

Table 2. Glyphosate with 0.5% X-77 and 3.36 kg/ha simazine applied sequentially at 374 L/ha and 112 L/ha rates on June 15, 1982.

Treatment	Glyphosate	Simazine	Diluent	Weed control 7/16/82	Weed control 8/25/82
	(kg/ha)		(L/ha)	(%)	
1	2.24	3.36	374	99	70
2	1.12	3.36	374	95	70
3	0.56	3.36	374	30	10
4	2.24	3.36	112	95	90
5	1.12	3.36	112	75	80
6	0.56	3.36	112	50	50

Glyphosate at 0.56 kg/ha applied with different adjuvants at 0.5% v/v with a 3.36 kg/ha simazine sequential application at the 374 L/ha diluent rate (Table 3) gave a variation in weed control of 50% at the four week observation but only 30% at the ten week observation period. The weeds present (in percent) for each adjuvant treatment as observed ten weeks following application are listed below for the treatments in Table 3.

1. Large crabgrass (30%), fall panicum (20%), yellow foxtail (20%), other weeds (30%) [nimblewill, redroot pigweed, prostrate knotweed, hedge smartweed, velvetleaf (Abutilon theophrasti Medic.), wood sorrel].
2. Fall panicum (50%), large crabgrass (20%), smooth crabgrass (10%), yellow foxtail (10%), other weeds (10%) [nimblewill, redroot pigweed, hemp dogbane].
3. Fall panicum (80%), smooth crabgrass (10%), other weeds (10%) [yellow foxtail, nimblewill, redroot pigweed, prostrate knotweed, goldenrod (Solidago spp L.), dandelion].
4. Fall panicum (80%), other weeds (20%) [large crabgrass, yellow foxtail, dandelion, redroot pigweed, poison ivy].
5. Fall panicum (80%), other weeds (20%) [yellow foxtail, nimblewill, large crabgrass, dandelion, goldenrod, onion].
6. Fall panicum (80%), other weeds (20%) [nimblewill, large crabgrass, dandelion, goldenrod, wood sorrel, hemp dogbane, poison ivy].
7. Fall panicum (75%), large crabgrass (10%), other weeds (15%) [nimblewill, yellow foxtail, dandelion, redroot pigweed, knotweed, hedge bindweed, hedge smartweed, chicory].

Table 3. Glyphosate at 0.56 kg/ha with 0.5% adjuvant (Nufilm-P, Widespread, Regulaid, Ag 98, WK, Prime) and 3.36 kg/ha simazine applied sequentially on June 15, 1982 at a 374 L/ha rate.

Treatment	Adjuvant	Weed control 7/16/82	Weed control 8/25/82
		(%)	
1	Nufilm-P	30	35
2	Widespread	50	20
3	Regulaid	15	10
4	Ag 98	45	20
5	WK	40	40
6	Prime	65	20
7	X-77	50	20

LITERATURE CITED

1. Ambach, R. M. and R. Ashford. 1982. Effects of variations in drop make-up on phytotoxicity of glyphosate. Weed Sci. 30:221-224.
2. Ivany, J. A. 1981. Quackgrass (Agropyron repens) control with fall applied glyphosate and other herbicides. Weed Sci. 29:382-386.
3. McKinley, K. S., R. Ashford and R. J. Ford. 1974. Effects of drop size, spray volume and dosage on paraquat toxicity. Weed Sci. 22:31-34.
4. McWhorter, C. G. 1963. Effect of surfactant concentration on johnsongrass control with dalapon. Weeds 11:83-86.
5. McWhorter, C. G. and T. N. Jordan. 1976. Effects of adjuvants and environment on toxicity of dalapon to johnsongrass. Weed Sci. 24:257-260.
6. Smid, D. and L. K. Hiller. 1981. Phytotoxicity and translocation of glyphosate in potato (Solanum tuberosum) prior to tuber initiation. Weed Sci. 29:218-223.

WEED CONTROL IN NEWLY TRANSPLANTED HIGHBUSH BLUEBERRIES

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ABSTRACT

Two year old highbush blueberry cv. Jersey plants were transplanted on May 13, 1982 into silt loam soil (2.5% OM) which had been fertilized and the pH adjusted for blueberries according to soil test results. There were four plants per plot placed 5 feet apart on 10 foot centers. Immediately after transplanting the plants were pruned to a single stem 14 inches tall and irrigated with 0.5 inches of water. Herbicide treatments were applied on May 17, 1982 using a CO^2-charged backpack sprayer delivering 35 gpa of diluent at 30 psi. The treated area of each plot was 6.3 by 20 feet and each treatment was replicated four times. Immediately following treatment application, the area was irrigated with 0.5 inches of water. Visual ratings of weed control and plant vigor were taken 6 and 11 weeks after treatment. Weed counts and growth measurements were taken at the end of the growing season.

Oxyfluorfen (2.0 and 4.0 lb/A) and Norflurazon (4.0 lb/A) resulted in excellent control of the six most frequently occurring weeds in the experimental area. Napropamide (4.0 lb/A) did not control black nightshade and yellow rocket but provided excellent control of giant foxtail, broadleaf dock, lambsquarters and mayweed. Weed control by oryzalin (4.0 and 8.0 lb/A) varied among the weed species, but the control of all weeds decreased considerably after 11 weeks. Blueberry plants grown in herbicide-treated plots, regardless of the herbicide, produced more shoots than plants in untreated areas. Shoot length was greater for plants grown in plots treated with either norflurazon or oxyfluorfen. Blueberry plants did not appear to be adversely affected by any herbicide treatment and growth differences were likely the result of the variation in the weed population. Treatment identity will be maintained for 3 years.

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EFFECT OF TRIFLURALIN, ORYZALIN, SETHOXYDIM, AND PP009 IN COMBINATION WITH METRIBUZIN FOR WEED CONTROL IN WHITE POTATOES

Hugh J. Murphy and Leigh S. Morrow[1]

ABSTRACT

Combinations of metribuzin preemergence plus trifluralin post emergence did not provide good control of mustard or perennial quackgrass but gave satisfactory control of annual barnyardgrass and lambsquarters.

Metribuzin applied preemergence followed by oryzalin, sethoxydim, or PP009 as post emergence or layby treatments controlled most grasses, lambsquarters, and most other weed species except mustard and wild radish.

Trifluralin and oryzalin applied alone as preemergence or preplant incorporated treatments were unsatisfactory for annual barnyardgrass or mustard control.

None of the grass herbicides had any noticeable crop injury on white potatoes.

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THE EFFECTS OF SEVERAL COMBINATIONS OF GRASS AND BROADLEAVED HERBICIDES ON WEED CONTROL IN WHITE POTATOES IN MAINE

Hugh J. Murphy and Leigh S. Morrow[1]

ABSTRACT

Differential rates of EPTC and EPTC plus extender 33865 applied preplant incorporated and followed by dinoseb all provided good commercial control of annual barnyardgrass, quackgrass, and lambsquarters.

Combinations of napropamide applied preplant incorporated with metribuzin as the preemergence herbicide provided good control of annual barnyardgrass and lambsquarters but did not adequately control mustard.

When metribuzin or dinoseb were applied preemergence and followed by sethoxydim at layby, all grass and broadleaved species in the field were controlled exceptionally well.

EPTC and napropamide applied in this test caused some temporary injury to the potato plants this year presumably because of very dry soil conditions.

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WEED CONTROL AFTER CHEMIGATION WITH LOW RATES OF METHAM

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ABSTRACT

Metham, when applied at 89 kg/ha (= 25 gallons/A of Vapam) through sprinkler irrigation to eight production fields on New Jersey vegetable farms, provided excellent weed control during the same year as application but control was variable during the following year. This rate of application is lower and more economical than rates required with the conventional shank injection method of application. Many vegetable farmers in New Jersey are now using chemigation with Vapam for obtaining a combination of disease and weed control.

INTRODUCTION

Metham[2/] (sodium methyldithiocarbamate) is a soil fumigant which is conventionally applied by soil injection at rates of 266-355 kg/ha (= 75-100 gal/A of Vapam). These high rates are not economical for use with most crops but are required because of difficulty in obtaining a uniform distribution in soils. Recent work in Israel has demonstrated that a more uniform distribution is possible when metham is applied in irrigation water (3,4). This method of application has made it possible to obtain excellent disease control at lower rates (3,5). Phatak (6) has demonstrated improved weed control by chemigation with metham through sprinkler irrigation compared to the conventional soil injection method.

The purpose of this study was to evaluate the effectiveness of chemigation with 89 kg/ha of metham for disease and weed control on production farms. Results dealing with disease control and crop yield are being reported separately (1,2). Results dealing with weed control are reported in this paper.

MATERIALS AND METHODS

Eight fields on commercial vegetable farms in southern New Jersey with sandy loam soil were treated with metham. Details of these applications are presented in Table 1. Metham was injected continuously into the irrigation water throughout the period of irrigation with a sprinkler system. Irrigation was continued until 89 kg/ha of metham (= 25 gallons/A of Vapam) was applied to all fields with 25 mm of irrigation as the target. Raingauges were distributed throughout the field in order to determine actual levels of irrigation and distribution.

Irrigation was applied to the entire field. Untreated plots were established in two ways. First, in the Flaim, Nurge, Russo, and Simoni fields, 8 x 8 m plastic sheets (3.3 x 7.5 m in the case of Simoni) were placed at random throughout the field. Second, in the Holding fields, selected sets of sprinkler heads were plugged. Four untreated plots were established in each field (three in the

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2/ Common name for the active ingredient in the commercial product Vapam. Vapam contains 32.7% or 0.380 kg/L (= 3.17 lb/gallon) of metham.

Table 1. Application and data collection information from eight fields treated with metham through sprinkler irrigation.

Field	Metham rate	Irrigation		Calculated concentration of metham in the irrigation water	Application date	Same season as application		Season after application	
		Mean	Range			weed count date	crop[a]	weed count date	crop[a]
	(kg/ha)	-----(mm)------		(ppmw)					
Flaim	89	30	16-24	300	7/21/81	8/13/81	None	4/29/82	Onion
Holding-1	89	52	23-91	175	7/21/80	--	--	7/16/81	Onion
Holding-2	89	32	23-55	281	7/15/81	--	--	6/15/82	Snapbean
Malench	89	24	17-37	368	7/21/81	10/5/81	Lettuce	6/15/82	Onion
Nurge	89	25	6-56	355	6/25/81	7/16/81	None	4/29/82	Leek
Russo-1	89	29	15-46	310	7/22/81	8/13/81	None	6/15/82	None
Russo-2	124	22	11-41	570	7/22/81	8/13/81	None	6/15/82	None
Simoni	89	34	23-51	260	7/14/81	10/5/81	Lettuce	6/15/82	Sorghum

[a] Crop at the date on which weed counts were taken.

Holding-2 and Simoni fields). Weed counts were taken from three sample areas within these untreated plots and from three sample areas in a treated section of the field adjacent to the untreated plots. Thus paired observations from treated and untreated areas where made for each untreated plot (or rep) within the field. The one exception was the unreplicated Malench field test in which a portion of the field was treated and the remainder left untreated.

Metham treatments were made to vegetation-free, recently disked soil. Approximately one month after application, fields were disked, beds formed, and crop planted. Conventional weed control practices consisting of preemergence herbicides, tractor cultivation, and handweeding were utilized with all crops. Because of these weed control procedures, weed counts could not be taken during every visit to every field. Weed counts were taken only when there were sufficient weeds in the untreated plots for a meaningful comparison with treated areas.

A paired t-test was performed for testing the significance of differences between means. In most cases, this test showed no significant difference (at P=0.05) even when large differences between the treated and untreated areas were evident. This was attributed to the large variation in counts from one untreated area to another within a field and not to variation in the relation of treated to untreated counts from one rep to another.

Weeds encountered in these fields were carpetweed (*Mollugo verticillata* L.), common lambsquarters (*Chenopodium album* L.), common purslane (*Portulaca oleracea* L.) mayweed (*Anthemis cotula* L.), shepherdspurse (*Capsella bursa-pastoris* (L.) Medic.), smallflower galinsoga (*Galinsoga parviflora* Cav.), and a weed of prostrate growth habit identified as *Chenopodium pumilio* R. Br. Grass weeds were not identified by species.

RESULTS AND DISCUSSION

Metham reduced by at least 95% the total number of weeds emerging in fields during the same season as application, except for the Simoni field (Table 2). Four of these fields had not been fitted for crop production subsequent to metham application (Tables 1 and 2). Of two fields which had been planted and received weed control treatments, weed numbers were reduced by 95% in the Malench field but were not reduced in the Simoni field. The reason for the failure of metham to control weeds in the Simoni field is not clear. Good disease control was obtained in this field (2) suggesting that there were no mistakes in application. The best explanation is that the two weed species that were dominant in this field, common purslane and *Chenopodium pumilio*, were resistant to metham (these weeds are discussed later in the paper).

Weed control by metham in the season after application was variable (Table 2). Good control still was evident in the Flaim and Holding-1 fields while partial control prevailed in the Nurge, Russo-1, and Russo-2 fields. There was very little difference between weed numbers in the treated and untreated areas of the Holding-2, Malench, and Simoni fields.

Weed species that were controlled by metham in the same season as application were carpetweed, common lambsquarter, smallflower galinsoga, and grasses (Table 3). By the season after application, control of all weed species was reduced. However, good shepherdspurse control was observed at this time along with partial control of common lambsquarter, mayweed, and grasses.

Table 2. Effect of chemigation with metham on total weed numbers in eight production fields in New Jersey.

Field	Total weed numbers in treated areas expressed as percent of untreated areas	
	Same season as application	Season after application
	(%)	
Flaim	3	31
Holding-1	--	20
Holding-2	--	89
Malench	5	83
Nurge	1	65
Russo-1	2	58
Russo-2	2	56
Simoni	102	102

Table 3. Effect of chemigation with metham on numbers of individual weed species in eight production fields in New Jersey

Weed	Field	Weed numbers in treated areas expressed as percent of untreated areas	
		Same season as application	Season after application
		(%)	
Carpetweed	Flaim	6	--
	Malench	--	79
	Russo-1	1	--
Chenopodium pumilio	Malench	3	207
	Simoni	72	--
Common lambsquarter	Flaim	0	--
	Holding-2	--	84
	Malench	--	33
	Nurge	1	--
	Russo-1	0	52
	Russo-2	0	46
Common purslane	Holding-2	--	84
	Malench	--	254
	Simoni	138	102
Mayweed	Flaim	--	46
	Holding-1	--	24
Shepherdspurse	Flaim	--	5
	Holding-1	--	3
Smallflower galinsoga	Holding-2	--	118
	Malench	1	100
	Russo-1	1	--
	Russo-2	1	83
Grass	Flaim	0	--
	Holding-2	--	66
	Malench	--	51
	Russo-1	5	--
	Russo-2	2	--

Two weeds that may be resistant to metham treatment are common purslane and Chenopodium pumilio. Common purslane was not controlled in any field at any time in the study. The Simoni field had some emerged common purslane present at the time of application which may account for a portion of the lack of control in that field. Chenopodium pumilio was not controlled in the Simoni field during the same season as application nor in the Malench field during the season after application. Fred Nurge reported that this weed has never been controlled by metham on his farm. The apparent control of this weed observed on the Malench farm during the same season as application may not be true becuase of the lack of replication in this particular field.

Results presented elsewhere (1,2) demonstrated that metham applications in these fields decreased two important diseases, lettuce drop and Allium white rot, and increased crop yields. The results reported here demonstrate that metham improved weed control substantially in the same year as application and partially, in some instances, in the following year. By applying metham through irrigation, therefore, lower rates of application can provide effective control of both diseases and weeds. These lower rates would cost approximately $383/ha (= $155/A) compared to $1,148-1,533/ha (= $465-620/A) for a conventional application. This price has proven to be economical enough that many vegetable farmers in the southern New Jersey area have begun using this practice for achieving both disease and weed control. This practice is particularly useful to small farmers handling multiple cropping vegetable farms because it offers reliable pest control management for many crops in a single operation.

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LITERATURE CITED

1. Adams, P. B. and S. A. Johnston. 1983. Factors affecting the efficacy of metham sodium applied through sprinkler irrigation for control of Allium white rot. Plant Disease 67: submitted.
2. Adams, P. B., S. A. Johnston, J. Krikun, and H. E. Carpenter. 1982. Sprinkler irrigation application of metham sodium to control lettuce drop caused by Sclerotinia minor. Plant Disease 66: in press.
3. Gerstl, Z., U. Mingelgrin, J. Krikun, and B. Yaron. 1977. Behavior and effectiveness of vapam applied to soil in irrigation water. Proc. of the Israel-France Symposium. 1975. Behavior of Pesticides in Soil. Special Publication 82. pp. 42-50.
4. Gerstl, Z., U. Mingelgrin, and B. Yaron. 1977. Behavior of vapam and methylisothiocyanate in soils. Soil Sci. Soc. Am. J. 41:545-548.
5. Krikun, J. and Z. R. Frank. 1982. Metham sodium applied by sprinkler irrigation to control pod rot and Verticillium wilt of peanut. Plant Disease 66:128-130.
6. Phatak, Sharad C. 1982. Effect of metham sodium applied through overhead irrigation systems on weed control and yield of vegetables. Proc. for the Second National Symposium on Chemigation. pp. 23-27.

EFFECT OF WIPER APPLICATION OF SEVERAL HERBICIDES AND CUTTING ON BLACK CHOKEBERRY

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ABSTRACT

Black chokeberry plants were treated with 0,36,73 or 145 g/l ai solutions of dicamba, fosamine, hexazinone, 2,4-D or 2,4-D in oil using a hand held wiper or were cut to the ground level 0,1,2 or 3 times. All treatments had a significant effect on the number and vigor of stems but cutting the plants did not affect the number of stems. Frequency of cutting, however, reduced the stem vigor.

INTRODUCTION

Black chokeberry (Pyrus melanocarpa) is a serious weed problem in lowbush blueberry (Vaccinium angustifolium) fields because it grows in close association with the lowbush blueberry and produces a fruit which adulterates the blueberry pack (2). Studies in the greenhouse (4) and field (5) indicate that 2,4-D [(2,4-dichlorophenoxy)acetic acid] and glyphosate [N-(phosphonomethyl)glycine] control black chokeberry plants. Currently only 2,4-D is registered for control of broadleaf weed species in blueberry fields so efficacy information for alternative herbicides is needed. Other herbicides have been tested for aspen (Populus tremuloides) with variable results (3). Some degree of black chokeberry control is obtained with broadcast application of hexazinone [3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5 -triazine-2,4-(1*H*,3*H*-dione] (1).

The objective of the experiment was to test a hand held wiper with several herbicides at different rates and cutting at different intervals to determine the optional treatment for control of black chokeberry.

MATERIALS AND METHODS

Black chokeberry cuttings were vegetatively propagated in 1975 and set out in a planting in 1977 at the University of Maine Blueberry Hill Farm in Jonesboro. Plants were allowed to establish themselves and were pruned by mowing in May of 1981. A hand held wiper applicator designed by a blueberry grower was used to apply the herbicides. The applicator consisted of two sponges with a trigger mechanism that enabled the operator to clasp the plant so that the herbicide solution could be applied to runoff on the target weed. A container with capillary tubing located at the opposite end of the wiper provided a means to store the herbicide and deliver it to the sponges.

Herbicides used in the trial include dicamba (3,6-dichloro-*o*-anisic acid), fosamine [ethyl hydrogen(aminocarbonyl)phosphonate], glyphosate, hexazinone, and 2,4-D in water or #2 fuel oil. Herbicide treatments were applied at four rates 0,36,73 and 145 g/l ai solutions on July 16, 1981. Stems were either

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not cut or cut to the ground level with a bush cutter once on July 16, twice on July 1 and August 5, and three times on July 16, August 5 and 21, 1981.

The efficacy of treatments was determined by counting the number of surviving stems one year after treatment. A visual assessment of vigor, with 0 = dead and 10 = healthy was also made at that time. Data were analyzed using orthogonal contrasts of no treatment and linear and quadratic trends within the remaining three rates. An F test at a single degree of freedom was used to determine significance.

RESULTS AND CONCLUSION

The black chokeberry plants were mowed in the spring to stimulate the type of growth which would be present in the first year of the blueberry pruning cycle. The plants sprouted new shoots that reached sufficient size for treatments in July. The applicator worked well in that weeds could be clasped and saturated to runoff without contacting adjacent vegetation. However, the copper tubing construction made it too heavy to be used for prolonged periods of time. Changing the construction to PVC pipe would improve its design.

Cutting and frequency of cutting black chokeberry stems had no effect on the number of live stems after treatment. All herbicides tested caused a significant decline in the number of live stems when compared to the non treated plants (Figure 1). One year after treatment untreated black chokeberry plants had an average of 18 stems, compared to those that had been treated with the herbicides which had an average of less than one living stem. No significant trends were found between the rates of any of the herbicides on the number of living stems.

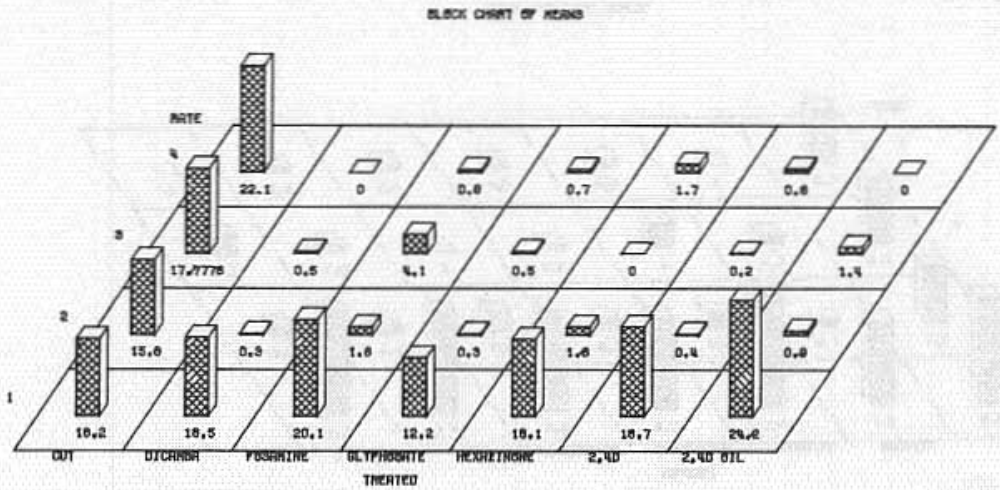
Frequency of cutting reduced the vigor of stems one year after treatment (Figure 2). This reduction was largely in plant height.

The wiper device provided sufficient saturation to effectively control black chokeberry with any of the herbicides tested. Although cutting reduced the vigor of the black chokeberry stems, its control does not compare favorably with the herbicides.

FIGURE 1

EFFECT OF RATE OF SEVERAL HERBICIDES AND CUTTING ON BLACK CHOKEBERRY

NUMBER OF STEMS ONE YEAR AFTER TREATMENT



HERBICIDE RATE = 0, 36, 73, 145 G/L AI SOLUTION
STEMS CUT 0,1,2,3 TIMES

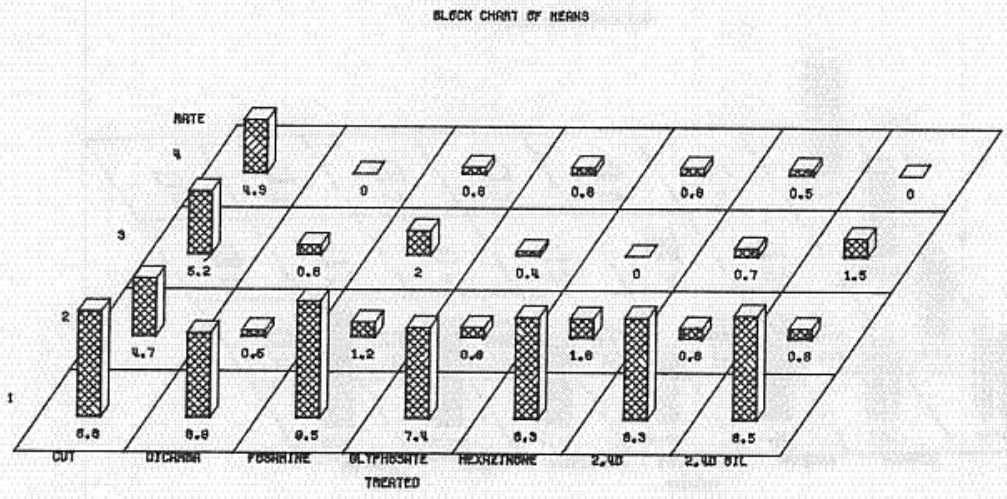
Rate Contrast	Treatment						
	Cut	Dicamba	Fosamine	Glyphosate	Hexazinone	2,4-D	2,4-D oil
0 vs All	NS	**	**	**	**	**	**
Linear	NS	NS	NS	NS	NS	NS	NS
Quadratic	NS	NS	NS	NS	NS	NS	NS

** = Significant at 1% level

NS = Non significant

FIGURE 2

EFFECT OF RATE OF SEVERAL HERBICIDES AND CUTTING ON BLACK CHOKEBERRY
VIGOR RATING ON 0 – 10 SCALE



0 = DEAD 10 = HEALTHY
HERBICIDE RATE = 0, 36, 73, 145 G/L AI SOLUTION
STEMS CUT 0,1,2,3 TIMES

Treatment

Rate Contrast	Cut	Dicamba	Fosamine	Glyphosate	Hexazinone	2,4-D	2,4-D oil
0 vs All	**	**	**	**	**	**	**
Linear	NS	NS	NS	NS	NS	NS	NS
Quadratic	NS	NS	NS	NS	NS	NS	NS

** = Significant at 1% level

NS = Non significant

LITERATURE CITED

1. Ismail, A.A. and D.E. Yarborough. 1982. Hexazinone for Weed Control in Lowbush Blueberry Fields. (Abstr.) Proc. NEWSS 36:186.

2. Murphy, E.F., R.N. True, A.A. Ismail, and J.M. Hogan. 1974. Effects of Foreign Edible Berries on the Flavor and Texture of Lowbush Blueberry Products. HortSci. 9:22-24.

3. Yarborough, D.E. and A.A. Ismail. 1982. Selective Application of Herbicides for Aspen Control in Lowbush Blueberries. Proc. NEWSS 36:193-198.

4. Yarborough, D.E., A.A. Ismail and P.R. Hepler. 1979. Effect of Contact Application of Glyphosate and 2,4-D on Black Barrenberry under Greenhouse Conditions. J. Amer. Soc. Hort Sci. 104:742-745.

5. Yarborough, D.E. and A.A. Ismail. 1979. Barrenberry Control in Lowbush Blueberry Fields through Selective Application of 2,4-D and Glyphosate. J. Amer. Soc. Hort. Sci. 104:786-789.

TIMING - SPECIES - HERBICIDE INTERACTIONS FOR TREE INJECTION TREATMENTS

David I. Maass 1/

ABSTRACT

Five hardwood species and two conifers common to New England were injected with one of eight herbicides in each of three seasons. Spring seemed to be the best season for injection. Overall, cacodylic acid and dicamba had the highest ratings for control.

INTRODUCTION

One technique for the silvicultural practice of Timber Stand Improvement (TSI) is the injection of herbicides into trees to inhibit their growth. Herbicides are an effective, easy and low cost method of meeting TSI objectives (3). Fisher (2) suggests that stem injection is effective, efficient, selective, minimizes the use of herbicides, and has maximum public acceptance of herbicide use because of drift.

Scott Paper Company in Maine has used tree injection as a method of improving the current stand and influencing the type of regeration after the stand is harvested (2). It was apparent, however, that there was a lack of information on which herbicides work best for a variety of species in Maine, and when during the year were applications most effective. In 1981 a study was established to try to answer some of these questions.

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METHOD

A number of herbicides are registered for or have the potential to be registered for tree injection. Eight herbicides were used in this study: dicamba (3,6-dichloro-o-anisic acid), 2,4-D [(2,4-dichlorophenoxy) acetic acid], triclopyr ([(3,5,6,-trichloro-2-pyridirnyl)oxy] acetic acid), glyphosate (N-(phosphonomethyl) glycine), cacodylic acid (hydroxydimethylarsine oxide), picloram (4-amino-3,5,6-trichloropicolinic acid), hexazinone [3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione), and a combination of glyphosate and triclopyr. Except for triclopyr, glyphosate and the combination, all were applied at full strenghth from the container. Triclopyr and glyphosate were diluted one part herbicide to three parts water. The glyphosate-triclopyr combination was diluted one part glyphosate, one part triclopyr to six parts water, making it the same concentration of herbicide to water as the glyphosate alone and the triclopyr alone.

There are several species in New England which sometimes need TSI treatments. Of the hardwoods, the common ones are aspen (*Populus* spp.), red maple (*Acer rubrum* L.) and beech (*Fagus grandifolia* Ehrh.). Occasionally white birch (*Betula papyrifera* Marsh.), yellow birch (*Betula alleghaniensis* Britton) and sugar maple (*Acer saccharum* Marsh.) need treatment as a thinning or cleaning measure. Two softwood species common in New England which sometimes need thinning are balsam fir (*Abies balsamea* (L.) Mill.) and spruce (*Picea* spp.). This study included all of these species. Red maple and sugar maple were combined as a single genus because each species did not occur consistently throughout the stands being treated. Spruce, too, was treated as a genus.

New England is known for its four seasons. However, the "growing season" in Maine spans a relatively short period of time. For this study three "seasons" were chosen. First, spring was defined as the season after budbreak and prior to shoot elongation. This generally occurs in the month of May. Summer was defined as the period of shoot elongation and radial growth. In Maine, this generally falls in June, July and August. For this study winter was defined as the dormant season.

In this study spring treatments were made in May and very early June in 1981. Summer injections were done in early August, 1981. Winter treatments were completed in March, 1982.

In order to test season-species-herbicide interaction, approximately ten trees of a single species were injected with an herbicide during each season. Six herbicides were used in the spring: triclopyr, glyphosate, glyphosate-triclopyr combination, cacodylic acid, picloram and hexazinone; whereas in the summer and winter, all eight previously mentioned were used.

TABLE 1

AVERAGE RESPONSE OF TREES TO INJECTED HERBICIDE TREATMENTS

	Aspen	Beech	White Birch	Yellow Birch	Maple	Balsam Fir	Spruce
SPRING							
Cacodylic Acid	10	10	10	10	6	10	9
Glyphosate	10	9	-	10	7	10	10
Triclopyr	10	10	-	10	7	9	-
Glyphosate-Triclopyr	10	9	-	9	5	10	-
Hexazinone	10	8	10	8	9	9	5
Picloram	10	5	8	4	9	10	10
SUMMER							
Cacodylic Acid	10	10	9	10	10	10	8
Dicamba	10	10	9	8	9	10	10
Glyphosate	9	10	10	9	9	10	4
Picloram	9	7	5	8	9	10	8
Glyphosate-Tricolpyr	10	9	7	10	6	10	3
2,4-D	10	5	10	9	2	10	2
Triclopyr	7	8	8	7	6	10	2
Hexazinone	10	4	7	2	5	8	4
WINTER							
Dicamba	10	9	7	6	3	10	10
Cacodylic Acid	9	9	4	7	3	10	7
Glyphosate	8	9	3	5	3	10	7
Picloram	9	6	6	4	1	9	10
2,4-D	10	2	8	4	3	10	5
Hexazinone	10	9	6	1	2	6	3
Glyphosate-Triclopyr	2	10	4	5	3	10	1
Triclopyr	3	6	7	7	3	4	2

The trees were injected using a small hand ax and a plastic titration bottle which released precisely one mililiter of herbicide. The bottles were rinsed three times with water between herbicide treatments. These tools were chosen over the Hypo-hatchet because of the ease of changing herbicides. The injections were made about one to two inches apart at a convenient height. Each tree was tagged with an aluminum tag which indicated the species, the chemical used and the date of application.

The trees were evaluated in September, 1982, one growing season after the summer and winter applications; two growing seasons after the spring application. The trees were rated from zero to ten, with zero meaning no apparent reaction to the treatment and ten meaning complete kill. At the time, diameter at breast height was estimated to determine if size had an effect on the treatment.

RESULTS AND DISCUSSION

Table 1 lists the average response to the herbicide treatments for each species. The average response is the average of ratings from zero to ten given for each tree that was found and identified. All treatments had at least four trees; most had ten. For those treatments which had relatively few trees, only the most consistent data are given. The treatments are ranked by their overall rating within each season.

Of all the species studied, balsam fir and aspen were the easiest to control throughout the year. The hardest to control were maple and, suprisingly, spruce, particularly in the winter season. Beech, white birch and yellow birch were in the middle, for ease of control.

The best season for treatment appeared to be in the spring. That season had an average response of 8.8 (not shown on the table). This higher rating may be a result of waiting two growing seasons before evaluation. Summer was the second best season for control with an average response of 7.9. Winter had the poorest response, 6.1, particularly with the maple. None of the herbicides tested were effective in controlling maple consistently.

Throughout the year, cacodylic acid and dicamba had the best response for the species studied. Unfortunately, dicamba was not tested in the spring. Judging from the other seasons it may have done very well. Glyphosate rated third highest average response and picloram had the fourth highest response. As expected, glyphosate did well on beech in all three seasons. Picloram was able to control spruce, while the other herbicides had difficulty with this species.

The combination of glyphosate-triclopyr and triclopyr alone were rated fifth and sixth. Part of the poor performance with these two herbicides in the winter was related to the fact that ice crystals started to form in the bottles during application. Surprisingly, triclopyr did poorly on maple overall. It is felt that the dilution of one to three is the maximum amount of dilution that should be tried for these species.

Hexazinone and 2,4-D were rated last. Hexazinone in the spring performed well on most species except spruce. 2,4-D performed well on aspen and balsam fir in the summer and winter and did well on white birch in the summer.

Biological synergism was expected with the glyphosate-triclopyr combination. That is, the response to the combination was expected to be higher than either of the two herbicides alone, despite the fact that in the combination, each was diluted more than they were when used alone. Generally, this synergism was not found. In the nineteen species-season interactions where glyphosate, triclopyr and the combination was used, the combination scored as high or higher than either alone in only eight cases. The combination was rated as high for balsam fir in all three seasons, aspen in the spring and maple in the winter, where no herbicide did well. The combination outperformed either alone on aspen in the summer, yellow birch in the summer, and beech in the winter. In the other eleven situations, the combination was rated lower. The dilution might have an effect on how the combination performed.

Data was taken on diameter at breast height. Generally the smaller trees were rated higher than larger trees. Because of the small sample, correlations were not possible. Another confounding factor, which is somewhat related to size is the dominance of the tree in a stand as it relates to the overall vigor of the tree. A small aspen might have higher rating than a large aspen simply because of its size or its small size might indicate that it is a suppressed tree and of poor vigor.

RECOMMENDATIONS

Generally, it is best to conduct tree injection treatments in the spring as defined in this study. Summer would also be acceptable. The most inconsistent results were achieved in the winter season. For a wide variety of species found in New England to be treated, cacodylic acid and dicamba are the best herbicides for injection. Glyphosate should not be diluted more than one to three. If the stand to be treated has a high proportion of a particular species, use the table to select the best herbicide treatment. For example, choose picloram if the stand to be treated has a large component of spruce.

LITERATURE CITED

1. Fisher, Burnell. 1980. Individual Stem Injection as a Silvicultural Strategy. Herbicide Supervisors Training Course, July, 1980. Augusta, Maine. (Lecture Notes)

2. Maass, David. 1981. The Use of Tree Injection in Timber Stand Improvement in Maine. In: Proceeding Northeastern Weed Science Society, pp. 194-198.

3. McCormack, Maxwell L. 1976. Status of Herbicide Technology for Control of Tree Species and to Reduce Shrub and Grass Competition. Symposium on Intensive Culture of Northern Forest Types, University of Maine, Orono.

HERBICIDES APPLIED IN BANDS TO CONTROL BRUSH PRIOR TO CONIFER PLANTING

David I. Maass [1/]

ABSTRACT

Banded herbicide treatments were applied to a slash-free, formerly wooded site. One fall treatment and four spring treatments were applied. Only one spring treatment, picloram plus triclopyr, was effective in controlling sprouts of aspen,red maple and ash, in the banded treatments and between the bands. These treatments will be planted to conifers in the spring following the treatment.

INTRODUCTION

Banded applications of herbicides have been applied successfully to control grasses before planting of Christmas trees or conifers for timber production. Simazine [2-chloro-4,6-bis(ethylamino)-s-triazine], for example, is labelled for Christmas tree plantings and shelterbelts in bands. The advantage is to reduce the amount of material needed to control grasses in those bands. Untreated strips between treated bands help prevent soil erosion and provides aesthetic cover.

Hexazinone [3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H, 3H)-dione] has been used for spot treatments in the form of gridballs or as a liquid in spot gun treatments. It can be applied directly to the soil for control of brush. It was thought that other soil residual herbicides such as picloram (4-amino-3,5,6-trichloropicolinic acid),and dicamba (3,6-dichloro-o-anisic acid) might also be applied in a way to control brush on a biomass chipping site prior to planting conifers.

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METHODS

In 1981, a 22.6 acre site was chosen for a whole tree harvest. It was a young pole size stand of aspen (*Populus* spp.), red maple (*Acer rubrum* L.), ash (*Fraxinus americana* L.), beech (*Fagus grandifolia* Ehrh.) and other hardwoods. The trees ranged from one inch to seventeen inches DBH, with an average stand diameter of just under two inches. The soil type is described as a Dixmont very stony silt loam with slow to medium runoff, and moderate to moderately slow permeability. The soil has an excellent site index for hardwoods, spruce-fir and white pine.

The stand was harvested in October, 1981 using fellerbunchers, and whole trees were skidded to a chipper. This method provided a very clean site for planting conifers, but there was a real concern about the amount of hardwood sprouts, which would result from the harvest.

It was thought that an early treatment of a soil residual herbicide would provide control of the sprouts. Banded treatments were selected to reduce the amount of chemical that would be needed as compared to a broadcast treatment. Some between-the-bands suppression was expected and desirable. Plans were made for both fall and spring applied herbicide treatments. The fall applied treatment would be planted in the spring of 1982, and the spring applied treatment would be planted in the spring of 1983. The bands would be planted with conifers.

On November 4, 1981 hexazinone was applied using a skidder-mounted boom sprayer provided by Lucas Tree of Portland, Maine. The nozzles were eight feet apart; each would effectively spray a three-foot swath. The plan called for applying two pounds of hexazinone per acre sprayed. "Target E" Drift Control Agent from Agway was used as a thickening agent. Dilution was with 150 gallons of water to two gallons of hexazinone with one gallon of Target E. Markers on each side of the area to be treated were set up every sixteen feet. After mixing and calibration, the skidder covered five acres in about half a day.

On June 28,1982, four treatments were applied to five acres using mist blowers. The applicators, who were spaced nine feet apart,were instructed to direct the spray to a three-foot band directly in front of them. Every third line was flagged. It was expected that the crew could maintain a fairly straight course through the low brush. The four treatments were hexazinone at 3.7 pounds per acre treated,hexazinone at 4.69 pounds per acre treated, dicamba at 2.27 pounds per acre treated, and picloram plus triclopyr ([(3,5,6-trichloro-2-pyridinyl)-oxy]acetic acid) at 4 a.e. pounds plus 5.56 a.e. pounds per acre treated. All four treatments were diluted with fifty gallons of water.

RESULTS AND DISCUSSION

There was no apparent effect of the fall hexazinone treatment on the brush. The height and the abundance of the aspen, red maple and ash were the same as for the area that was not treated.

The spring treatments were evaluated on August 24, 1982, two months (one growing season) after application. Field notes and photographs were taken. There were no numerical data taken.

Hexazinone at 3.7 pounds and 4.69 pounds per acre had distinct bands to bare ground after two months. Red maple, aspen and pin cherry (Prunus pensylvanica L.) were controlled in the sprayed bands. Stump control on aspen was achieved in the bands. Beech and ash sprouts appeared in the bands after application, but they were burned and had reduced growth. There was little or no suppression between bands except where lateral movement of the herbicide occurred. While the bands were distinct it seemed unlikely that the treatment would be effective for controlling hardwood competition when planting conifers.

Dicamba at 2.27 pounds per acre had less distinct bands than other treatments. There were more grasses reinvading or shadowing the bands. Aspen, red maple and ferns (Pteridium aquilinum (L.) kuhn. and Dennstaedtia puntilobula(Michx.) Moore.) were controlled in the bands. When the fern reinvaded, it was burned. Aspen was generally not as tall between the bands as in the areas not treated, so there might be some suppression indicated. Stumps of red maple in the bands had no stump sprouts. This treatment was also not effective for controlling hardwood competition when planting conifers, because of the lack of adequate suppression between the bands.

The picloram plus triclopyr treatment provided distinct bands and suppression between the bands. Ash, red maple, birch (Betula papyrifera Marsh. and B. populifolia Marsh.) aspen, ferns and grasses were controlled in the bands. Aspen and red maple had reduced height growth between the bands as compared to areas outside of the treated area. There appeared to be some lateral movement of the herbicide outside of the bands. This treatment would be adequate for controlling hardwood brush when planting conifers.

CONCLUSION

Only one of the five banded herbicide treatments seemed to be effective in controlling hardwood brush prior to planting of conifers. This might prove to be a cost effective technique, however further refinement of the application technique, timing of treatments and rates of herbicides to be used is necessary.

RESIDUAL SUPPRESSION OF BRAMBLES IN FOREST CLEARCUTS

Maxwell L. McCormack, Jr. [1/]

ABSTRACT

Dense stands of raspberry [Rubus idaeus L. var. strigosus (Michx.) Maxim.] compete with desirable conifer regeneration. During 1980, small plots were established in northern Piscataquis Co. Maine. Treatments were applied on three dates, in water, using a backpack mistblower delivering a total volume of 10 gal/a. One-year results were summarized earlier (1). On July 27, 1982 residual effectiveness was evaluated (Table 1).

Table 1. Two-year silvicultural effectiveness[a] of mistblower-applied herbicides, by date of application, in controlling brambles

No.[b] of plots	Herbicide	Rate[c] lb/a	Date of application July 31 1980	Aug. 27 1980	Sept. 15 1980
1	hexazinone	1	6.5	3	-
2		2	8.5	4	6
2		4	8	8	7.5
1		6	9	8.5	7
1	fosamine	4	6	1.5	7.5
2		6	4.5	4.5	7
2		8	6	5	6.5
1	glyphosate	2	7	6	6.5
2	oxyfluorfen	1	1	4	1
2		2	1	2.5	0

[a] Zero to 4 represents inadequate silvicultural advantage; five is the threshold of benefit; 6 to 10 indicates increasing silvicultural effectiveness up to complete control. Ratings are based on four independent appraisals.

[b] Number of plots treated on each date, table values are averages where appropriate.

[c] All rates are ai.

There was a slight, but inadequate, improvement of suppression by oxyfluorfen. All July treatments of hexazinone, fosamine and glyphosate retained good effectiveness. Higher rates of hexazinone were needed in August and September to retain good effectiveness. August applications of fosamine faded below effective levels of suppression, but the September treatments were satisfactory. Glyphosate maintained acceptable levels of suppression, but September treatments decreased notably. This appears to reflect the influence of autumn frost prior to treatment.

LITERATURE CITED

1. Sprague, Ellis and Maxwell McCormack, Jr. 1982. Herbicide trials to suppress brambles in forest clearcuts. Proc. Northeast. Weed Control Conf. 36:204.

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PROMOTING THE ESTABLISHMENT OF BLACK ALDER WITH HERBICIDES

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Abstract

A field trial was conducted in 1982 to evaluate the effects of seven preemergence herbicides on the growth and development of black alder. One year old seedlings averaging 10 cm in height were planted at two sites in April 1982. The soils at both locations were silt loams with an average pH of 5.8 and 3.5 to 4.5% organic matter. Site preparation consisted of applications of glyphosate at 3.3 kg/ha in September 1981 and 1.7 kg/ha in April 1982 prior to planting.

The preemergence herbicides atrazine, napropamide, oryzalin, oxadiazon, oxyfluorfen, and simazine were applied at one, two, and four times the recommended rate to the 1.22 m x 3.05 m test plots. Each plot contained seven seedlings. Combinations of low levels of simazine (2.2 kg/ha) with metolachlor, atrazine, napropamide, and oryzalin were also tested. All herbicides were applied 4-6 days after planting, except the G formulation of oxyfluorfen which was applied 20 days after planting. EC and WP formulations were applied using a backpack CO_2 bomb sprayer; G formulations were applied by hand. All test plots treated with preemergence herbicides were kept free of any subsequent weed competition throughout the growing season with wick applications of glyphosate and hand weeding. Two test plots in each replication of the experiment were not treated with preemergence herbicides to serve as controls. One control plot received the same postemergent control methods as the treatment plots; the other received no treatment in order to provide a qualitative measure of the effects of weed competition. The experiment was replicated seven times.

Survival rates and height measurements of the black alder seedlings were obtained at monthly intervals throughout the growing season. Visual symptoms of injury were also periodically recorded.

Atrazine and simazine applied alone and in combination resulted in high mortality of black alder seedlings. Surviving seedlings were visibly stunted and showed moderate to severe necrosis. High survival rates and similar growth increments were recorded for all other herbicide treatments and the weeded control, even though some herbicide treated seedlings showed slight necrosis early in the growing season. The unweeded control showed high survival, but growth increments diminished substantially in the last two months of the growing season.

Preliminary results suggest that most of the herbicide treatments tested may be safely used to help control unwanted herbaceous vegetation in black alder plantations. Data on the height growth measurements will be presented.

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WEED CONTROL IN BLACK LOCUST NURSERY SEED BEDS

Lori J. Graunke, C. Ed Beste, Frank R. Gouin, and John F. Kundt [1/]

ABSTRACT

Field studies conducted at Buckingham State Forest Tree Nursery in Harmans, MD in 1982 to determine appropriate herbicides for weed control in black locust (Robinia pseudoacacia L.) seed beds. The beds were treated with paraquat (0.28 kg/ha) to kill existing weeds prior to amending half of the beds of the Evesboro sandy loam soil with composted sewage sludge, made from lime dewatered sludge from Blue Plains waste water treatment facilities, Washington D.C., composted by the aerated pile method in Beltsville, MD. The unamended beds were limed to a pH 6.3 and K levels adjusted to a medium range. Beds were rototilled to a depth of 18cm and rolled smooth. Acid scarified seed from two sources were machine seeded in rows 15 cm apart with eight rows/bed. Two seeding depths of 0.63 and 1.27 cm were used for each seed source. Nitrogen (ureaform) as 38-0-0 (97.6 kg N/ha) was applied soon after seeding on fertilizer amended beds. Granular herbicides were uniformly distributed and sprayable herbicides were applied by a hand held boom with flat fan 9503 nozzles, 276 kPa, applying 1370 L of H_2O/ha. Herbicide plots (1.2 by 1.5m) were randomized in each bed of fertilized or compost amended soil replicated three times. Plots were evaluated then hand weeded every three weeks from seeding date until harvest. Measurements include tree and weed populations, % control weeds, tree root/shoot ratio by dry weight, and stem length.

Oxadiazon 2G (1.7, 3.4, 6.7 kg/ha) caused unacceptable reductions in black locust populations. Adequate tree populations and tree vigor were obtained in fertilized soil with oryzalin 4F - 1.1 kg/ha, alachlor 15G- 2.3 kg/ha, prometryn 80W - 0.8 kg/ha, napropamide 10G - 2.8 kg/ha, and napropamide 50W - 2.8 kg/ha. Five additional treatments produced acceptable vigorous tree populations in compost amended soil; these treatments include oryzalin 4F - 2.2 kg/ha, napropamide 10G - 5.6 and 11.2 kg/ha, and napropamide 50W - 5.6 and 11.2 kg/ha. Therefore, compost appears to reduce tree injury with the higher rates of oryzalin and napropamide. Dominant weed species include crabgrass, lovegrass, goosegrass, fall panicum, prostrate spurge, carpetweed, and knawel (Scleranthus annuus L.). Weed counts indicate that compost did not reduce herbicide efficacy. Most herbicides tested provided excellent weed control; however, oryzalin 4F - 1.1 kg/ha and napropamide 50W - 2.8 kg/ha did not inhibit tree vigor and population in either compost or fertilizer amended soil.

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TRICLOPYR AMINE CONTROL OF LARGE TREES ON A WEST VIRGINIA PIPELINE ROW

Phillip E. Reynolds[1/], Richard J. Hendler[2/], Walter D. Betsch[3/], and William Ollice[4/]

ABSTRACT

During July 1981, a canopy-crowned, tree-overgrown gas pipeline ROW in southern West Virginia was aerially sprayed using triclopyr amine alone and a mixture of triclopyr amine, picloram and 2,4-D. Fifty-five days following spraying, the large mixed mesophytic hardwoods growing on the ROW were numerically tagged, evaluated for percent brownout and rated for the extent of their defoliation. During May of 1982, following complete spring leaf-out, the tagged trees were further evaluated for percent kill. Most of the sprayed trees showed 100% control, demonstrating for the first time that triclopyr amine is an effective herbicide for controlling large tree growth. Additionally, herbaceous growth on the ROW appears to have been greatly stimulated. Percent control data for the various tree species is presented and evaluated in reference to initial percent brownout and defoliation data. The implications of using triclopyr as a new tool for reclaiming tree-overgrown ROW's is discussed.

INTRODUCTION

As mandated by federal law, natural gas utilities must periodically inspect their pipelines for leaks. This is accomplished by observing the herbaceous ground cover of ROW's for brownout caused by leaks. Observation for leaks is normally performed by walking the ROW or by aerial inspection. Terrain features often dictate which method is chosen; however, if the ROW is aerially visible, a helicopter patrol of the ROW is safer for employees and less time consuming in mountainous terrain.

Many older gas pipeline ROW's in the Appalachian Region are canopy crowned and/or tree overgrown. These ROW's cannot be aerially observed during the summer months, and must be inspected on the ground. In order to aerially patrol these ROW's, tree growth on the ROW's must be controlled or removed. In steep, mountainous terrain, the safest and most cost-effective means of controlling vegetation is by aerial spraying. Other methods of vegetation control (e.g., manual removal, mowing, ground herbicide applications) are impossible, too costly or pose undue worker safety hazards. In order for aerial spraying to be successful, two technical problems must be solved: (a) an herbicide effective in controlling large trees must be found and (b) an effective marking technique for locating the ROW's during the summer growing

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season must be developed. This paper affords an opportunity to consider the first of these problems by reporting on percent control achieved after aerially spraying large trees using triclopyr amine. An accompanying paper (1) provides a discussion of the second problem.

STUDY AREA

Two sections of Columbia Gas Line B-18 located in Mingo County, West Virginia were selected for testing and evaluation of triclopyr amine efficacy on large tree growth (2). Line B-18 is located in the Miller's Creek Watershed on land owned by Cotiga Land Development. The Watershed is approximately 60 miles south of Huntington, West Virginia, and is adjacent to the Kentucky border. It ranges in elevation from approximately 500 to 1700 feet, is covered by a mixed mesophytic forest (3) consisting of at least 35 tree species, and is used for coal, oil, natural gas and timber production.

METHODS

On July 29, 1981, two sections of Line B-18 (each approximately two acres in size) were sprayed aerially using a helicopter equipped with a MICROFOIL BOOM[5/] having .060 inch nozzles. One section was treated with a triclopyr amine mixture consisting of three gallons of triclopyr amine concentrate plus 22 gallons of water equalling a total volume delivery of 25 gallons spray per acre. A second section of ROW was treated with triclopyr amine plus a picloram/2,4-D[6/] mixture consisting of 1.5 gallons of triclopyr amine and two gallons of picloram/2,4-D with 21.5 gallons of water equalling a total volume delivery of 25 gallons per acre. The ROW was treated to a width of 40 feet. Helium filled weather balloons were used to mark the test plots.

On September 22, 1981 (55 days), an inventory of sprayed trees was made. Trees were tagged and evaluated for percent brownout and the extent of their defoliation. On May 13, 1982 (288 days), trees were evaluated for percent kill (control). Trees showing any form of leaf-out (most generally, adventious leaves) or possessing moist cambial tissue were considered to be uncontrolled. Only those trees directly sprayed, as opposed to those side-trimmed or crowned, are reported in this paper. Defoliation index values reported range numerically from 0 to 5: 0 being no defoliation and 5 reflecting complete defoliation.

RESULTS AND DISCUSSION

Table 1 shows that 100% control was achieved for nine tree species using triclopyr amine alone, whereas ten other species exhibited less than 100% control. Trees showing recovery were not numerous and only totalled 21 (9.8%)

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Table 1

Percent control for various tree species one year following herbicide treatment

Species	Triclopyr amine				Triclopyr amine + Picloram/2,4-D			
	n	% brownout	DI	% control	n	% brownout	DI	% control
White oak (*Quercus alba*)	81	96	1.7	91	26	91	1.4	81
Shagbark hickory (*Carya ovata*)	26	64	1.2	92	27	75	1.4	89
American beech (*Fagus grandifolia*)	17	66	1.3	88	14	81	1.5	100
Red oak (*Quercus rubra*)	14	59	1.5	71	1	20	0.0	0
Black oak (*Quercus velutina*)	5	89	2.6	80	4	68	1.2	75
Chestnut oak (*Quercus prinus*)	1	50	0.0	0	0	--	--	--
Flowering dogwood (*Cornus florida*)	5	86	1.4	80	27	68	1.5	100
Sugar maple (*Acer saccharum*)	7	87	1.6	100	26	92	1.5	96
Tulip poplar (*Liriodendron tulipfera*)	22	100	3.3	100	14	98	2.8	93
Red elm (*Ulmus fulva*)	6	100	3.3	83	2	100	3.5	0
Cucumber (*Magnolia acuminata*)	3	18	0.33	66	1	65	1.0	0
Tupelo (*Nyssa sylvatica*)	5	70	0.44	80	7	100	1.7	100
White ash (*Fraxinus americana*)	3	43	1.7	100	4	100	4.0	100
Black birch (*Betula lenta*)	7	84	3.4	100	22	90	2.7	100
Redbud (*Cercis canadensis*)	2	100	1.5	100	4	100	1.5	100
Sweetbay magnolia (*Magnolia virginiana*)	1	10	2.0	100	2	55	3.5	100
Sassafras (*Sassafras albidum*)	0	--	--	--	1	90	3.0	100
Hophornbeam (*Ostrya virginiana*)	0	--	--	--	2	100	3.5	100
Sycamore (*Platanus occidentalis*)	3	100	2.3	100	0	--	--	--
Black locust (*Robinia pseudoacaeia*)	0	--	--	--	0	--	--	--
Staghorn sumac (*Rhus typhina*)	2	100	2.3	100	0	--	--	--
Buckeye (*Aesculus glabra*)	3	90	3.0	100	0	--	--	--

n = number of trees observed.

% brownout = leaf brownout 55 days following herbicide treatment.

DI = defoliation index value 55 days following herbicide treatment. Values range from 0.0 to 5.0. A value of 0.0 reflects no defoliation. A value of 5.0 reflects complete defoliation.

of a total of 213 individuals reported. Tree species ranged in size up to 24 inches dbh. A size class distribution for the species is given in a previous report (2). Slightly greater control was achieved using a mixture of triclopyr amine, picloram and 2,4-D. With this mixture, nine tree species showed 100% control, whereas eight species exhibited less than 100% control. Trees showing recovery amounted to 15 (8.1%) out of a total of 184 individuals reported.

Those tree species showing recovery did not correspond identically for the two herbicide treatments. Whereas maple (Acer saccharum Marsh.) and tulip poplar (Liriodendron tulipfera L.) were controlled with triclopyr amine, they were not with the mixture of triclopyr amine, picloram and 2,4-D. However, species showing 100% control with the mixture and not with triclopyr amine alone were tupelo (Nyssa sylvatica), dogwood (Cornus florida L.), and beech (Fagus grandifolia Ehrhart.). By contrast, white oak (Quercus alba L.), hickory (Carya ovata (Miller) K. Koch), red oak (Q. rubra L.), black oak (Q. velutina Lamark.), cucumber (Magnolia acuminata), and elm (Ulmus fulva) showed greater control with triclopyr amine alone. However, four species including red oak, elm, cucumber and chestnut oak (Q. prinus) registered zero percent control. Since all four species were represented by only one or two individuals, low percentages of control for these species are not considered significant.

Tree species which produced leaves in 1982 following herbicide treatment in 1981 were characterized by lower percent brownout and defoliation values. By contrast, species which did not refoliate in 1982 had higher brownout and defoliation values (Table 2). In only one instance (86.2%) was a reversal of this trend noted.

Table 3 examines the mean percent brownout and defoliation values of individuals for a given species which recovered (refoliated) following herbicide treatments compared with values of other individuals for the same species which failed to recover (died). For those individuals recovering (as compared with no recovery) from triclopyr amine treatment, lower percent brownout values were noted for white oak, beech, red oak, black oak and chestnut oak; similarly, lower defoliation values were noted for white oak, beech, red oak, elm and tupelo. Comparable results were noted for white oak, hickory, black oak, maple and tulip poplar for individuals treated with a mixture of triclopyr amine, picloram and 2,4-D.

CONCLUSIONS

1. The present report demonstrates for the first time that triclopyr amine is an effective herbicide for killing large diameter Appalachian hardwoods. These results demonstrate that tricoplyr amine can be used successfully for managing canopy-crowned and/or tree-overgrown pipeline ROW's.

Table 2

Average leaf brownout and tree defoliation values for tree species showing no recovery or recovery one year after herbicide treatment

	Triclopyr amine				Triclopyr amine + Picloram/2,4-D			
	mean % brownout[a]	mean DI[b]	weighted mean % brownout[c]	weighted mean DI[d]	mean % brownout	Mean DI	weighted mean % brownout	weighted mean DI
No Recovery (n)	79.3 (9)	2.34 (9)	90.1 (50)	2.76 (50)	87.1 (9)	2.54 (9)	82.5 (83)	2.07 (83)
Recovery (n)	69.8 (10)	1.38 (10)	81.7 (163)	1.56 (163)	76.1 (8)	1.6 (8)	86.2 (101)	1.64 (101)

[a] average based upon % brownout values presented in Table 1. % brownout = leaf brownout 55 days following herbicide treatment.

[b] average based upon DI values presented in Table 1. DI = defoliation index value 55 days following herbicide treatment. Defoliation index values are defined in Table 1.

[c] average obtained by multiplying total n values (Table 1) x % brownout values (Table 1).

[d] average obtained by multiplying total n values (Table 1) x DI values (Table 1).

No Recovery = 100% control (kill) one year after herbicide treatment.

Recovery = less than 100% control (kill) one year after herbicide treatment.

* n = number of tree species.

** n = number of individuals for several tree species.

Table 3

Average leaf brownout and tree defoliation for individual trees showing no recovery or recovery one year after herbicide treatment. Tree species presented are those showing less than 100% control (kill) one year after herbicide treatment

Species	Triclopyr amine						Triclopyr amine + Picloram/2,4-D					
	No recovery			Recovery			No recovery			Recovery		
	n	%	DI	n	%	DI	n	%	DI	n	%	DI
White oak (*Quercus alba*)	74	98	1.7	7	82	1.3	21	95	1.6	5	78	0.2
Shagbark hickory (*Carya ovata*)	24	62	1.1	2	85	1.5	24	79	1.4	3	47	0.66
American beech (*Fagus grandifolia*)	15	70	1.5	2	42	0.5	14	81	1.5	0	--	--
Red oak (*Quercus rubra*)	10	63	1.7	4	49	1.0	0	--	--	1	20	0.0
Black oak (*Quercus velutina*)	4	94	2.5	1	70	3.0	3	68	1.3	1	65	1.0
Chestnut oak (*Quercus prinus*)	0	--	--	1	50	0.0	0	--	--	0	--	--
Flowering dogwood (*Cornus florida*)	4	82	1.0	1	100	3.0	27	68	1.5	0	--	--
Sugar maple (*Acer saccharum*)	7	87	1.6	0	--	--	25	92	1.5	1	100	1.0
Tulip poplar (*Liriodendron tulipfera*)	22	100	3.3	0	--	--	13	99	2.8	1	90	3.0
Red elm (*Ulmus fulva*)	5	100	3.4	1	100	3.0	0	--	--	2	100	3.5
Cucumber (*Magnolia acuminata*)	2	12	0.0	1	30	0.0	0	--	--	1	65	1.0
Tupelo (*Nyssa sylvatica*)	4	42	2.5	1	50	1.0	7	100	1.7	0	--	--

n = number of individual trees observed.

% = percent leaf brownout 55 days following herbicide treatment.

DI = defoliation index values 55 days following herbicide treatment.

2. This study shows that there is a strong correlation between initial leaf brownout and tree defoliation two months after herbicide treatment and subsequent long-term (1 year) kill data. This correlation can be effectively capitablized upon as an early barometer of herbicide efficacy.

LITERATURE CITED

1. Reynolds, P. E., R. J. Hendler, W. D. Betsch, and W. Ollice. 1983. Evaluation of aerial dormant spraying with triclopyr ester on a West Virginia pipeline ROW. Proceedings of the Northeastern Weed Science Society, Volume 37.

2. Hendler, R. J., P. E. Reynolds, W. D. Betsch, W. Ollice, and J. Williamson. 1982. Preliminary evaluation of Garlon herbicide as a tool for natural gas pipeline right-of-way management in southern West Virginia. In: A. F. Crabtree (ed.), Environmental Concerns in Rights-of-Way Management: Proceedings of the Third Symposium held at San Diego, California, February 15-18, 1982.

3. Braun, E. L. 1967. Deciduous Forests of Eastern North America. Hafner Publishing Company, New York and London.

PRELIMINARY EVALUATION OF TRICLOPYR ESTER EFFICACY ON A WEST VIRGINIA PIPELINE ROW

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ABSTRACT

During July 1982, a canopy-crowned, tree-overgrown gas pipeline ROW in southern West Virginia was aerially sprayed using triclopyr ester alone and a mixture of triclopyr ester, picloram and 2,4-D. Fifty-five days following spraying, the large mixed mesophytic hardwoods growing on the ROW were numerically tagged, evaluated for percent brownout and rated for the extent of their defoliation. Data for the trees is compared with similar brownout and defoliation data for trees sprayed during July 1981 with triclopyr amine alone or a mixture of triclopyr amine, picloram and 2,4-D. In general, lower brownout and defoliation values were observed for trees sprayed with triclopyr ester as opposed to triclopyr amine. A similar trend held for trees sprayed with a mixture of triclopyr ester, picloram and 2,4-D compared with trees sprayed with a mixture of triclopyr amine, picloram and 2,4-D. Slightly higher brownout and defoliation values were obtained with a mixture of triclopyr ester, picloram and 2,4-D as compared with triclopyr ester alone. Variations in species susceptibility to the four herbicide formulations was noted. Percent brownout and defoliation values for trees treated with triclopyr ester suggest that a high percent control (kill) will be observed during the summer of 1983. However, lower brownout and defoliation values for these trees (as compared with trees treated with triclopyr amine) suggests that a somewhat lower percent control will be observed for the trees sprayed with ester formulations.

INTRODUCTION

As mandated by federal law, natural gas utilities must periodically inspect their pipelines for leaks. If the ROW is aerially visible, a helicopter patrol of the ROW for leaks may be performed. In order to aerially patrol these ROW's, tree growth on the ROW's must be controlled or removed. In the Appalachian Region, the most practical means of controlling vegetation is by aerial herbicide spraying. Since many older gas pipeline ROW's in this Region are overgrown with large trees or canopy crowned, obscuring their observation from aircraft, it is necessary to

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identify an herbicide which will be effective in controlling large trees. Although the efficacy of triclopyr in controlling small trees is well documented (1), the ability of triclopyr to kill large trees has not been established. Additionally, the question of whether the amine or ester formulation of triclopyr is best for controlling large tree growth has not been answered. Since the ester formulation is assumed to be more capable of penetrating leaf wax of older trees, it is important to determine if this formulation is more effective in controlling large tree growth. An accompanying paper (2) presents control data for triclopyr amine aerially sprayed on large trees growing on a gas pipeline ROW. This paper presents preliminary efficacy data for the triclopyr ester formulation aerially applied to large trees, and attempts to assess whether the ester or amine formulation may ultimately be better in controlling large tree growth.

STUDY AREA

Two sections of Columbia Gas Lines BW-8700 and BW-8796 located in Mingo County, West Virginia were selected for testing and evaluation of triclopyr ester efficacy on large tree growth. The lines are located in the Miller's Creek Watershed on land owned by Cotiga Land Development. The Watershed is located between the towns of Kermit and Williamson, is approximately 60 miles south of Huntington, West Virginia, and is adjacent to the Kentucky border. It ranges in elevation from approximately 500 to 1700 feet, is covered by a mixed mesophytic forest (3) consisting of at least 35 tree species, and is used for coal, oil, natural gas and timber production.

METHODS

On July 9, 1982, two sections (each approximately two acres in size) of Lines BW-8700 and BW-8796 were sprayed aerially using a helicopter equipped with a MICROFOIL BOOM[5/] having .060 inch nozzles. One section (Line BW-8796) was treated with a triclopyr ester mixture consisting of two gallons of triclopyr ester concentrate plus 23 gallons of water equalling a total volume delivery of 25 gallons spray per acre. A second section (Line BW-8700) of ROW was treated with triclopyr ester plus a picloram/2,4-D[6/] mixture consisting of one gallon of triclopyr ester and two gallons of picloram/2,4-D with 22 gallons of water equalling a total volume delivery of 25 gallons per acre. The ROW was treated to a width of 40 feet. Helium filled weather balloons were used to mark the test plots. An accompanying paper (2) describes aerial spraying of Columbia Gas Line B-18 during the summer of 1981 with triclopyr amine and a mixture containing triclopyr amine, picloram and 2,4-D.

5/Registered trademark of Union Carbide Agricultural Products Co., Inc.

6/TORDON 101, a registered trademark of The Dow Chemical Company, Midland, Michigan.

On September 2, 1982 (55 days), an inventory of sprayed trees was made. Trees were tagged and evaluated for percent brownout and the extent of their defoliation. Only those trees directly sprayed, as opposed to those side-trimmed or crowned, are reported in this paper. Defoliation index values reported range numerically from 0 to 5: 0 being no defoliation and 5 reflecting complete defoliation.

RESULTS AND DISCUSSION

Table 1 reveals that a mixture of triclopyr ester, picloram and 2,4-D generally produced higher percent leaf brownout and/or defoliation for several tree species when compared with triclopyr ester alone. Variation in percent brownout for various tree species is evident. Species showing higher percent brownout and defoliation after treatment with a mixture of triclopyr ester, pirloram and 2,4-D include dogwood (*Cornus florida* L.), hickory (*Carya ovata* (Miller) K. Koch), white oak (*Quercus alba* L.), and cucumber (*Magnolia acuminata* L.).

Lower leaf brownout and tree defoliation values were generally observed for tree species treated with triclopyr ester as compared with those treated with triclopyr amine. Examples where triclopyr ester resulted in higher values include red oak (*Quercus rubra* L.), cucumber, white ash (*Fraxinus americana* L.), and chestnut oak (*Quercus prinus*).

Table 1 further shows that higher leaf brownout and tree defoliation values generally resulted from treatment with a mixture of triclopyr amine, picloram and 2,4-D as compared with treatment using a mixture of triclopyr ester, picloram and 2,4-D. Instances where better results were obtained using a mixture containing triclopyr ester include red oak and dogwood.

An accompanying paper (2) demonstrates that there is a strong correlation between initial (55 days) leaf brownout and tree defoliation following triclopyr amine application and subsequent tree control (kill) one year following herbicide treatment. This observation suggests that less tree kill will be observed for trees treated with triclopyr ester formulations than those treated with triclopyr amine formulations. However, since brownout and defoliation values for triclopyr ester treated trees are high, a notable kill of large trees sprayed with triclopyr ester is expected when these trees are evaluated for percent control during the summer of 1983.

CONCLUSIONS

1. Preliminary results suggest that triclopyr ester will be an effective herbicide for controlling the growth of large mixed mesophytic trees on tree overgrown pipeline ROW's.

2. Preliminary results suggest that triclopyr amine may be more effective than triclopyr ester in controlling the growth of large (up to 24 inches dbh, 60 feet tall) mixed mesophytic hardwoods.

Table 1

Leaf brownout and tree defoliation for various tree species
55 days following herbicide treatment

Species	Triclopyr ester			Triclopyr amine			Triclopyr ester + Picloram/2,4-D			Triclopyr amine + Picloram/2,4-D		
	n	% brownout	DI	n	%	DI	n	%	DI	n	%	DI
Redbud (Cercis canadensis)	14	92	2.0	2	100	1.5	11	92	1.4	4	100	1.5
Tulip poplar (Liriodendron tulipfera)	18	93	3.0	22	100	3.3	15	94	2.9	14	98	2.8
Black birch (Betula lenta)	13	65	1.2	7	84	3.4	24	64	1.9	22	90	2.7
Sassafras (Sassafras albidum)	6	56	1.7	0	--	--	0	--	--	1	90	3.0
Flowering dogwood (Cornus florida)	26	61	0.58	5	86	1.4	18	77	0.78	27	68	1.5
Shagbark hickory (Carya ovata)	20	25	0.60	26	64	1.2	18	49	0.89	27	75	1.4
Tupelo (Nyssa sylvatica)	21	62	2.0	5	70	0.44	5	59	2.0	7	100	1.7
Red elm (Ulmus fulva)	8	100	2.1	6	100	3.3	9	99	3.3	2	100	3.5
Black oak (Quercus velutina)	12	82	0.41	5	89	2.6	8	52	0.62	4	68	1.2
Staghorn sumac (Rhus typhina)	4	100	1.0	2	100	2.3	8	100	1.8	0	--	--
American beech (Fagus grandifolia)	15	60	0.53	17	66	1.3	12	31	0.08	14	81	1.5
Red oak (Quercus rubra)	12	85	1.2	14	59	1.5	8	88	1.2	1	20	0.0
White oak (Quercus alba)	23	82	0.70	81	96	1.7	12	84	1.0	26	91	1.4
Sugar maple (Acer saccharum)	29	89	1.6	7	87	1.6	23	92	1.0	26	92	1.5
Cucumber (Magnolia acuminata)	2	25	0.0	3	18	0.33	3	67	2.0	1	65	1.0
White ash (Fraxinus americana)	4	86	2.8	3	43	1.7	8	68	2.1	4	100	4.0
Chestnut oak (Quercus prinus)	7	98	1.4	1	50	0.0	5	94	0.80	0	--	--

n = number of trees observed.

% = percent leaf brownout.

DI = defoliation index value. Values range from 0.0 to 5.0. A value of 0.0 reflects no defoliation. A value of 5.0 reflects complete defoliation.

LITERATURE CITED

1. Hendler, R. J., P. E. Reynolds, W. D. Betsch, W. Ollice, and J. Williamson. 1982. Preliminary evaluation of Garlon herbicide as a tool for natural gas pipeline right-of-way management in southern West Virginia. In: A. F. Crabtree (ed.), Environmental Concerns in Rights-of-Way Management Proceedings of the Third Symposium held at San Diego, California, February 15-18, 1982.

2. Reynolds, P. E., R. J. Hendler, W. D. Betsch, and W. Ollice. 1983. Triclopyr amine control of large trees on a West Virginia pipeline right-of-way. Proceedings of the Northeastern Weed Science Society, Volume 37.

3. Braun, E. L. 1967. Deciduous Forests of Eastern North America. Hafner Publishing Company, New York and London.

EVALUATION OF AERIAL DORMANT SPRAYING WITH TRICLOPYR ESTER ON A WEST VIRGINIA PIPELINE ROW

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ABSTRACT

During March 1982, a canopy-crowned, tree-overgrown gas pipeline ROW in southern West Virginia was aerially sprayed using triclopyr ester and two oil substitute products as carriers. Spraying was accomplished during the dormant season (prior to bud break or leaf-out), and herbicide uptake was via buds or bark. The intent of the spraying was to mark the ROW's for a later summer foliar application with triclopyr. The two oil substitute carriers consisted of a commercially available product and an experimental product. The efficacy (tree defoliation was rated in May and July 1982) of both were compared with a control test plot sprayed with triclopyr ester using oil as a carrier. In addition to testing the efficacy of the two oil substitutes, various ROW marking schemes were evaluated. These included a 40 foot broadcast, a 20 foot center strip, and 10 foot outer edge strips, all on a 40 foot wide ROW. Both oil substitutes and all marking schemes marked the ROW satisfactorily for a followup summer application. Results with the two oil substitutes were comparable to using oil as a carrier. Often, the experimental oil substitute product yielded superior results compared with the commercial product. Marking with the experimental oil substitute is expected to be effective for two seasons. Finally, results suggest that triclopyr aerially applied during the dormant period may control (kill) large trees rather than simply mark them for subsequent summer foliar spraying. Such a capability would substantially change the direction of ROW management and extend the aerial spray season.

INTRODUCTION

As mandated by federal law, natural gas utilities must periodically inspect their pipelines for leaks. If the ROW is aerially visible, a helicopter patrol of the ROW for leaks may be performed. In order to aerially patrol these ROW's, tree growth on the ROW's must be controlled or removed. In the Appalachian Region, the most practical means of controlling vegetation is by aerial herbicide spraying. Since many older gas pipeline ROW's in this Region are overgrown with large trees or canopy crowned, obscuring their observation from aircraft during the summer months, it is essential to develop a suitable marking technique which will delineate the location of the ROW's during the foliar season. If an herbicide carrier system can be identified which could be aerially

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applied to the ROW during the dormant (prior to leaf-out) season, a potentially effective marking procedure might be possible. Such a procedure would allow for followup foliar spraying during the summer months. If the herbicide-carrier system were to prove capable of controlling (killing) the trees rather than simply marking them, a new direction in ROW management would result. As a result of this direction, the aerial spray season would be extended and additional environmental advantages would accrue. Two accompanying papers (1, 2) describe the efficacy of triclopyr amine and ester on large diameter trees which grow on these ROW's. This paper examines the development of an herbicide-carrier system using oil substitute products which can be aerially applied during the dormant season.

STUDY AREA

Five sections of Columbia Gas Line B-18 located in Mingo County, West Virginia were selected for testing and evaluation of triclopyr amine efficacy on large tree growth. Line B-18 is located in the Miller's Creek Watershed on land owned by Cotiga Land Development. The Watershed is located between the towns of Kermit and Williamson, is approximately 60 miles south of Huntington, West Virginia, and is adjacent to the Kentucky border. It ranges in elevation from approximately 500 to 1700 feet, is covered by a mixed mesophytic forest (3) consisting of at least 35 tree species, and is used for coal, oil, natural gas and timber production.

METHODS

On March 24 and 25, 1982, five sections (each approximately one acre in size) of Line B-18 were sprayed aerially using a helicopter equipped with a MICROFOIL BOOM[5/] having .060 inch nozzles. All sections were treated with triclopyr ester herbicide at a rate of two gallons per acre. Total ROW width for all five sections was 40 feet. Using this available width, three spray pattern marking schemes were tested. These included a 40 foot broadcast, a 20 foot center strip, and 10 foot outer edge strips. One ROW section was sprayed to a width of 40 feet with a mixture consisting of two gallons herbicide concentrate, one gallon of commercial oil substitute (Red-Top MOR-ACT[6/] adjuvant) plus 12 gallons of water equalling a total volume delivery of 15 gallons spray per acre. A second ROW section was also sprayed to a width of 40 feet using an identical mixture, except for the substitution of one gallon of Dowanol[7/] TPM (tripropylene glycol methyl ether) experimental oil substitute for the MOR-ACT. A third section of ROW was treated with a 15 gallon mixture containing one gallon MOR-ACT by applying a 20 foot center spray strip along the 40 foot ROW. A fourth section of ROW was treated with a 15 gallon mixture containing one gallon MOR-ACT by applying 10 foot outer edge strips along the 40 foot ROW. A fifth section of ROW was treated with a 15 gallon mixture containing one gallon jet diesel fuel (oil) by applying a 20 foot center strip along the 40 foot ROW.

5/Registered trademark of Union Carbide Agricultural Products Co., Inc.

6/Registered trademark of Wilbur-Ellis Co., Portland, Oregon.

7/Registered trademark of The Dow Chemical Company, Midland, Michigan.

On May 14, 1982 (50 days) and again on July 8, 1982 (105 days), trees on the five sprayed sections of ROW were examined for brownout and leaf loss. On July 14, trees were tagged and evaluated for the extent of their defoliation. Only those trees directly sprayed, as opposed to those side-trimmed or crowned, are reported in this paper. Defoliation index values reported range numerically from 0 to 5: 0 being no defoliation and 5 reflecting complete defoliation.

On July 9, 1982, one-half of each of the five sections were retreated using a foliar spray consisting of triclopyr ester plus picloram/2,4-D and applied aerially as described above. The spray mixture consisted of one gallon of triclopyr ester, two gallons of picloram/2,4-D with 22 gallons of water equalling a total volume delivery of 25 gallons per acre. All sections were treated to a width of 40 feet. During the summer of 1983, the remaining half sections (not treated in July 1982) for each of the five treatments established in March 1982 will be evaluated (a) for their continued potential marking ability or (b) to determine whether control (kill) of the trees is possible after treating with triclopyr using oil substitute carriers during the dormant season.

RESULTS AND DISCUSSION

Table 1 presents defoliation values obtained on July 8 for the various tree species growing on the five treated sections of ROW. Values for the ROW section treated with oil are all generally high (4 or 5). The lowest values for oil were seen with redbud (*Cercis canadensis* L.), tupelo (*Nyssa sylvatica*), sassafras (*Sassafras albidum*), and tulip poplar (*Liriodendron tulipfera* L.). However, all of the above species were judged to be dead when examined on the ground in July. All four species showed peeling bark, dry cambial tissue and/or vascular carameling tissue.

Compared with the oil treated section, the ROW section treated with the Dowanol TPM oil substitute was characterized by defoliation values ranging from 1.5 to 5.0. Many values exceeded 3.0. In all instances except one, elm (*Ulmus fulva*), defoliation values for the Dowanol TPM 40 foot strip exceeded those for the MOR-ACT 40 foot strip.

For the three ROW strips treated with MOR-ACT, best results were obtained on the 20 foot strip. Defoliation values for the 20 foot strip compared more favorably with the oil treated strip than values observed for the ROW section treated with the Dowanol TPM oil substitute. Similarly, reasonably high defoliation values were noted for trees treated with MOR-ACT using 10 foot strips. Why MOR-ACT gave high defoliation values on the 20 foot strip and notably lower values on the 40 foot broadcast treatment is not clear. Tree species, altitude, or aspect for the two ROW sections do not vary significantly. Although the 40 foot section was treated on the evening of March 24 and the 20 and 10 foot sections on the morning of March 25. weather conditions did not vary appreciably for the two dates.

Table 1

Tree defoliation values for various tree species 105 days after dormant treatment with triclopyr ester using oil or various oil substitutes

Species	Oil		Dow 40'		Com. 40'		Com. 20'		Com. 10'	
	n	DI	n	DI	n	DI	n	DI	n	DI
Redbud (*Cercis canadensis*)	1	2.0	0	--	0	--	3	4.5	1	5.0
Tulip poplar (*Liriodendron tulipfera*)	5	3.2	0	--	6	1.6	1	2.0	0	--
Black birch (*Betula lenta*)	10	4.6	5	1.7	1	1.0	3	4.3	0	--
Sassafras (*Sassafras albidum*)	5	3.5	0	--	0	--	1	5.0	15	2.5
Flowering dogwood (*Cornus florida*)	15	4.8	3	5.0	1	3.0	8	3.9	2	5.0
Shagbark hickory (*Carya ovata*)	18	4.6	2	3.0	0	--	8	3.3	1	0.0
Tupelo (*Nyssa sylvatica*)	2	0.75	0	--	4	0.75	1	2.0	0	--
Red elm (*Ulmus fulva*)	0	--	1	2.0	1	3.0	0	--	0	--
Black oak (*Quercus velutina*)	5	4.6	2	1.5	0	--	6	2.8	13	1.5
Staghorn sumac (*Rhus typhina*)	1	5.0	0	--	0	--	0	--	0	--
American beech (*Fagus grandifolia*)	2	5.0	37	3.7	3	1.0	3	5.0	0	--
Red oak (*Quercus rubra*)	0	--	2	1.5	4	0.75	1	2.5	10	1.1
White oak (*Quercus alba*)	2	5.0	17	1.9	14	1.5	18	3.8	6	3.3
Sugar maple (*Acer saccharum*)	5	4.6	6	3.7	9	1.7	10	4.5	0	--
Cucumber (*Magnolia acuminata*)	1	4.5	0	--	1	0.0	1	2.5	0	--
Ironwood (*Carpinus caroliniana*)	1	5.0	12	4.3	0	--	0	--	0	--
White ash (*Fraxinus americana*)	2	4.0	7	3.1	13	1.6	2	3.5	2	2.8
Basswood (*Tilia americana*)	2	4.0	0	--	0	--	2	4.5	0	--
Chestnut oak (*Quercus prinus*)	0	--	0	--	1	1.0	2	4.0	8	2.2
Hophornbeam (*Ostrya virginiana*)	5	4.4	0	--	2	2.5	1	1.0	0	--
Black locust (*Robinia pseudoacaeia*)	2	5.0	0	--	0	--	1	4.0	1	2.0
Sourwood (*Oxydendrum arboreum*)	0	--	0	--	0	--	2	2.5	1	0.0

n = number of trees observed.

DI = defoliation index value. Values range from 0.0 to 5.0 A value of 0.0 reflects no defoliation. A value of 5.0 reflects complete defoliation.

Dow = Dowanol TPM oil substitute.

Com. = MOR-ACT oil substitute.

All five ROW test sections were aerially examined and photographed in May and again in July. Observations on the two dates allow for an evaluation of the effectiveness of the marking and the extent of time the marking may be expected to last. For purposes of comparison, the Dowanol TPM oil substitute and the MOR-ACT 40 foot strips may be contrasted. As observed in July, numerous trees on the MOR-ACT section had refoliated. The location of this section viewed from the air was less discernable in July than in May, and considerable amounts of leaves on the ground in July confirmed that initial leaf brownout seen in May was due to these leaves. By contrast, the Dowanol TPM oil substitute section was equally visible from the air in July, and fewer amounts of leaves were noted on the ground in July. This observation, coupled with higher defoliation values for the Dowanol ROW section, suggests that fewer leaves were actually produced by trees treated with the Dow product than with MOR-ACT for the two 40 foot broadcast sections.

Despite this observation, the other MOR-ACT treatments (20 and 10 foot strips) produced equal results compared with the Dowanol 40 foot broadcast when viewed aerially and on the ground in both May and July. This finding suggests, for whatever reason, that the MOR-ACT 40 foot broadcast treatment simply did not work optimally. Additionally, positive results with MOR-ACT on the 20 and 10 foot strips suggests that MOR-ACT is as effective as the Dowanol TPM oil substitute in inhibiting leaf production following spring dormant treatment.

A comparison of the various marking strips viewed aerially revealed that all marking techniques are effective. If the intent of a late winter dormant spraying is to mark the ROW for subsequent summer foliar spraying, then it is believed that a 20 foot center strip is best. However, if a dormant spray is found to be effective in controlling (killing) large tree growth, it would then be appropriate to spray ROW's to their desired width. Observations of the half sections of each of the five treated sections in the summer of 1983 should allow for an assessment of whether control can be attained.

Evaluation of the duration of marking cannot be fully assessed until early summer 1983. As of July 1982, all ROW sections remained effectively marked, except the MOR-ACT 40 foot broadcast section. Continued aerial visibility of this one ROW section is not expected beyond the summer of 1982. However, the other four ROW sections are expected to remain effectively marked into 1983, and based upon 1982 defoliation values (also see accompanying papers 1 and 2), trees on these ROW sections may be controlled (killed).

If dormant spraying can be used to control large tree growth, the duration of the ROW spray season can be extended, and a number of environmental advantages will result. Most important of these are a lessening of brownout during the foliar season and far greater visibility of watershed drainages during the dormant season.

CONCLUSIONS

1. This study shows that an aerial application of triclopyr ester using oil substitute products during the dormant season (March, prior to leaf-out) is an effective way of marking tree-overgrown, tree canopied pipeline ROW's which are not visible when viewed from the air during the foliar season. ROW's marked in this manner may be aerially treated with a foliar spray during the following summer. Such marking may extend beyond one season.

2. The present report suggests that an aerial dormant spray mixture may be effective in controlling (killing) large tree growth as opposed to being an effective marker only. This capability would change the direction of ROW management, extend the aerial spray season, and offer environmental advantages.

LITERATURE CITED

1. Reynolds, P. E., R. J. Hendler, W. D. Betsch, and W. Ollice. 1983. Triclopyr amine control of large trees on a West Virginia right-of-way. Proceedings of the Northeastern Weed Science Society, Volume 37.

2. Reynolds, P. E., R. J. Hendler, W. D. Betsch, and W. Ollice. 1983. Preliminary evaluation of triclopyr ester efficacy on a West Virginia pipeline right-of-way. Proceedings of the Northeastern Weed Science Society, Volume 37.

3. Braun, E. L. 1967. Deciduous Forests of Eastern North America. Hafner Publishing Company, New York and London.

AN AERIAL TECHNIQUE TO ADJUST SPRUCE-FIR DENSITY OF STOCKING

M. L. McCormack, Jr.[1/] and C. H. Banks[2/]

ABSTRACT

A helicopter system for the application of herbicide bands was tested in northern Maine. It shows promise for adjusting the density of stocking and distribution of stems in young, developing forest stands.

INTRODUCTION

Overstocking is a prevalent management problem in developing forest stands of the northeastern spruce-fir forest [*Abies balsamea* (L.) Mill., *Picea rubens* Sarg., *P. mariana* (Mill.) B.S.P., *P. glauca* (Moench) Voss]. There is an immediate need for feasible, operational-scale treatments to adjust density of stocking (ADS). Natural regeneration typically develops with 10,000 to 40,000 stems per acre on sites where 800 to 2,000 stems would be preferred.

Damage to old-growth forests from the current spruce budworm [*Choristoneura fumiferana* (Clemens)] epidemic and a backlog of untended, overstocked young stands have resulted in large acreages in need of treatment. A silvicultural method allowing early entry to improve the overstocked stands would help to solve the problem. An acceptable ADS treatment should satisfy several requirements.

1. Safety to personnel. The terrain is irregular with logging slash and boulders distributed over the sites.

2. Minimum soil disturbance. Problem weeds such as raspberry [*Rubus idaeus* L. var. *strigosus* (Michx.) Maxim.] and pin cherry (*Prunus pensylvanica* L.f.) often proliferate following disturbance.

3. Relatively low cost. These treatments must be applied in the early years of 30- to 70-year rotations needed for the production of timber crops.

4. Minimum direct access. Large areas exist without well-developed road systems.

5. Treat large acreages within a limited calendar period. Weather conditions and other work requirements limit the time available to treat many of the areas.

6. Suppress, or remove, a broad spectrum of brush and tree species.

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An ADS treatment system, utilizing helicopter application of herbicides, was developed, as a possible means of satisfying this management need. Field tests have been initiated.

STUDY AREAS

Three northern Maine cutover forest sites were utilized. Treatments were applied as helicopter swath pairs. Sixteen pairs were applied in the Town of Shirley, 13 in Spencer Bay Township (T1R14 WELS), and 25 in Township 14 Range 11 WELS. In addition to the spruces and fir, other conifers included eastern white pine (*Pinus strobus* L.), tamarack [*Larix laricina* (DuRoi) K. Koch], and northern white-cedar (*Thuja occidentalis* L.). Prominent hardwoods included red mapel (*Acer rubrum* L.), paper birch (*Betula papyrifera* Marsh.) and quaking aspen (*Populus tremuloides* Michx.). These areas are typical regrowth following logging with scattered, individual residual trees with heights up to 65 feet. Young growth is heavy and ranges in height from 3 to 25 feet depending on site. Adjacent logging roads and landings served as helicopter ports.

METHODS

Delivery technology was developed during the preceding winter. In order to satisfy the anticipated operational conditions, helicopter spray patterns were flown from altitudes of 75 and 100 ft. above the target surface. Total volumes delivered per surface acre of target were 15 to 20 gal. Test patterns were sprayed across large strips of white paper using Rhodamine B red dye solution in water.

A delivery system was desired which would assure a well-defined pattern of strips. This would allow band applications of predetermined widths and alternate residual strips of trees to form the basis of the future merchantable stand. A desired pattern was achieved using a Microfoil Boom fitted with 0.060 orifice nozzles delivering 20 gal/a. Treatment band widths and spacing could be modified by changing the numbers of nozzles on the boom. For the field tests the nozzles were in groups of four with 11 blank nozzle positions along the boom between each set of spraying nozzles. The resultant ground pattern was treatment bands 4 ft wide between 9 ft untreated residual strips (Figure 1).

Field sites were arranged so the center of each flight line was marked by a flagman during treatment. For operational treatments an electronic guidance system could be used to keep spray strips in line. Chemical treatments offering potential for the required broad spectrum control were prepared and mixed separately. Each was applied as a pair of helicopter spray swaths. Most of the treatments were replicated across at least two of the study sites. Table 1 summarizes the treatments which were applied on July 10 and 14, 1982.

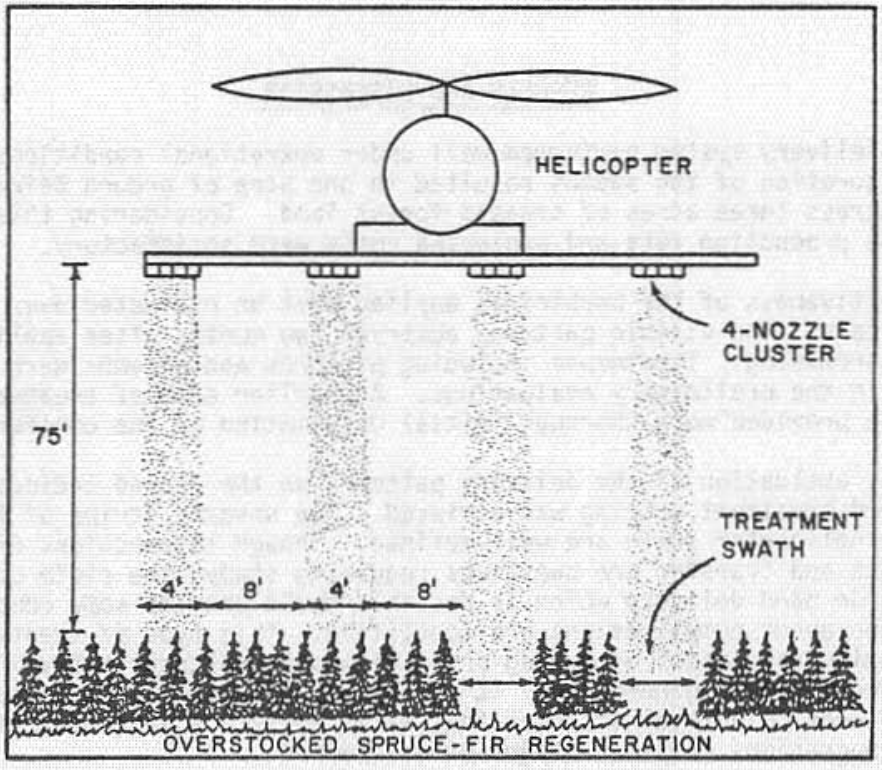

Figure 1. Conceptual diagram of spray delivery system for alternate strip treatments.

Table 1. Summary of strip treatments applied to adjust density of stocking in developing spruce-fir stands.

Herbicide	Rate lb/a[a/]	Swath Pairs Applied
dicamba (3,6-dichloro-*o*-anisic acid)	6	6
dicamba + 2,4-D [(2,4-dichlorophenoxy)acetic acid]	2+3.8	7
dicamba + 2,4-D	3+5.7	5
dicamba + picloram (4-amino-3,5,6-trichloropicolinic acid)	3+1	6
dicamba + 2,4-D + picloram	4+4+1	5
picloram + 2,4-D	1+4	5
picloram + 2,4-D	1.5+6	5
bromacil (5-bromo-3-*sec*-butyl-6-methyluracil)	4	5
bromacil	8	5
glyphosate [N-(phosphonomethyl) glycine]	6	2
glyphosate + (d-limonene + emulsifiers)	6+(2 qt)	1
dicamba + 2,4-D + (d-limonene + emulsifiers)	2+3.8+(2 qt)	2

[a/] All rates are ai except the adjuvant added to the last two treatments listed.

RESULTS AND DISCUSSION

The delivery system performed well under operational conditions. The configuration of the swaths resulted in one acre of ground being sprayed across three acres of treated forest land. Considering this ratio, the production rate and projected costs were satisfactory.

Effectiveness of the herbicides applied must be evaluated over several years. The visible patterns observed two months after application are promising. Treatments including picloram and dicamba were most apparent in the preliminary evaluations. An earlier date of treatment might have provided more thorough initial defoliation of the conifers.

Early evaluation of the delivery patterns on the ground indicates the desired treatment spacing was achieved. The sprayed strips of four bands per helicopter swath are well-defined. Though interactions of root uptake and transfer are questions requiring study, the rigid control of herbicide band delivery which is possible could provide some compensation in the event complications are identified. This type of treatment shows promise as a means of making an initial silvicultural entry into overstocked forest regeneration. It can enable managers to manipulate natural stands to a level of order that will facilitate efficient silvicultural operations in later stages of development.

ACKNOWLEDGEMENTS

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Pre- and Postemergence Herbicides Used on Seedbeds of Black Locust

Larry J. Kuhns, Gregory Twerdok, and Chiko Haramaki[1/]

ABSTRACT

Unfumigated seedbeds were prepared and seeded on May 11, 1982. Immediately after seeding, napropamide was applied, the seedbeds were mulched, and one-half inch of overhead irrigation was applied. The black locust seedlings emerged on May 24. On June 11 fluazifop, oxadiazon, and sethoxydim were applied. Rates of application and herbicide combinations applied are presented in Table 1. Visual ratings of weed control and phytotoxicity were recorded on July 9 and injury ratings were again made on October 18.

The primary weeds in the plots were large crabgrass and barnyardgrass. Clover, Pennsylvania smartweed, and sheepsorrel were present in lesser amounts. At the time of application of the postemergence herbicides the grasses were 10-15 cm. in height.

Napropamide provided very good weed control at 2.2 and 4.4 kg/ha and excellent weed control at 6.6 kg/ha. The black locust seedlings showed no visual symptoms of injury caused by napropamide.

Oxadiazon provided marginal weed control at 2.2 kg/ha and excellent control at 4.4 and 6.6 kg/ha when applied alone. Almost all surviving weeds were grasses. When sethoxydim at 0.55 kg/ha and oxadiazon were combined, all rates of oxadiazon provided excellent weed control and almost all surviving weeds were broadleaves. Oxadiazon caused unacceptable injury at all rates of application. Plants were stunted, burned, or killed. At the time of the final evaluation surviving plants were large, but stand density was greatly reduced.

Fluazifop and sethoxydim provided excellent weed control and almost no injury. Some seedlings in some of the treated plots exhibited a grayish discoloration of the foliage. Including a crop oil concentrate at 0.25% did not improve the weed control provided by fluazifop or sethoxydim.

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Table 1. Weed control provided by pre- and postemergence herbicides applied to black locust seedbeds, and their phytotoxicity.

Chemical	Rate Kg/ha	Weed Control[1/]	% Grasses[2/]	Phytotoxicity[3/] July 9	Phytotoxicity[3/] Oct. 18
Control			80	0	0
Fluazifop + Oil[4/]	0.27	8.5	0	0	0
Fluazifop	0.27	9.4	17	0	0
Fluazifop	0.55	9.3	0	0.8	0
Fluazifop	1.1	9	0	0.4	0
Napropamide	2.2	8.5	83	0	0
Napropamide	4.4	8.5	35	0	0
Napropamide	6.6	9.7	0	0	0
Oxadiazon	2.2	6.5	93	6.5	3
Oxadiazon	4.4	9.6	93	9	7.2
Oxadiazon	6.6	9.5	100	9.5	8.2
Sethoxydim + oil	0.27	8.7	0	0	0
Sethoxydim	0.27	9.3	0	0	0
Sethoxydim	0.55	8.7	0	0.3	0
Sethoxydim	1.1	9.4	0	0	0
Sethoxydim	0.55				
+ Oxadiazon	2.2	9.2	3	6.5	3.8
Sethoxydim	0.55				
+ Oxadiazon	4.4	9.7	0	9.2	8.3
Sethoxydim	0.55				
+ Oxadiazon	6.6	10	0	9.3	9

1/ Rated on a scale of 0-10; 10 = total control.

2/ Percent of surviving weeds that were grasses.

3/ Rated on a scale of 0-10; 10 = dead.

4/ Crop oil concentrate included at 0.25% of total volume.

EVALUATIONS OF FOUR HERBICIDES IN SLOW RELEASE FORMULATIONS FOR CONTAINER GROWN LANDSCAPE CROPS

M. A. Ruizzo, E. M. Smith and S. F. Gorske[1]

ABSTRACT

In an attempt to improve the efficacy of selected herbicides, formulations have been altered in a manner that will control the rate of herbicide release. Technical grade formulations of alachlor, chloramben, naptalam and propachlor were individually incorporated into dicalcium phosphate and plaster of paris slow release tablet formulations. One tablet per container was applied, delivering 20 and 40 kg/ha active ingredient.

Dicalcium phosphate and plaster of paris slow release herbicide tablet formulations successfully controlled annual bluegrass (*Poa annua* L.), Common purslane (*Portulaca oleracea* L.), Pennsylvanica smartweed (*Polygonum pensylvanicum* L.) and yellow foxtail (*Setaria lutescens* (Wiegel) Hubb.) for 16 weeks with no significant injury to Royal Beauty Cotoneaster, Emerald 'N Gold euonymus, Spring Glory forsythia and Vicary privet in 3.78 liter nursery containers. There were no significant differences due to tablet formulation or herbicide incorporated.

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HAND-HELD APPLICATORS USING SC-0224, SC-0545, AND GLYPHOSATE FOR NURSERY WEED CONTROL

J. Ray Frank and W. V. Welker[1/]

ABSTRACT

Hand-held wick applicators have been developed for use in a variety of horticultural weed control situations. Four applicators including two experimental types known as the West Virginia Walker and the roller wiper (both designed and developed by the junior author) and two commercial applicators, the Walk-a-wick and the Weed wand were compared in this experiment. The effectiveness of the herbicides glyphosate and SC-0224 was evaluated when applied as a 10% solution using the various wipers. These herbicide treatments were applied July 26 and August 19, 1982. The herbicide SC-0545 was also applied as a 10% solution using the roller wiper on August 6 and August 19, 1982.

The experimental design was a randomized complete block with each treatment replicated three times. Each plot was 3.65 m x 3.65 m (13.3 sq m) and contained 3 established 5-year-old Andorra junipers (*Juniperus horizontalis* Plumosa) and 3 hicks yew (*Taxus media* Hicksii).

The roller wiper was the most effective applicator evaluated in that it provided the most uniform coverage and, when used with SC-0545, reduced the percentage weed cover the most (78%) after 12 days. The West Virginia Walker was the second most effective applicator evaluated, however, the highest total reduction in percentage weed cover (52%) at the end of the season was found with this equipment. The percentage reduction in weed cover at the end of the season for the three herbicides applied with the roller wiper were glyphosate, 40%; SC-0224, 38%; and SC-0545, 50%.

The Walk-a-wick and the Weed wand did not provide as uniform coverage as the other applicators and reduced the total percentage weed cover 20 to 22%.

None of the applicators used with any chemical treatment caused significant observable injury or reduction in growth of either juniper or yew.

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HERBICIDES FOR CONIFER TRANSPLANTS

J. F. Ahrens 1/

ABSTRACT

Replicated experiments with preemergence herbicides were conducted in 1981 and 1982 in transplant beds of rooted cuttings of Taxus media 'Browni' and seedlings of Eastern hemlock (Tsuga canadensis (L.)Carr.), Douglas fir (Pseudotsuga menziesii), Fraser fir (Abies fraseri), and white pine (Pinus strobus L.). The herbicides included simazine at 1 or 2 lb/A, oryzalin at 3 or 6 lb/A in Taxus, and 2, 4 or 8 lb/A in the other conifers, napropamide at 4, 8 or 16 lb/A, DCPA at 10 lb/A, oxadiazon at 2, 4 or 8 lb/A, oxyfluorfen at 0.5, 1 or 2 lb/A, bifenox at 3 or 6 lb/A, and several combinations of the lower rates of these herbicides. In general, combinations of herbicides gave more effective or longer lasting control of weeds than individual herbicides. Herbicides at normal rates reduced weeding times at least 70% and some reduced weeding times over 85% during the first season in the transplant bed. Bifenox at 6 lb/A injured Taxus and only oryzalin and oryzalin+simazine injured the other conifers. Oryzalin injured hemlock and 1-yr but not 2-yr Douglas-fir, and 2-yr but not 3-yr Fraser fir.

INTRODUCTION

Conifers usually are propagated in seedbeds where they are grown for 1 to 3 years following germination. These seedlings and rooted cuttings of other narrowleafed evergreens such as yew (Taxus spp.), are commonly planted into beds at close spacings for 2 or 3 more years until they are large enough to sustain the stresses of field plantings. Irrigation and sometimes shade are supplied in these transplant beds to maximize survival and growth. As in the seedbed, weeds must be removed by hand if chemicals are not available. Less research has been directed to developing chemical controls for transplant beds than for seedbeds or field uses. Since the plants involved are smaller than field-grown plants, it is dangerous to assume that herbicides tolerated in the field will be tolerated in the transplant bed. Simazine [2-chloro-4,6-= bis(ethylamino)-s-triazine] and oryzalin (3,5-dinitro-N^4,N^4-dipropylsulfanil= amide), which are widely used in field-grown plantings of conifers have caused injury to certain species in seedbed situations (1,2). The purpose of this work was to evaluate these and other preemergence herbicides for use in transplant beds.

MATERIALS AND METHODS

Three experiments were conducted during 1981 and 1982. Herbicides were applied with two-nozzle hand-held booms calibrated to deliver 30 or 50 gal/A or with a calibrated auger-feed granular applicator. Treatments were arranged

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in randomized complete block designs with three or four replicates. Irrigation was supplied within 1 h of treatment and as needed during the season. Weed control and plant injury were rated on a scale of 0 to 10, with 0 as no control or injury, and 10 as 100% control or all plants dead.

1981 Trial in Taxus - Rooted cuttings of *Taxus media* 'Browni' were planted on June 6, 1981 into beds at a commercial nursery in Rocky Hill, CT on a Hartford sandy loam soil with 6% organic matter. The beds were 4 ft wide and the plants were spaced 1.8 in by 4 in. The herbicides were applied on wet soil on June 4, 1981, in 3 ft swaths across the beds in 50 gal/A. Plots were spaced 4.5 ft apart leaving 1.5 ft untreated between each. Each treated plot contained 243 plants. Two untreated plots were included in each of the three replicates. The plots were covered with a 50% lath shade for the season. Weed control and plant injury were rated visually in July and October and the plots were handweeded after each rating. The principal weed in this test in July was marshcress (*Rorippa islandica* (Oeder)Borbas), but oakleaf goosefoot (*Chenopodium glaucum* L.) and large crabgrass (*Digitaria sanguinalis* (L.)Scop.) occurred later in some plots.

1981 Trial in Conifers - An established grass sod on Merrimac sandy loam with 3.8% organic matter was treated with glyphosate [N-(phosphonomethyl)=glycine] on April 23, 1981, limed to pH 5.7, and plowed on April 27. Uniformly graded 2-yr (2-0) seedlings of Eastern hemlock (*Tsuga canadensis* (L.)Carr., Fraser fir (*Abies fraseri*) and white pine (*Pinus strobus* L.), and 1-yr (1-0) seedlings of Douglas-fir (*Pseudotsuga menziesii*) were planted into plots on May 6 and 7. Twelve to 14 plants of each species were planted at 4 by 5 in spacings into 3 by 5 ft plots separated by 2-ft borders. The herbicides were applied on May 13, 1981 as sprays in 50 gal/A or as granules. The predominate weeds included large crabgrass, carpetweed (*Mollugo verticillata* L.), common dandelion (*Taraxacum officinale* Weber), common yellow woodsorrel (*Oxalis stricta* L.), and horseweed (*Conyza canadensis* (L.)Cronq.).

1982 Trial in Conifers - The soil type and plot sizes were similar to those in 1981, but the trial differed in that it was on a site requiring no pretreatment for perennial weeds. The land was planted to the same species as in 1981 on April 15 to 19, 1982, with 15 of each per plot. However, 2-yr Douglas-firs were planted into two replicates and 1-yr Douglas-firs were planted into the other two replicates. Three-yr Fraser fir were planted in 1982. The herbicides were applied on April 29 as sprays in 30 gal/A or as granules. The predominant weeds in 1982 were large crabgrass, common lambs-quarters (*Chenopodium album* L.), carpetweed, and horseweed. Rainfall was about three times normal in June of 1982. In both conifer trials the times required to weed individual plots were taken at three intervals during the season. Weeding times were corrected for times required to look for weeds in weed-free plots. Survival counts also were taken in September each year.

RESULTS AND DISCUSSION

All herbicide treatments gave early control of marshcress in *Taxus* beds (Table 1). The least effective were napropamide [2-(α-naphthoxy)-N,N-diethyl=propionamide] at 4 lb/A and DCPA (dimethyl tetrachloroterephthalate) at 10 lb/A. Bifenox [methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate] at 6 lb/A was the only treatment that injured Taxus, resulting in slightly reduced growth in late

Table 1. Weed Control and Injury in Rooted Cuttings of *Taxus* 'Browni'.

Herbicide	lbs ai/A	Weed control 1/ July 16 (7 weeks)	Weed control 1/ Oct 13 (19 weeks)	Injury 1/ July 16 (7 weeks)	Injury 1/ Oct 13 (19 weeks)
untreated		0	1.5	0	0
oryzalin 75W	3	9.9	8.8	0	0
	6	9.8	8.5	0	0
napropamide 50W	4	8.3	5.3	0	0
	8	9.7	6.3	0	0
simazine 80W	1	9.3	6.8	0	0
	2	9.8	10.0	0	0
DCPA 75W	10	7.0	3.3	0	0
simazine+DCPA	1+10	9.9	8.2	0	0
simazine+ oryzalin	1+3	10.0	10.0	0	0
simazine+ napropamide	1+4	9.9	9.7	0	0
oxadiazon 2G	2	9.2	7.8	0	0
	4	9.9	8.2	0	0
	8	10.0	9.2	0	0
oxyfluorfen 2EC	1	9.8	8.8	0	0
	2	10.0	9.2	0	0
oxyfluorfen+ napropamide	1+4	9.8	8.8	0	0
bifenox 80W	3	9.7	7.2	0	0.3
	6	9.8	8.3	0	1.0
bifenox+ napropamide	3+3	9.8	7.0	0	0

1/ 0 = no control or injury; 10 = 100% control or all plants dead.

season. Combining simazine at 1 lb/A with oryzalin at 2 lb/A or napropamide at 4 lb/A, or DCPA at 10 lb/A gave longer control than either herbicide alone.

Results of the two experiments in the conifer beds are given in Tables 2 and 3. Control of weeds by three handweedings alone required 845 h of labor/A in 1981 and 386 h/A in 1982 on a site with lower weed pressures. Weed populations and therefore weeding times were higher earlier in the season than later. All herbicide treatments reduced weeding times by at least 70% for the

Table 2. Reductions in Weeding Time and Survival of Conifers in 1981.

Herbicide	Rate, ai, lb/A	% Reduction in Weeding Time: June 30 7 wks	Aug 13 13 wks	Oct 14 22 wks	Season Total	% Survival: Hem-lock	Doug. fir	Fraser fir	White pine
handweeded control		-1/	-1/	-1/	-1/	70	94	94	73
Periodically weeded control		0	0	0	0	98	88	87	62
oryzalin 75W	2	94	90	53	83	43	69	78	60
	4	99	100	91	98	7	25	65	76
	8	99+	100	94	99	26	18	43	67
napropamide 50W	4	98	86	60	85	96	80	93	67
	8	100	90	59	88	93	80	96	60
	16	99+	92	60	88	89	82	91	56
simazine 80W	1	97	56	7	63	87	69	83	71
	2	95	83	51	81	76	90	93	67
DCPA 75W	10	90	69	37	71	96	84	80	51
simazine+DCPA	1+10	98	78	22	74	85	84	94	67
simazine+oryzalin	1+2	99+	93	88	97	39	59	89	76
simazine+napropamide	1+4	99+	94	47	86	87	76	91	73
oxadiazon 2G	4	95	95	61	88	82	88	80	71
	8	98	99	79	94	82	88	93	76
oxyfluorfen 2EC	0.5	88	79	49	76	69	76	85	56
	1	94	97	65	88	94	88	89	67
	2	98	99	65	91	78	88	89	67
oxyfluorfen+ napropamide	0.5+4	96	95	62	88	93	80	96	71
bifenox 80W	3	98	91	44	84	74	86	89	67
	6	93	98	67	89	80	84	91	60
bifenox+napropamide	* 3+3	99+	99	75	94	91	88	83	56
L.S.D. p = .05		20	16	43	-	24	21	15	N.S.
p = .01		27	22	58	-	33	28	20	N.S.

1/ Times required to weed the untreated controls were 356 man-hours/A on June 30, 302 man-hours/A on Aug 13, and 187 man-hours/A on Oct 14 for a total of 845 h/A.

Table 3. Reductions in Weeding Time and Survival of Conifers in 1982.

Herbicide	Rate, ai, lb/A	% Reduction in Weeding Time: June 3 5 wks	July 16 11 wks	Aug 23 17 wks	Season total	% Survival: Hem-lock	Doug. fir	Fraser fir	White pine
Handweeded control		-1/	-1/	-1/	-1/	95	93	97	97
Periodically weeded control		0	0	0	0	92	92	100	100
oryzalin 75W	2	98	98	92	97	83	90	95	93
	4	100	100	100	100	55	70	98	87
	8	100	100	100	100	8	58	83	97
napropamide 50W	4	93	87	75	88	97	93	97	95
	8	97	96	78	95	95	93	95	88
simazine 80W	1	100	61	18	74	92	83	95	97
	2	100	79	0	76	97	100	95	97
DCPA 75W	10	86	86	38	79	93	95	100	100
simazine+DCPA	1+10	100	97	46	91	93	95	98	100
simazine+oryzalin	1+2	100	100	91	99	90	92	98	97
simazine+napropamide	1+4	100	98	86	97	100	100	95	92
oxadiazon 2G	4	100	99	98	99	90	97	93	93
	8	100	100	99	99+	95	98	97	95
oxyfluorfen 2EC	0.5	100	79	0	73	93	83	97	95
	1	100	94	63	92	98	98	98	92
	2	100	99	46	92	90	92	97	97
oxyfluorfen+ napropamide	0.5+4	100	99	78	97	96	95	98	98
	1+4	100	98	83	97	95	92	97	100
bifenox 4F	3	98	90	0	76	92	97	95	93
	6	100	93	47	90	93	93	98	93
bifenox+napropamide	3+4	99	99	83	97	95	92	97	93
L.S.D. p = .05		22	16	56	-	12	19	N.S.	N.S.
p = .01		29	21	75	-	15	N.S.	N.S.	N.S.

1/ Times required to weed the untreated controls were 190 man-hours/A on June 16, 140 h/A on July 16, and 56 h/A on Aug 23 for a total of 306 h/A.

season. Those that reduced weeding times by over 85% both years without significantly affecting injury or survival of hemlock, Douglas-fir, Fraser fir or white pine included napropamide at 4 or 8 lb/A, oxyfluorfen [2-chloro-1-=(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene] at 1 or 2 lb/A, bifenox at 6 lb/A, granular oxadiazon [2-tert-butyl-4(2,4-dichloro-5-isopropoxyphenyl)=-Δ^2-1,3,4-oxadiazolin-5-one] at 4 or 8 lb/A, and combinations of simazine+napropamide at 1+4 lb/A, bifenox+napropamide at 3+3 or 3+4 lb/A, and oxyfluorfen+napropamide at 0.5+4 lb/A. Simazine+DCPA at 1+10 lb/A caused no injury and reduced weeding times in 1981 and 1982 by 74 and 91%, respectively. In most cases the combinations gave broader spectrum and longer lasting control than single herbicides. This is expected because each herbicide has its weaknesses. Large crabgrass was resistant to low rates of simazine, oxyfluorfen and bifenox, and certain broadleafed weeds were resistant to DCPA and napropamide.

Oryzalin at 2 lb/A alone or with simazine at 1 lb/A gave excellent weed control, but oryzalin was the only herbicide to injure one or more of the conifers in these tests. In 1981, oryzalin caused severe injury and mortality in 2-yr hemlock and Fraser fir, and 1-yr Douglas-fir (Table 2). In the 1982 trial oryzalin at 4 lb/A caused severe injury on hemlock and Douglas-fir, but no injury to the 3-yr Fraser fir or white pine. At 2 lb/A the injury to hemlock was marginal in 1982. However, a closer comparison between the two replicates of Douglas-fir with 2-yr seedlings and the two replicates with 1-yr seedlings, showed that the 1-yr seedlings were much more sensitive to oryzalin than 2-yr seedlings (Table 4). Therefore, both in 1981 and 1982, oryzalin at 2 lb/A caused excessive injury to 1-yr Douglas-fir in transplant beds. Thus, seedling age (size) appears to be a significant factor in the susceptibility of Douglas-fir and Fraser fir to oryzalin. The greater sensitivity of hemlock and Douglas-fir than white pine to oryzalin agrees with similar findings in seedbeds (1).

Table 4. Percentage Survival of 1-yr (1-0) and 2-yr (2-0) Douglas-fir Seedlings in 1982.

Herbicide	Rate, ai lb/A	1-yr Plants	2-yr Plants
weedfree		96	90
periodically weeded		86	96
oryzalin	2	80	100
	4	47	94
	8	30	87
oryzalin+simazine	2+1	83	100

LITERATURE CITED

1. Ahrens, J.F., C.G. Merrill, and M. Cubanski. 1976. Herbicides for conifer seedbeds. Conn. Agric. Exp. Sta. Bull. 766, 13 p.

2. Ahrens, J.F. and M. Cubanski. 1977. Herbicides for hemlock seedbeds. Proc. Northeast. Weed Sci. Soc. 31:315-319.

Pre- and Postemergence Herbicides for Use on Conifer Seedbeds

Larry J. Kuhns, Gregory Twerdok, and Chiko Haramaki[1/]

ABSTRACT

Seedbeds were prepared and fumigated (methyl bromide) in September, 1981 and seeds of Fraser fir and white pine were sown in October. The Colorado spruce and Douglas fir seeds were not sown until June 20, 1982. Following sowing of all species a cellulose fiber hydro-mulch was applied. The Fraser fir and white pine seedbeds were protected through the winter by a six inch layer of salt hay.

Preemergence herbicide applications were made immediately after removal of the salt hay from the fall-sown beds and 9 days after the Colorado spruce and Douglas fir were sown. Postemergence herbicide applications were made 8 weeks after the conifer seedlings began to emerge. Combinations and rates of application are presented in Table 1.

Weeds were removed and counted prior to the postemergence applications because we were most interested in determining crop tolerance and we did not want the weeds to intercept any of the herbicide. Red clover density was high so it was counted separately from the other weeds. The other predominant weeds in the plots were smooth crabgrass and yellow foxtail. The final phytotoxicity ratings were conducted on October 10, after all growth for the year was complete.

Bifenox alone reduced weed populations, but not to satisfactory levels. Control was not improved by increasing its rate of application. The control provided by oxyfluorfen alone was rate dependent. At 0.27 kg/ha control was inadequate, at 0.55 kg/ha control was marginal, and at 1.1 kg/ha control was very good. Combining napropamide at 2.2 or 4.4 kg/ha with bifenox or oxyfluorfen greatly improved the control of both the clover and the grasses.

Douglas fir, Fraser fir, and white pine were tolerant of all of the herbicides and combinations at all rates. The only injury evident was a slight stunting of some plants caused by oxyfluorfen.

Colorado spruce was the most sensitive of the conifers to the herbicides. Bifenox at 6.6 kg/ha and bifenox or oxyfluorfen in combination with napropamide caused severe, commercially unacceptable injury. Injured plants were stunted, had burned or contorted growing points, exhibited a grayish discoloration, were less dense, or were killed (less than 5%). None of the combinations including postemergence applications caused severe injury. There were slight decreases in size and density and some seedlings exhibited gray or purple discoloration, but all injury was within a commercially acceptable level.

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Table 1. The weed control provided by herbicides applied prior to conifer emergence; and the phytotoxicity of herbicides applied pre- and postemergence.

Applied Preemergence	Rate kg/ha	Applied Postemergence	Rate kg/ha	Weed Count[1/] Clover	Weed Count[1/] Others	Phytotoxicity[2/] Colo. Spruce	Phytotoxicity[2/] Doug. Fir	Phytotoxicity[2/] Fraser Fir	Phytotoxicity[2/] White Pine
Control				299	74	1.2	1	1	1
Bifenox	1.5			149	39	1.5	1	1	1
Bifenox	3.3			130	34	1.7	1	1	1
Bifenox	6.6			146	36	3	1	1	1
Bifenox	1.6								
+ Napropamide	2.2			92	5	2.3	1	1	1
Bifenox	1.6								
+ Napropamide	4.4			43	8	3.2	1	1	1
Bifenox	3.3								
+ Napropamide	2.2			50	8	3.8	1	1	1
Bifenox	3.3								
+ Napropamide	4.4			31	9	3.8	1	1	1
Bifenox	1.6	Bifenox	1.6			1.3	1	1	1
Bifenox	1.6	Bifenox	3.3			2.2	1	1	1
Bifenox	1.6	Fluazifop	0.27			1.8	1	1	1
Bifenox	1.6	Fluazifop	0.55			1.8	1	1	1
Bifenox	3.3	Fluazifop	0.27			1.8	1	1	1
Bifenox	3.3	Fluazifop	0.55			2.3	1	1	1
Bifenox	1.6	Sethoxydim	0.27			1.5	1	1	1
Bifenox	1.6	Sethoxydim	0.55			1.8	1	1	1
Bifenox	3.3	Sethoxydim	0.27			2.8	1	1	1
Bifenox	3.3	Sethoxydim	0.55			1.8	1	1	1
Oxyfluorfen	0.27			191	39	1.5	1	1	1
Oxyfluorfen	0.55			100	22	1.1	1	1	1.3
Oxyfluorfen	1.1			45	7	2.2	1.3	1	1.7
Oxyfluorfen	0.27								
+ Napropamide	2.2			71	9	2.7	1	1	1
Oxyfluorfen	0.27								
+ Napropamide	4.4			35	5	3.7	1	1	1
Oxyfluorfen	0.55								
+ Napropamide	2.2			46	12	3	1	1	1
Oxyfluorfen	0.55								
+ Napropamide	4.4			26	3	3.3	1	1	1
Oxyfluorfen	0.27	Oxyfluorfen	0.27			1.8	1	1	1
Oxyfluorfen	0.27	Oxyfluorfen	0.55			1.8	1	1	1
Oxyfluorfen	0.27	Fluazifop	0.27			1.8	1	1	1
Oxyfluorfen	0.27	Fluazifop	0.55			1.2	1	1	1
Oxyfluorfen	0.55	Fluazifop	0.27			1.3	1	1	1
Oxyfluorfen	0.55	Fluazifop	0.55			2	1	1	1
Oxyfluorfen	0.27	Sethoxydim	0.27			1.7	1	1	1
Oxyfluorfen	0.27	Sethoxydim	0.55			2	1	1	1
Oxyfluorfen	0.55	Sethoxydim	0.27			2.2	1	1	1
Oxyfluorfen	0.55	Sethoxydim	0.55			1.8	1	1	1

1/ Total number of weeds in all replications of all species; recorded 8 weeks after preemergence applications.

2/ Evaluated at the end of the growing season (Oct. 10). Rated 1-5; 3 = commercially unacceptable, 5 = dead.

HERBICIDES FOR CONIFER SEEDBEDS

J. F. Ahrens and M. Cubanski 1/

ABSTRACT

Herbicides were applied on newly emerged conifer seedlings in replicated trials at the State Forest Nursery in Voluntown, Connecticut, in May of 1981 and 1982. Irrigation was applied within 1 h of the herbicides and on almost a daily basis thereafter. Some treatments were repeated 5 weeks later. Herbicides that gave satisfactory weed control for at least 5 weeks with tolerable injury to white pine, hemlock, Douglas-fir, and Fraser fir included napropamide 50W at 2 or 3 lb/A, bifenox 4F at 3 lb/A, and oxyfluorfen 2E at 0.25 lb/A. Oxyfluorfen at 0.5 lb/A caused excessive injury in most species, but double rates of the other herbicides were tolerated. Napropamide at 2 lb/A, combined with bifenox at 3 lb/A in early May or followed by oxyfluorfen at 0.25 lb/A 5 weeks later gave longer control of weeds than either herbicide alone, with adequate conifer safety. Metolachlor 8E at 1.5 lb/A repeated after 5 weeks gave excellent control of annual grasses, but poor control of broadleaves. One or two applications of metolachlor at 1.5 lb/A injured white pine, hemlock and Fraser fir, and a single application at 3 lb/A caused moderate to severe injury in all conifers.

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THE EFFECTS OF TIME OF HERBICIDE APPLICATION ON CONIFER SEEDBEDS

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ABSTRACT

Seeds of Colorado spruce (Picea pungens Engelm.)and Douglas fir [Pseudotsuga menziesii (Mirb.) Franco] were sown into 3.9 l containers of an amended, steam pasteurized 1 soil:1 sand:1 peat medium. Additional containers of the same medium were sown with seeds of four common weeds. Conifer and weed seeds were covered with a steam pasteurized mix of 1 sand:1 peat. Bifenox, oxyfluorfen, napropamide, and napropamide + oxyfluorfen were applied at three rates prior to conifer emergence and one, two, and three weeks after emergence.

Bifenox and napropamide provided poor weed control, oxyfluorfen provided good control, and napropamide + oxyfluorfen provided excellent control. Both conifer species were more tolerant of bifenox and oxyfluorfen and less tolerant of napropamide when they were applied prior to emergence. Oxyfluorfen caused considerable injury when applied anytime during the three weeks following emergence. Bifenox was safe when used at 3.3 kg/ha or less two weeks after germination. Napropamide was safe when used at 2.2 kg/ha or less at anytime before or after germination.

Colorado spruce was more sensitive to the herbicides than Douglas fir.

INTRODUCTION

Bifenox and oxyfluorfen have recently been labelled for pre- and postemergence use in conifer seedbeds. However, the labels state that they should not be applied within four or five weeks respectively, of conifer emergence. This creates a problem, because if the preemergence application is missed, the weeds grow to a size too large to be controlled by postemergence applications of these materials. The first objective of this study was to determine the tolerance of Colorado spruce and Douglas fir to applications of these herbicides made preemergence and one, two, and three weeks postemergence. The second objective was to determine the same information for napropamide, a herbicide which has been safely used on seedbeds of some conifers.

MATERIALS AND METHODS

A medium of 1 soil:1 sand:1 peat, pH 6.7, was amended with 84g gypsum, 62g superphosphate (0-46-0), 40g lime, 10.3g epsom salt, and 0.75g fritted trace elements per bushel. After mixing, it was steam pasteurized at 82°C for 30 minutes and used to fill 3.9 l containers. A vacuum activated template was used to evenly distribute 25 seeds of Colorado spruce or Douglas fir on some of the containers, and seeds of barnyardgrass [Echinochloa crus-galli (L) Beauv.], yellow foxtail [Setaria lutescens

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(Weigel) Hubb], common purslane (Portulaca oleracea L.), and redroot pigweed (Amaranthus retroflexus L.) were broadcast on the remainder. The conifer and weed seeds were covered with 0.25cm of a steam pasteurized 1 sand: 1 peat mix.

The following treatments were then applied with a CO_2 pressurized sprayer at 20 psi through aluminum 8004 flat fan nozzles: bifenox [methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate] at 1.6, 3.3, or 6.6 kg/ha; oxyfluorfen [2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene] at 0.27, 0.55, or 1.1 kg/ha; and napropamide [2-(a-naphthoxy)-N, N-diethylpropionamide] at 1.1, 2.2, or 4.4 kg/ha alone or in combination with 0.27 kg/ha oxyfluorfen. These treatments were repeated one, two, and three weeks after emergence of the conifer seedlings. All treatments were replicated four times.

The seedlings were maintained under 50% shade. They were evaluated for visual symptoms of injury two weeks after each application and on October 1, after growth had ceased for the year. Seedling mortality was also recorded. This was the difference in the number of seedlings per container prior to the first postemergence application and the number of seedlings on October 1. In some containers a positive number was recorded because of late germination of some seeds.

The preemergence weed control provided by the herbicides was evaluated eight weeks after application. The percent of weeds that were grasses was also estimated.

RESULTS

The overall weed control rating for bifenox was poor (Table 1). But almost all of the weeds in bifenox treated containers were grasses, indicating it did control the broadleaved weeds. Oxyfluorfen provided poor weed control at 0.27 kg/ha, good control at 0.55 kg/ha, and excellent control at 1.1 kg/ha. It also completely controlled broadleaved weeds. Napropamide's overall weed control was poor, but almost all of the weeds present were broadleaves. It provided good to excellent control of the grasses. The combination of napropamide + oxyfluorfen provided good to total weed control.

Applied preemergence, bifenox caused stunting of both Douglas fir and spruce seedlings and burning of the needle tips on the spruce (Table 2). This initial injury was overcome and by October 1 a slight stunting of the spruce was the only remaining symptom.

When applied one week after emergence, bifenox burned the growing points of both species. This distorted and stunted the new growth or killed the seedling. On October 1 the Colorado spruce were stunted and a high percentage of the seedlings exhibited multiple breaks, an undesirable characteristic for conifer seedlings. This was apparently due to the death of the primary growing point and the subsequent formation and growth of multiple adventitious buds. The degree of stunting and presence of multiple breaks in Douglas fir varied considerably within each container, but those treated with 3.3 or 6.6 kg/ha were still unacceptable on October 1.

Table 1. Weed control provided by preemergence herbicides applied to containers seeded with barnyardgrass, yellow foxtail, and redroot pigweed.

	Rate Kg/ha	Weed Control 1/	% Grasses 2/
Control		0	70
Bifenox	1.6	2.6	96
Bifenox	3.3	3.6	100
Bifenox	6.6	6.9	100
Oxyfluorfen	0.27	3.5	100
Oxyfluorfen	0.55	8.1	100
Oxyfluorfen	1.1	9.9	100
Napropamide	1.1	2.1	28
Napropamide	2.2	3.3	4
Napropamide	4.4	4.3	1
Napropamide	1.1		
+ Oxyfluorfen	0.27	7.8	100
Napropamide	2.2		
+ Oxyfluorfen	0.27	9.2	100
Napropamide	4.4		
+Oxyfluorfen	0.27	10.0	-

1/ Rated on a scale of 0-10; 10 = total control.

2/ Percent of weeds that were grasses.

When applied two or three weeks postemergence, bifenox caused serious injury only at the 6.6 kg/ha rate. Symptoms included stunting and burning of the growing point and distortion of the new growth. At the lower rates, there was slight stunting and some distortion of the new growth. The only symptom remaining on October 1 was limited stunting.

Oxyfluorfen applied preemergence appeared to cause very little injury to either species. However, on October 1 the spruce seedlings treated with 0.55 or 1.1 kg/ha were stunted and many had developed multiple leaders. This did not happen to the Douglas fir.

When applied one, two, or three weeks after emergence oxyfluorfen severely injured both species. Injury symptoms were similar to those described for bifenox. Initial observations included burned needle tips and growing points, distorted and stunted new growth, discolored foliage, and death of some seedlings. On October 1, many seedlings were stunted and exhibited multiple breaks. Again, there was much variation in symptom expression among seedlings within the same container. Douglas fir seedlings treated with the low rates two weeks after emergence were not injured as severely as those treated three weeks after emergence. It can not be definitely stated why this occurred, but it may be related to the development of the primary bud. If the bud was unopened at the two week application, it may have resisted injury and if it was newly expanding at the three week application it may have been highly susceptible to injury.

Napropamide applied alone did not cause unacceptable injury to spruce or Douglas fir at any rate or time of application except at the 4.4 kg/ha rate applied one week after emergence. Initial injury to spruce was a burn of the tips of the primary needles, yellowing of the

Table 2. Injury to conifers caused by herbicides applied preemergence or one, two, or three weeks postemergence.[1/]

		COLORADO SPRUCE												DOUGLAS FIR											
		Preemergence			1 week, Postemergence			2 weeks, Postemergence			3 weeks, Postemergence			Preemergence			1 week, Postemergence			2 weeks, Postemergence			3 weeks, Postemergence		
	Rate Kg/ha	Init.[2/]	Oct.1[3/]	Mort.[4/]	Init.	Oct.1	Mort.	Init.	Oct.1	Mort.	Init.	Oct.1	Mort.	Init.	Oct.1	Mort.	Init.	Oct.1	Mort.	Init.	Oct.1	Mort.	Init.	Oct.1	Mort.
Bifenox	1.6	3	2	-1	4	3	-2	2	2	-1	2	1	-1	2	1	+1	4	2	-4	2	1	0	2	3	-2
Bifenox	3.3	4	2	0	4	4	0	2	2	-2	2	2	-1	4	1	+2	4	4	+1	2	2	0	1	1	+1
Bifenox	6.6	3	2	-1	4	4	-2	4	3	-2	3	2	-2	3	1	0	4	4	-1	3	3	-1	2	1	0
Oxyfluorfen	0.27	2	2	-1	4	4	-2	4	2	0	4	3	+1	2	2	0	4	3	-3	1	1	+1	3	3	+2
Oxyfluorfen	0.55	2	4	-1	4	4	-5	4	3	-1	4	4	0	2	1	+1	4	3	-1	2	3	-1	4	4	-1
Oxyfluorfen	1.1	2	3	0	4	4	-6	4	4	-1	4	4	0	2	2	0	4	4	-6	4	4	-1	4	4	0
Napropamide	1.1	2	2	-1	2	2	0	1	1	-1	1	1	+1	2	2	0	1	1	-2	1	1	+1	1	1	0
Napropamide	2.2	3	1	0	3	2	-1	2	1	0	1	1	0	2	1	-1	1	1	-1	1	1	0	1	1	0
Napropamide	4.4	3	3	-2	3	4	-3	2	2	-2	1	1	0	2	2	-2	4	4	0	1	1	0	1	1	0
Napropamide	1.1																								
+ Oxyfluorfen	0.27	2	1	-1	4	4	-1	4	3	-3	4	3	0	2	1	-1	4	3	-2	4	3	-1	4	3	-1
Napropamide	2.2																								
+ Oxyfluorfen	0.27	2	1	-1	4	4	-3	4	3	-1	4	3	-1	2	1	+1	4	4	-5	4	3	-1	4	3	+1
Napropamide	4.4																								
+ Oxyfluorfen	0.27	3	3	-2	4	4	-4	4	3	-1	4	3	-1	2	1	0	4	4	-10	4	3	-1	4	3	0

1/ Injury rated on a scale of 1-4; 1 = none, 2 = acceptable, 3 = marginally acceptable, 4 = unacceptable injury.

2/ Initially evaluated 2 weeks after application.

3/ End of growing season.

4/ Difference between the number of seedlings per container prior to the first postemergence application and the number of seedlings on October 1.

new growth, and stunting. Initial injury to Douglas fir varied; the growing points were either normal, stunted and distorted, or were absent. On October 1, seedlings of both species in this treatment exhibited stunting and multiple breaks.

Napropamide + oxyfluorfen caused unacceptable initial injury at all rates of application only when applied after emergence. Injury symptoms were the same as those for oxyfluorfen applied alone. There appeared to be some intensification of symptoms caused by the napropamide. When applied prior to emergence the combination caused little injury.

DISCUSSION

Applied preemergence at low rates, bifenox and oxyfluorfen provide very good control of broadleaved weeds and napropamide provides very good control of grasses. But even at low rates oxyfluorfen caused severe injury to Colorado spruce and Douglas fir when applied anytime during the three-week period following germination and bifenox caused severe injury if applied one week after germination.

It appears that the safest, most effective weed control in seedbeds of Colorado spruce and Douglas fir can be obtained by applying napropamide at 2.2 kg/ha in combination with oxyfluorfen at 0.27 kg/ha prior to germination of the conifer seeds.

POSTEMERGENCE GRASS HERBICIDES FOR WOODY ORNAMENTALS AND CHRISTMAS TREES

J. F. Ahrens [1/]

ABSTRACT

The postemergence grass herbicides fluazifop-butyl and sethoxydim were evaluated for selective weed control in a number of ornamental and Christmas tree plantings at dosages of 0.25 to 1.5 lb/A, plus crop oil with surfactant at 0.25 to 1% v/v concentrations. Dowco 453 at 0.125 to 0.5 lb/A plus crop oil also was evaluated in Christmas tree plantings. Combinations with preemergence herbicides also were tested.

Several annual and perennial grasses and volunteer rye were controlled by these herbicides. In narrowleafed evergreens combinations of sethoxydim or fluazifop-butyl with oxyfluorfen controlled many broadleaves postemergence, as well as grasses. Combinations with simazine and/or oryzalin were effective for postemergence grass control and residual control of broadleaves in ornamentals and Christmas trees. Control of perennial grasses with these combinations has varied from fair to excellent, indicating the need for more research on factors affecting their activity.

All conifers tested, including actively growing seedlings or larger plants of spruces, firs, Douglas-fir and pines, as well as yews, junipers and arborvitae, and several broadleafed ornamentals were unaffected by broadcast sprays of these herbicides. However, Azalea hinocrimson was injured by fluazifop-butyl in one test, whereas two other azalea cultivars were unaffected, and actively growing forsythia sometimes showed tip distortion resulting in growth reduction from fluazifop-butyl and sethoxydim. Therefore, it cannot be assumed that these herbicides will have no effects on all broadleafed plants. In some ornamental plantings it may be necessary to use semi-directed rather than broadcast sprays to avoid plant injury.

Selective postemergence grass herbicides are needed to control escaped annual and perennial grassy weeds in nurseries and landscape plantings, and to control sod grasses in newly planted Christmas trees. Tools such as these can also lead to improved weed management and reduced soil erosion in nursery plantings, by better utilizing grass or cereal cover crops which can be controlled at will.

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THE EFFECT OF CROP OIL, SETHOXYDIM, FLUAZIFOP-BUTYL, DOW 453 AND CGA 82725 APPLIED TO GROWING NURSERY PLANTS IN CONTAINERS AND IN THE FIELD FOR POSTEMERGENCE GRASS CONTROL

A. Bing[1/]

INTRODUCTION

Grasses are important weeds in production nurseries and landscape plantings. When annual or perennial grasses survive cultural or chemical treatment they are difficult to remove. Quackgrass (Agropyron repens (L.) Beauv.) and other perennial grasses overwhelm low growing ground cover plantings. Sometimes directed sprays of paraquat or glyphosate can be used. There is need for a safe postemergence grass herbicide. Some materials already on the market can perform this function to a limited extent. The herbicides used in this experiment have shown promise in other crops, and therefore may become available for use on ornamentals. This experiment tests the safety of crop oil alone and combinations of crop oil with sethoxydim, fluazifop-butyl), Dow 453 or CGA 82725 on a wide variety of ornamental plants.

MATERIALS AND METHODS

One study was with container grown plants and the other with field grown nursery liners. The established young plants (as shown in Table 1) in 1-gallon containers were removed on June 15 from the growing area and placed on a 10 x 10 ft treatment plot. The different plants for the same treatment were sprayed with a Spraying Systems 80003 nozzle. After treatment plants were individually labeled with wooden pot labels, and after drying returned to the growing area for continuous observation. Ratings were made on July 1 using 1 for a dead or missing plant, 7 for satisfactory appearance, to 10 for optimum growth and appearance. Smaller amounts of several annuals and perennials were also tested.

In the field experiment the nursery liners shown in Table 2 were machine planted, one species per row, approximately 2 ft between plants, and 4 ft between rows on May 12 at Farmingdale, NY. The whole field was treated with simazine 1 lb AI/A and alachlor 4 lb AI/A to control seedling weeds. The field was divided into 2 blocks, each containing 14 plots of approximately 5 plants of each species across the 7 rows.

On June 1, the plots were sprayed with crop oil, crop oil with sethoxydim 1.53E at 0.25, 0.50 and 1.0 lb AI/A, crop oil with fluazifop-butyl 4E at 0.5, 1.0 and 2.0 lb AI/A, crop oil with Dow 453 2G at 0.25, 0.50 and 1.0 lb AI/A and crop oil with CGA 82725 2E at 0.25, 0.50 and 1.0 lb AI/A. The spray was evenly distributed over the weed-free ground surface and the plants using a hand-pumped 1.5 gallon sprayer. Plants were observed frequently during the growing season and ratings were made July 7 on the container grown plants using the scale 1 = dead or missing, 7 = satisfactory growth, to 10 = optimum growth and appearance.

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RESULTS AND DISCUSSION

The ratings made on July 1 on container grown plants are shown in Table 3. The only ratings below 9 or 10 are 9 and 7 with fluazifop-butyl, 9 and 8 Dow 453 and 9 and 8 with CGA 82725 on maple. There was no other injury observed on July 1 or later during the growing season. Some annuals and perennials that were treated also showed no injury.

In the field experiment there was no injury from any of the treatments on arbor vitae, dogwood, forsythia, maple, pine or yew. Privet had severe tip burn from sethoxydim at 1 lb AI/A and slight tip burn from the 0.5 lb AI/A and none from the 0.25 lb rate. Semi-directed sprays of sethoxydim on variegated privet in a grower's nursery at 0.5 lb AI/A did not cause injury.

With the exception of sethoxydim on privet, the herbicides tested were very safe on a wide variety of ornamentals.

Table 1. Plants in containers treated with postplant postemergence grass herbicides, Riverhead, New York, 1982.

Common Name	Scientific Name
Azalea var Fashion	Rhododendron obtusum (Lindl.) Planch, cv Fashion
Golden Bells	Forsythia X intermedia Zab
Holly, boxleafed	Ilex crenata convexa Thunb.
Ivy, English	Hedera Helix L.
Japanese Snowball	Viburnum plicatum var Tomentosum Thunb.
Juniper, compact Pfitzers	Juniperus chinensis L.Pfitzeriana'compacta' L.
Maple, red	Acer rubrum L.
Rhododendron, Roseum Elegans	Rhododendron catawbiense Michx, cv Roseum Elegans

Table 2. Plants used for postemergence grass control in field liners at Riverhead, New York 1982.

Common Name	Scientific Name
Arbor vitae, globe	Thuja occidentalis L.
Dogwood, flowering	Cornus florida L.
Golden bells	Forsythia intermedia Zab
Maple, Japanese	Acer palmatum Thunb.
Pine, white	Pinus strobus L.
Privet, California	Ligustrum ovalifolium Hassk.
Yew, Hicks	Taxus cuspidata Hickii Siebold & Zucc.

Table 3. Tolerance of container grown nursery plants to postemergence grass herbicides, treated June 15, rated on July 1, 1982 at Riverhread, NY.

Treatment		Tolerance ratings[a]							
Herbicide	Rate lb ai/A	Az[b]	Rhody	Jun	For	Vib	Maple	Holly	Ivy
Sethoxydim 1.53E	0.25	10	10	10	10	10	10	10	10
+ 1% oil	0.5	10	10	10	10	10	10	10	10
Fluazifop-butyl 4E	0.5	10	10	10	10	10	9	10	10
+ 1% oil	1.0	9	10	10	10	10	7	8	10
Dowco 453 2E	0.25	10	10	10	10	10	9	9	10
+ 1% oil	0.50	10	10	10	10	10	8	9	10
CGA82725 2E	0.25	10	10	10	10	10	9	9	10
+ 1% oil	0.50	10	10	10	10	9	8	10	10
Crop oil 1%	10	10	10	10	10	10	10	10	10

(a) Tolerance ratings 1=dead to 8=slight injury to 10=no injury.

(b) Az = Azalea, Rhody=Rhododendron, Jun=Juniper, For=Forsythia, Vib-Viburnum.

CHEMICAL CONTROL OF WEEDS IN CONTAINER-GROWN AZALEAS

Richard A. Creager[1]

ABSTRACT

Herbicides were evaluated on container-grown azaleas (Rhododendron obtusum Planck. 'Hino Crimson') for weed control, phytotoxicity, and final plant size in 1978, 1979, and 1980. Four herbicides were evaluated each year at 4 rates of application. Oxyfluorfen [2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene], oxadiazon [2-tert-butyl-4-(2,4-dichloro-5-isopropoxyphenyl)-Δ^2-1,3,4-oxadiazolin-5-one] and oryzalin (3,5-dinitro-N^4,N^4-dipropylsulfanilamide) were evaluated each year. A single application of granular oxyfluorfen at 2.2 or 9.0 kg/ha controlled at least 70% and 90% of the weeds, respectively, for 4 months in 2 out of 3 years. Granular oxadiazon at 2.2 kg/ha provided better than 60% weed control for 4 months in 1978 and 1979, and for 2 months in 1980. Oxadiazon at 17.9 kg/ha provided better than 80% weed control for 4 months in 1978 and 1979 and better than 60% control for 4 months in 1980. Granular or flowable oryzalin at 4.5 or 9.0 kg/ha provided better than 80% weed control for 2 months in all years. Napropamide [2-(α-naphthoxy)-N,N-diethylpropionamide] was evaluated only in 1978 and did not control weeds adequately at dosages up to 38 kg/ha. Granular prodiamine [2,4-dinitro-N^3,N^3-dipropyl-6-(trifluoromethyl)-1,3-benzenediamine] was evaluated in 1979 and 1980. It provided better than 60% weed control for 2 months in both years when applied at 2.2 kg/ha and better than 80% weed control for 2 months when applied at 4.5 or 9.0 kg/ha in 1980. Phytotoxic effects from any of these herbicide treatments were very slight one month after treatment in all growing seasons and were virtually absent 4 months after treatment. Final plant size was usually directly correlated with weed control.

INTRODUCTION

Season-long control of both broadleaf weeds and grasses in container-grown, herbicide-sensitive azaleas is difficult to achieve without causing crop injury. Cultivation is not feasible in containers and manual weeding is both time-consuming and expensive (2, 4). Several herbicides and herbicide combinations have been evaluated on azaleas in containers (3, 5, 7, 8), but there was invariably some crop injury or stunting. No herbicide controlled all weed species studied throughout the growing season in experiments conducted by Ryan (6).

MATERIALS AND METHODS

Uniform liners of Hino Crimson azalea were planted in 1978, 1979, and 1980 in a medium of sand and Canadian sphagnum peat moss (1:1 v/v) in 3.8-liter black plastic containers. The medium had an organic matter content of 4.5% (1978), 4.6% (1979), or 3.7% (1980); a pH of 4.5 (1978), 4.3 (1979), or 5.7 (1980), and was amended with fritted trace elements (FTE No. 503 at 73.68 g/m^3).

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The plants were potted in late April, and the herbicides were applied during the third and fourth weeks of May in all years. In each year, 1.3 cm of irrigation water was applied by overhead sprinkler immediately after treatment. Rainfall during the growing season was supplemented by sprinkler irrigation to provide 3.8 cm of total water per week in 1978, 5.3 cm in 1979, and 4.8 cm in 1980. Soluble fertilizer (21-7-7 acid special) was applied every other week to maintain a N level of 100 ppm. Iron sulfate [1.4 kg/190 liter (3 lb/50 gallons)] was applied to maintain proper pH as indicated by soil tests. The plants received standard nursery maintenance for the growing season. All treated and control plants were grown in full sun on black plastic in a randomized block design with split plots containing 16 replications of one pot each in 1978, and 12 replications in 1979 and 1980. An unweeded and a monthly handweeded control were included for comparison.

Four herbicides were evaluated during each of the 3 years. The following herbicides were applied in 1978: napropamide 2% granular at 4.5, 9.0, 17.9, or 36.0 kg/ha; oxyfluorfen 2% granular and oryzalin 4AS (40% aqueous solution) at 1.1, 2.2, 4.5, or 9.0 kg/ha; and oxadiazon 2% granular at 2.2, 4.5, 9.0, or 17.9 kg/ha, respectively. In 1979 and 1980 an experimental 5% granular formulation of oryzalin was evaluated along with prodiamine 2% granular and oxyfluorfen 2% granular formulations at 1.1, 2.2, 4.5, or 9.0 kg/ha, and oxadiazon 2% granular formulation at 2.2, 4.5, 9.0, or 17.9 kg/ha, respectively.

Seeds of bittercress (*Cardamine hirsuta* L.), large crabgrass [*Digitaria sanguinalis* (L.) Scop.], and oxalis (*Oxalis* sp.) were broadcast over the containers after herbicide application. In 1978, 1979, and 1980, 21, 17 and 25 other weed species, respectively, were identified in the containers during the growing season. These arose primarily from the planting medium and secondarily from wind deposition. The monthly weed control ratings were based on a scale of 0 (no weed control) to 10 (total weed control). Weed control of 75% (7.5) or better was considered commercially acceptable. The effects of the herbicides on the nursery stock were also visually evaluated monthly on a scale where a rating of 0 to 3 = no reduction or limited injury, 4 to 9 = undesirable injury, and 10 = total kill. At the final evaluation, the plant size was also rated using the American Standard for Nursery Stock (1). The final plant evaluation was conducted in late September of all 3 years and all data were subjected to analysis of variance and Duncan's multiple range test.

RESULTS AND DISCUSSION

1978 Experiment. Oxyfluorfen at 2.2, 4.5, and 9.0 kg/ha provided better than 75% weed control at the final evaluation (Table 1). Oxadiazon at the 4.5, 9.0, and 17.9 kg/ha rates also controlled 75% or more of the weeds. Oryzalin at 4.5 and 9.0 kg/ha controlled weeds adequately for 2 months. Napropamide did not control weeds at any dosage tested.

Herbicide phytotoxicity to azalea was limited (1.2 or less) 1 month after treatment, and was essentially absent after 4 months. At the end of the season the weediest treatments generally contained the smallest azaleas.

1979 Experiment. Oxyfluorfen at 4.5 and 9.0 kg/ha provided 75% weed control for 4 months, and the 2.2 kg/ha rate was effective for 2 months (Table 2). Oxadiazon at 4.5, 9.0, and 17.9 kg/ha provided 4 months of satisfactory weed control, and the 2.2 kg/ha rate was almost commercially acceptable (74%) for 4 months. The 5% granular formulation of oryzalin provided acceptable weed control for 1 month at all application rates. The 2.2, 4.5, and 9.0 kg/ha oryzalin treatments provided only 2 months of satisfactory weed control. Prodiamine failed to control weeds adequately at any rate tested.

Phytotoxicity to azaleas was most visible during the first month. Oxadiazon at 4.5 kg/ha was the only treatment that caused significant limited injury (3.3). Four months after application, the injury rating from all treatments was 0.9 or less and was not commercially significant. The largest plants were produced in the handweeded control, and in containers treated with oxyfluorfen at 4.5 or 9.0 kg/ha; in all treatments of oxadiazon; in the 1.1, 2.2 kg/ha treatments of oryzalin 5% granular; and in those treated with prodiamine at 2.2, 4.5, and 9.0 kg/ha.

1980 Experiment. Oxyfluorfen at all rates controlled weeds adequately for 2 months, but only the 9.0 kg/ha application rate was satisfactory for 4 months (Table 3). All applications of oxadiazon and oryzalin provided 2 months of satisfactory weed control. Prodiamine at 4.5 and 9.0 kg/ha controlled weeds well for 2 months.

Phytotoxic effects of the herbicides were not commercially significant for the first 2 months (1.3 or less). Crop injury was greatest in the unweeded control 3 and 4 months after treatment (4.9 and 4.8), and is probably ascribable to a combination of several weeks of temperatures above 31° C (90° F) and competition from large, established weeds. The larger azalea plants were present in the handweeded control, and in pots treated with oxyfluorfen at 2.2 or 9.0 kg/ha, and in the 2.2 kg/ha oxadiazon treatment.

Based on the results of these experiments, the most effective chemicals for weed control in azaleas were, in descending order, as follows: oxyfluorfen at 9.0 kg/ha, oxadiazon at 17.9 and 9.0 kg/ha, oxyfluorfen at 4.5 kg/ha, oxadiazon at 4.5 and 2.2 kg/ha, and oxyfluorfen at 2.2 kg/ha. The 5% granular formulation of oryzalin was effective for 2 months at all application rates, whereas the 4AS formulation was effective only at 4.5 and 9.0 kg/ha for the first 2 months. Napropamide and prodiamine generally did not provide commercially acceptable weed control under these conditions. Phytotoxicity from any herbicide tested seldom exceeded 3.0 (limited injury). Generally, the largest plants were produced in either the handweeded control or in the most efficacious herbicide treatments. These experiments indicate that azalea growers could use either oxyfluorfen or oxadiazon on newly potted liners with 4-month-long weed control and minimal phytotoxicity to produce commercially saleable plants.

LITERATURE CITED

1. American Standard for Nursery Stock. 1973. Amer. Assoc. Nurserymen, Inc., ANSI Z60.1 - 1973. 26 p.

2. Dickey, R. D., E. W. McElwee, C. A. Conover, and J. N. Joiner. 1978. Container growing of woody ornamental nursery plants in Florida. Florida Agr. Expt. Sta. Bul. 793. 122 p.

3. Monaco, T. J. 1974. Response of container-grown azalea and ivy to four preemergence herbicides in three planting media. HortScience 9:550-551.

4. Padgett, J. H. and T. L. Frazier. 1962. The relationship between costs and pricing of woody ornamentals. Georgia Agr. Expt. Sta. Bul. N.S. 100. 34 p.

5. Ryan, G. F. 1978. Timing of alachlor-simazine applications in container grown azaleas. Weed Sci. Soc. Amer. Mtg., Abstr. No. 75, p. 35.

6. Ryan, G. F. 1976. Herbicides for container grown nursery stock. Weed Sci. 24:261-265.

7. Self, R. L. and M. L. Zarko. 1978. Phytotoxicity testing of nilweed on azalea. Proc. Southern Nurserymen's Assoc. Res. Conf., Ann. Rpt., p. 178.

8. Singh, M., N. C. Glaze, and S. C. Phatak. 1981. Herbicidal response of container-grown Rhododendron species. HortScience 16:213-215.

Table 1. Efficacy, phytotoxicity, and final plant size of container-grown azaleas for 1978.

Treatment	Rate (kg/ha)	Efficacy[z] Months 1	2	3	4	Phytotoxicity[y] Months 1	2	3	4	Final plant size[x] (4 months)
Unweeded control	-	2.0ijk[w]	1.7gh	3.5c	1.8i	0.9abc	0.5bc	0.8ab	0.3a	1.8c-f
Weeded control	-	1.6jk	4.8de	3.5c	8.2abc	0.8bc	0.9a	0.7abc	0.0b	2.2ab
Oxyfluorfen 2% G	1.1	4.6fg	5.2de	5.6b	5.4ef	0.8bc	0.7b	0.6abc	0.0b	1.5fg
	2.2	7.0cd	7.2bc	6.7b	7.9abc	0.9abc	0.3bc	0.6abc	0.0b	1.6efg
	4.5	8.5abc	8.8a	6.8b	8.1abc	0.9abc	0.6bc	0.4bc	0.0b	1.9b-f
	9.0	9.5ab	9.6a	8.7a	9.3a	0.9abc	0.4bc	0.2c	0.0b	2.4a
Oxadiazon 2% G	2.2	8.9ab	8.4ab	6.5b	6.9cde	0.9abc	0.6bc	0.5bc	0.0b	1.3g
	4.5	9.1ab	9.2a	7.4ab	8.3abc	1.0ab	0.4bc	0.4bc	0.0b	2.3ab
	9.0	9.7a	9.5a	6.7b	8.1abc	1.2a	0.4bc	0.5bc	0.0b	2.3ab
	17.9	9.9a	10.0a	8.9a	8.9ab	0.8bc	0.2c	0.6abc	0.0b	2.1abc
Oryzalin 4 AS	1.1	3.7fgh	3.4fg	0.3f	0.9i	0.9abc	0.5bc	0.5bc	0.0b	1.6efg
	2.2	6.2de	5.8cd	1.4def	3.0gh	0.9abc	0.6bc	0.5bc	0.0b	1.8c-f
	4.5	8.2abc	8.8a	1.8def	6.8cde	1.0ab	0.6bc	1.2a	0.6a	1.6d-g
	9.0	7.9bc	8.9a	1.9c-f	6.1de	0.9abc	0.6bc	0.6abc	0.0b	1.9b-f
Napropamide 50% W	4.5	2.0ijk	2.0gh	0.8ef	1.2i	0.9abc	0.4bc	0.3c	0.0b	1.8c-f
	9.0	4.2fgh	4.6def	2.0c-f	3.5gh	1.0ab	0.4bc	0.7abc	0.0b	2.1a-d
	17.9	5.0ef	7.1bc	2.5cde	4.4fg	1.1ab	0.6bc	0.4bc	0.0b	2.1a-d
	36.0	3.2ghi	5.9cd	1.8def	5.8def	1.1ab	0.5bc	0.5bc	0.0b	2.0a-e

[z]Efficacy: Mean of 16 reps. Weed control based on a scale of 0-10: no weed control to total weed control.

[y]Phytotoxicity: Mean of 16 reps. Visible damage based on a scale where 0-3 = no reduction or limited injury, 4-9 = undesirable injury, 10 = total kill.

[x]Final plant size: Rated using the American Standard for Nursery Stock [See Literature Cited (1)].

[w]Means in a column followed by the same letter or letters are not significantly different at the 5% level as determined by Duncan's multiple range test.

Table 2. Efficacy, phytotoxicity, and final plant size of container-grown azaleas for 1979.

Treatment	Rate (kg/ha)	Efficacy[z] Months 1	2	3	4	Phytotoxicity[y] Months 1	2	3	4	Final plant size[x] (4 months)
Unweeded control	-	2.4ef[w]	2.6i	1.8e	3.2e	1.9bcd	0.9a	0.3ab	0.8a	1.4cd
Weeded control	-	2.1f	7.9b-e	7.1abc	7.8ab	1.2d	0.2b	0.2b	0.1a	2.3a
Oxyfluorfen 2% G	1.1	3.8e	4.4h	4.3d	5.9bcd	2.4abc	0.2b	0.0b	1.1a	1.3d
	2.2	8.3ab	8.3abc	7.2ab	7.0abc	2.0bcd	0.0b	0.2b	0.4a	1.9ab
	4.5	9.1a	8.8abc	7.4ab	8.2ab	2.0bcd	0.1b	0.3ab	0.7a	2.0ab
	9.0	9.7a	9.7ab	9.2a	9.6a	2.4abc	0.1b	0.1b	0.5a	2.0ab
Oxadiazon 2% G	2.2	9.4a	8.0bcd	7.8ab	7.4ab	2.6abc	0.2b	0.2b	0.5a	2.2ab
	4.5	9.9a	9.7ab	8.5a	7.8ab	3.3a	0.4b	0.4ab	0.2a	2.0ab
	9.0	10.0a	9.7ab	8.2ab	8.9a	1.9bcd	0.0b	0.3ab	0.2a	2.1ab
	17.9	9.9a	10.0a	8.9a	9.2a	1.9bcd	0.1b	0.2b	0.2a	2.2ab
Oryzalin 5% G	1.1	8.6ab	7.4c-f	4.8cd	4.7cde	2.4abc	0.0b	0.6ab	0.2a	2.2ab
	2.2	9.5a	8.9abc	5.9bcd	4.3de	2.2bcd	0.1b	0.2b	0.2a	2.1ab
	4.5	9.6a	9.7ab	7.1abc	4.5cde	2.2bcd	0.2b	0.2b	0.2a	1.8b
	9.0	9.8a	10.0a	7.4ab	6.2bcd	2.2bcd	0.0b	0.1b	0.2a	1.8b
Prodiamine 2% G	1.1	5.3d	4.8gh	3.5de	3.8de	2.3abc	0.1b	0.1b	0.1a	1.8b
	2.2	6.6cd	6.5def	3.6de	4.9cde	2.8ab	0.2b	1.1a	0.9a	2.1ab
	4.5	6.0cd	6.2efg	4.1de	4.5cde	1.7cd	0.1b	0.2b	0.2a	2.1ab
	9.0	7.1bc	6.2efg	4.3d	4.9cde	2.0bcd	0.0b	0.2b	0.4a	2.0ab

[z]Efficacy: Mean of 12 reps. Weed control based on a scale of 0-10: no weed control to total weed control.
[y]Phytotoxicity: Mean of 12 reps. Visible damage based on a scale where 0-3 = no reduction or limited injury, 4-9 = undesirable injury, 10 = total kill.
[x]Final plant size: Rated using the American Standard for Nursery Stock [See Literature Cited (1)].
[w]Means in a column followed by the same letter or letters are not significantly different at the 5% level as determined by Duncan's multiple range test.

Table 3. Efficacy, phytotoxicity, and final plant size of container-grown azaleas for 1980.

Treatment	Rate (kg/ha)	Efficacy[z] Months 1	2	3	4	Phytotoxicity[y] Months 1	2	3	4	Final plant size[x] (4 months)
Unweeded control	-	2.9g[w]	4.4f	5.6b-f	5.6b-e	0.1ab	1.0b	4.9a	4.8a	0.8e
Weeded control	-	6.5ef	8.2cd	3.0fg	4.2b-g	0.3ab	1.1ab	0.3d	0.6cd	1.6ab
Oxyfluorfen 2% G	1.1	7.9b-e	8.6a-d	7.1ab	6.2bcd	0.2ab	1.0b	3.3ab	2.9b	1.0cde
	2.2	9.8abc	9.8ab	5.8b-e	5.9bcd	0.2ab	1.1ab	0.5d	0.8cd	1.7a
	4.5	9.9ab	9.8ab	6.1bcd	6.3bc	0.1ab	1.0b	1.2cd	1.2bcd	1.4a-d
	9.0	9.8abc	10.0a	9.2a	9.4a	0.5ab	1.0b	0.7d	0.7cd	1.6ab
Oxadiazon 2% G	2.2	9.7abc	9.7abc	5.5b-f	5.0b-f	0.3ab	1.0b	1.3cd	1.4bcd	1.7a
	4.5	9.9ab	9.8ab	6.8bc	6.8b	0.0b	1.1ab	0.8cd	0.8cd	1.5abc
	9.0	10.0a	9.9ab	4.4b-g	5.2b-e	0.2ab	1.2ab	0.3d	0.8cd	1.3a-d
	17.9	10.0a	10.0a	6.5bc	6.8b	0.7a	1.1ab	0.6d	0.3d	1.3a-d
Oryzalin 5% G	1.1	8.5a-d	8.3bcd	3.5d-g	4.5b-g	0.2ab	1.0b	0.8cd	0.8cd	1.2a-e
	2.2	8.9abc	9.6abc	1.8g	2.2g	0.2ab	1.0b	0.8cd	0.8cd	0.9de
	4.5	9.8abc	9.9ab	3.2efg	3.2efg	0.0b	1.0b	0.7d	0.4d	1.1b-e
	9.0	10.0a	9.9ab	2.4g	2.5fg	0.0b	1.1ab	0.7d	0.8cd	0.2f
Prodiamine 2% G	1.1	6.8def	7.7de	6.1bcd	4.6b-g	0.0b	1.2ab	2.3bcd	2.1bcd	0.9de
	2.2	5.2f	6.4e	4.2c-g	3.9c-g	0.3ab	1.0b	2.8bc	2.6bc	1.1b-e
	4.5	8.4a-e	8.4a-d	3.2efg	3.7d-g	0.2ab	1.3a	1.2cd	1.2bcd	1.1b-e
	9.0	7.8cde	8.9a-d	3.6d-g	3.2efg	0.2ab	1.0b	0.8cd	0.3d	1.4a-d

[z]Efficacy: Mean of 12 reps. Weed control based on a scale of 0-10: no weed control to total weed control.
[y]Phytotoxicity: Mean of 12 reps. Visible damage based on a scale where 0-3 = no reduction or limited injury, 4-9 = undesirable injury, 10 = total kill.
[x]Final plant size: Rated using the American Standard for Nursery Stock [See Literature Cited (1)].
[w]Means in a column followed by the same letter or letters are not significantly different at the 5% level as determined by Duncan's multiple range test.

THE EFFECT OF TIME OF WATERING AFTER HERBICIDE SPRAY APPLICATION ON PHYTOTOXICITY TO CONTAINER GROWN NURSERY PLANTS

A. Bing[1/]

INTRODUCTION

Herbicides are applied to growing nursery plants in a liquid or a granular form. The granular formulations are preferred in many cases because of their safety. Some herbicides may only be available as spray formulations, or spray applications may be less expensive. Herbicides such as oxyfluorfen sprayed on the foliage of deciduous plants may cause severe burn. Growers are interested if irrigation applied to the plants shortly after spraying would wash enough herbicide off the foliage to avoid injury. This experiment was to determine if watering after spraying would decrease herbicide toxicity to foliage of nursery plants.

MATERIALS AND METHODS

One gallon containers of the plants shown in Table 1 were actively growing at the time of treatment. They were fertilized and regularly watered before and after treatment. The plants to be treated were placed in a separate area, sprayed, and then placed under an overhead impact irrigation nozzle. Some plants (treatment A) were under irrigation before spraying with herbicide and moved directly to the spraying area, treated, and put back under irrigation immediately. Treatment B plants were put under irrigation within a few seconds after spraying. In treatment C, the interval from spraying to irrigation was 10 minutes, and in treatment D the interval was 30 minutes. Treatment E received no irrigation until the regular watering the next day.

After irrigation the plants were replaced in the growing area for observation.

The first series used the herbicides shown in Table 2. As trifluralin did not produce injury it was not used in the later test. The most sensitive plants were used in the September test. Also, the 4 lb rate of oxyfluorfen was not used because it was too phytotoxic to show differences in the effect of watering.

The rating system was 10 for no injury, to 7 for moderate injury, to 1 for a dead plant.

RESULTS AND DISCUSSION

Tables 3 and 4 show the treatments and the tolerance ratings. Oxyfluorfen injures foliage of azalea, and burns the growing points of boxleafed holly. At 0.5 lb AI/A increased time intervals of watering after spraying increased injury to azalea and holly. Injury on azalea showed as a leaf burn very soon after treatment. Juniper was not adversely affected by any treatment. The 0.5 lb

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rate of oxyfluorfen was safe on hemlock. Trifluralin caused no injury on azalea, holly, juniper, forsythia, viburnum or hemlock. Washing alachlor off the leaves of azaleas even 30 minutes after spraying avoided injury as shown by a rating of 10 for treatment D, but the non-irrigated azaleas had only a rating of 5. Forsythia and viburnum sprayed with alachlor had to be irrigated within 10 to 30 minutes to avoid injury. Azaleas picked up enough oxyfluorfen to be hurt regardless of how soon irrigation took place, but immediate watering did help.

Irrigation after spraying is not necessary with trifluralin, is helpful on sensitive plants with alachlor, but only partially effective with a quickly acting herbicide such as oxyfluorfen.

ACKNOWLEDGMENT

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Table 1. Plants in containers used in study of effects of time of watering on the safety of herbicide applications.

Common Name	Scientific Name
Andromeda, Japanese	Pieris japonica Thunb.
Azalea var Hershey Red	Rhododendron obtusum (Lindl.) Planch
Golden Bells	Forsythia X intermedia Zab.
Holly, boxleafed	Ilex crenata convexa Thunb.
Japanese snowball	Viburnum plicatum var Tomentosum Thunb.
Juniper, compact Pfitzers	Juniperus chinensis Pfitzeriana 'compacta' L.
Hemlock, Canadian	Tsuga canadensis (L.) Carriere
Maple, red	Acer rubrum L.

Table 2. Herbicides used in study of effects of time of watering on herbicide safety.

Common Name	Chemical Name	Formulation
Alachlor	2-chloro-2',6'-diethyl-N-(methoxymethyl) acetanilide	4 EC
Oxyfluorfen	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene	2 E
Trifluralin	a,a,a-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine	4 EC

Table 3. The effect of time of watering in relationship to herbicide application on the safety to container grown nursery plants at Riverhead, NY in 1982.

Herbicide	Rate lb ai/A	Date treated	Date rated	Treat-ment	Tolerance rating[a/] Az[i/]	Hol	Jun	For	Vib	Hem
Oxyfluorfen 2E	4	6/22/82	7/1/82	A	3[b/]	5[c/]	10	9[d/]	9[e/]	
				B	3	5	10	9	9	
				C	3	5	10	9	9	
				D	3	5	10	9	9	
				E	3	5	10	9	9	
Oxyfluorfen 2E	1	7/8/82	7/13/82	A	4[f/]	6[g/]				
				B	4	5				
				C	4	5				
				D	3	5				
				E	3	4				
Oxyfluorfen 2E	0.5	8/3/82	8/5/82	A	6[f/]	10[g/]		8		10
				B	5	7		8		10
				C	4	7		7		10
				D	3	5		7		10
				E	2	4		7		10
Alachlor 4EC	8	6/23/82	7/1/82	A	10	10	10	10	10	
				B	10	10	10	10	10	
				C	10	10	10	10	10	
				D	10	10	10	9	9	
				E	5[h/]	10	10	8	8	
Trifluralin 4EC	4	6/23/82	7/1/82	A	10	10	10	10	10	
				B	10	10	10	10	10	
				C	10	10	10	10	10	
				D	10	10	10	10	10	
				E	10	10	10	10	10	

a/ Tolerance ratings 1=dead to 10=no injury. Values are averages of 4 plants.

b/ All growing tips burned.

c/ Complete loss of growing points.

d/ New growth slightly burned.

e/ Young leaves all reddish-yellow and damaged.

f/ New growth burned, intensity increases with time interval of watering.

g/ Growing tips burned, greater at longer time interval to watering.

h/ Many leaves badly burned.

i/ Az=Azalea, Hol=Holly, Jun=Juniper, For=Forsythia, Vib=Viburnum, Hem=Hemlock.

Treatments: A: Irrigated before and immediately after treating.
B: Irrigated immediately after treating.
C: Irrigated 10 minutes after treating.
D: Irrigated 30 minutes after treating.
E: No irrigation after treating.

Table 4. The effect of time of watering in relationship to application of herbicides to safety to container grown nursery plants treated September 8th and rated on September 13, 1982 at Riverhead, New York.

Treatment			Tolerance ratings[a]					
Herbicide	Rate ai/A	Treat-ment[b]	Holly	Andromeda	Maple	Hemlock	Viburnum	Azalea
Alachlor 4E	4	A	10	10	10			
		B	10	10	10			
		C	10	10	10			
		D	10	10	9			
		E	10	10	8 (c)			
	8	A	10	10	8 (c)			
		B	10	10	8			
		C	10	10	8			
		D	10	10	7 (c)			
		E	10	9 (e)	6 (c)			
Oxyfluorfen 2E	0.5	A	10			10	10	9
		B	9 (c)			10	10	7
		C	9			10	10	6 (d)
		D	9			10	10	6
		E	8 (c)			10	10	5 (c,d)
	1.0	A	10			10	10	7
		B	10			10	10	6 (d)
		C	10			10	10	6
		D	10			10	10	6
		E	10			10	10	5 (d)

(a) Tolerance ratings: 1=dead to 10=no observable injury.

(b) Treatments: A-irrigated before & right after treating; B-irrigated right after treating; C-irrigated 10 minutes after treating; D-irrigated 30 minutes after treating; E-no irrigation after treating.

(c) Injury as tip burn.

(d) Injury as leaf burn.

SETHOXYDIM AND FLUAZIFOP-BUTYL FOR WEED CONTROL IN FIELD-GROWN AZALEAS

J. Ray Frank and C. E. Beste[1/]

ABSTRACT

Herbicides applied during the early part of the growing season are often leached out of the top layer of soil because of the use of regular overhead irrigation which is required for good crop growth. This leaching of herbicides often allows the germination and rapid growth of grass weeds which can greatly reduce the growth of azaleas in ground beds.

Rooted cuttings of Hinocrimson and Hershey red azaleas were planted in raised ground beds in April 1982. These beds were treated with oxadiazon at 3.3 kg/ha immediately following planting.

Sethoxydim and fluazifop-butyl were applied on July 15, 1982 to determine their postemergence activity on grass weeds and their effect on two varieties of azaleas. Both compounds were applied as broadcast sprays at 215 L/ha with 960 ml crop oil/ha at 0.25, 0.50 and 1.0 kg/ha. Irrigation was not applied until 48 hours after application. The experimental design was a randomized complete block with four replicates. Each plot contained 20 plants and was 1.8 m x 3.0 m (5.4 sq m). The percentage weed cover, major weed species, azalea height x width and herbicide phytotoxicity to the crop were determined 6, 33, 62, and 82 days after treatment.

Sethoxydim and fluazifop-butyl at 1.0 kg/ha caused some necrosis and chlorosis on the Hinocrimson variety of azaleas after six days. All rates of fluazifop-butyl caused significant injury to Hinocrimson azaleas after 33 days whereas the 0.5 and 1.0 kg/ha rates caused significant injury on this variety for 82 days.

No significant phytotoxicity symptoms were observed on the Hershey red azaleas. Rough bentgrass (*Agrostis scabra* Willd.) was controlled by fluazifop-butyl at 1.0 kg/ha and sethoxydim at 0.5 and 1.0 kg/ha.

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TOLERANCE OF CONTAINER GROWN NURSERY PLANTS TO SOME PREEMERGENCE HERBICIDE APPLICATIONS

A. Bing[1/]

ABSTRACT

Plants grown in containers were safely treated with the following herbicides: simazine 80WP on rhododendron; metolachlor 8E on viburnum; napropamide 50WP on cotoneaster and dogwood; oxyfluorfen 1G on cotoneaster, azalea, holly and privet.

INTRODUCTION

The growing of plants in containers is an important part of nursery production because many plants can be grown rapidly in a limited area and plants can be sold and planted most of the year. There are a wide variety of plants grown and the safety of herbicides is of great importance. This study is a continuation of several years study (1) funded by IR-4 to increase the availability of labeled herbicides. Plants used in this experiment were donated by Long Island nurserymen.

MATERIALS AND METHODS

The plants listed in Table 1 were put in 1 gallon white plastic containers May 17-21. The growing media was a 50% decomposed bark, 25% peat moss, 25% sand from Half Hollow Nursery. The containers were placed on sand in beds with overhead irrigation as needed by rotary impact sprinklers. Herbicides listed in Table 2 were pre-measured and applied to a 10 x 10 ft plot near the growing area. Plants for the same treatment were placed on the 10 X 10 ft area and treated at one time. Each plant was marked with a label after treatment before it was returned to the growing area. Granules were applied with a hand shaker. Sprays were applied with a 1.5 gallon handpumped sprayer with a Spraying Systems 80003 flat spray nozzle using 1 qt of spray for the 100 sq ft plot. For each treatment there were 4 replicates of 6 plants each.

The growing media was nearly weed free and no weed seeds were artificially introduced into the containers. Weeds did not develop adequately to justify recording. Growth was visually rated on June 15. The rating scale was 1 = a dead or missing plant, 7 = satisfactory growth and 10 = optimum expected growth and appearance. Containers were observed several times during the growing season to determine if there was later injury. Plants were individually fertilized with pellets of slow release fertilizer. Less hardy plants will be overwintered in a plastic structure, others in the open for further evaluation the following spring.

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RESULTS AND DISCUSSION

There were no visible signs of injury in any of the treatments during the growing season. Ratings of individual plants were made on June 15. Table 3 shows the averages of 4 replicates of 6 plants each. A rating of 9 or 10 shows very good growth and appearance. The only 7 ratings were for metolachlor 8E on viburnum.

Later observations showed no injury. The conclusion is that there may have been slight injury to viburnum from metolachlor, but the other treatments were all safe.

LITERATURE CITED

1. Bing, A. 1982. Container weed control studies, 1981. NEWSS 36:248-252.

Table 1. Plants used in postplant preemergence nursery container herbicide experiment, Riverhead, New York, 1982.

Common Name	Scientific Name
Azalea var Fashion	Rhododendron obtusum (Lindl). Planch cv Fashion
Cotoneaster, congesta	Cotoneaster congestus Bak.
Dogwood, red stemmed	Cornus sericea L.
Holly, boxleafed	Ilex crenata convexa Thunb.
Privet, California	Ligustrum ovalifolium Hassk.
Rhododendron var Roseum Elegans	Rhododendron catawbiense cv Roseum elegans Mich.
Japanese Snowball	Viburnum plicatum var tomentosum Thunb.

Table 2. Herbicides used in postplant preemergence treatments on container grown nursery liners at Riverhead, New York 1982.

Common Name	Scientific Name	Formulation
Metolachlor	2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxyl-1-methylethyl) acetamide	8E
Napropamide	2-(a-naphthoxy)-N,N-diethylpropionamide	50WP
Oxyfluorfen	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene	2E
Simazine	2-chloro-4,6-bis(ethylamino)-s-triazine	4L

Table 3. Effect of postplant preemergence herbicide treatments on container grown nursery liners planted May 17-21, treated May 25-27 and rated June 15, 1982, at Riverhead, New York.

Treatment			Plant Growth[a]						
Herbicide	Formulation	Rate lb ai/A	Rhododendron	Viburnum	Cotoneaster	Dogwood	Azalea	Holly	Privet
Simazine	80WP	1	9						
		2	10						
		4	9						
Metolachlor	8E	3		7					
		6		7					
Napropamide	50WP	4			10	10			
		8			10	10			
Oxyfluorfen	1G	2			10		10	10	10
		4			10		10	10	10
Untreated			9	10	10	10	10	10	10
Handweeded			10	10	10	10	10	10	10

[a] Each number is the average of 4 replicates of 6 plants each.
The rating is 1=dead or missing to 7=acceptable growth to 10=optimum growth.

Post Transplant Herbicide Applications on Selected Woody Liners

C. Haramaki and L. J. Kuhns[1/]

ABSTRACT

Combinations of alachlor and simazine, metolachlor and simazine, and napropamide and oxadiazon; and oryzalin and oxyfluorfen alone gave good to excellent weed control over a 10 week period. Barberry had good vegetative growth when treated with oryzalin at 2 and 8 pounds per acre. Common boxwood had less growth and some injury when treated with alachlor and simazine and also metolachlor and simazine but not with napropamide and oxadiazon at recommended rates. Oxyfluorfen sprays injured cranberry cotoneaster. Bluerug juniper had good vegetative growth with no injury when treated with napropamide and oxadiazon. Japanese pachysandra had some injury from alachlor and simazine, metolachlor and simazine, and napropamide and oxadiazon combinations and with oxyfluorfen. Laland pyracantha had some injury on the older leaves but not the new subsequent growth when sprayed with metolachlor and simazine at the recommended rate. Winterjasmine had good vegetative growth with no injury when sprayed with oryzalin at 2 pounds per acre.

On July 9, 1982 liners were planted in a Hagerstown silt loam soil which had been disc plowed, harrowed and rototilled. The liners were Mentor barberry (Berberis mentorensis), common boxwood (Buxus sempervirens), cranberry cotoneaster (Cotoneaster apiculata), Laland firethorn (Pyracantha coccinea lalandi), bluerug juniper (Juniperus horizontalis wiltoni), Japanese pachysandra (Pachysandra terminalis), and winterjasmine (Jasminum nudiflorum). There were eight plants of each species tested in the treated plots and the treatments were replicated four times. There were four plants of each of the species in the control and control - handweeded plots and each of these plots were replicated eight times. Immediately after planting the plots were sprinkler irrigated with one inch of water. The herbicides were applied on July 13, 1982 when the weed seedlings were ¼ inch high. A combination of alachlor 4E (2-chloro-2',6'-diethyl-N-(methoxymethyl) acetanilide) and simazine 80W (2-chloro-4,6-bis (ethylamino)-S-triazine) were applied to common boxwood and Japanese pachysandra liners. A combination of metolachlor 8E (2-chloro-N-(2-ethyl-G-methylphenyl)-N-(2-methoxy-1-methylethyl) acetamide) and simazine 80W were applied to common boxwood, Japanese pachysandra, and Laland firethorn. A combination of napropamide 10G (2-(a-naphthoxyl)-N,N-diethylpropionamide) and oxadiazon 2G (2-text-butyl-4-(2,4-dichloro-S-isopropoxyphenyl)-Δ^2-1,3,4-oxadiazolin-S-one) were applied to common boxwood, bluerug juniper and Japanese pachysandra. Oryzalin 75W (3,5-dinitro N^4,N^4-dipropylsulfanilamide) was applied to Mentor barberry and winterjasmine. Oxyfluorfen 2E (2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene) was applied to cranberry cotoneaster and Japanese pachysandra. The herbicides were applied at the recommended rate and 4 times this rate. The granular herbicides were hand broadcast and the rest were sprayed on using an AZ CO_2 pressured four nozzle boom sprayer at 20 PSI at the rate of 24 gallons per acre. The nozzles were LP8002 with a 50 mesh screen. Each of

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Table 1. Effect of preemergent herbicides on weed growth five and ten weeks after application, 1982.

Chemical	Rate	Grasses 5W	Grasses 10W	Broad-leaves 5W	Broad-leaves 10W	All Weeds 5W	All Weeds 10W	Weed Height 5W	Weed Height 10W
Control	0	0.75[a/]	3.50	1.88	3.25	2.63	6.75	0.50[b/]	2.00
Control-Handweed	0	0.88	0	2.25	0.38	3.25	0.38	0.81	0.13
	Weeding time per plot = 44 minutes								
Alachlor,4E	4+0.8#/A	0	0	0	0.25	0	0.25	0	0.13
+ Simazine,80W	16+3.2#/A	0	0	0	0	0	0	0	0
Metolachlor,8E	3+0.8#/A	0	0	0	0	0	0	0	0
+ Simazine,80W	12+3.2#/A	0	0	0	0	0	0	0	0
Napropamide,10G	4+2#/A	0	0	0	0	0	0	0	0
+ Oxadiazon,2G	16+2#/A	0	0	0	0	0	0	0	0
Oryzalin,75W	2#/A	0	0.25	0	1.25	0	1.50	0	0.38
	8#/A	0.25	0.25	0.25	0.75	0.50	1.00	0.13	0.38
Oxyfluorfen,2E	2#/A	0	0	0	0	0	0	0	0
	8#/A	0	0	0	0	0	0	0	0

a/ 0 = No Weeds, 2 = 25% Weed Coverage, 4 = 50% Weed Coverage, 6 = 75% Weed Coverage, 8 = 100% Weed Coverage, Light Infestation, 10 = 100% Weed Coverage, Heavy Infestation.

b/ In Feet.

the plots were 135 square feet. The temperatures were: air - 81°F, soil surface - 116°F and 2 inches below - 80°F. The wind was between 4 and 6 miles per hour, the sky was sunny and clear; and the soil was at field capacity. One half inch of water was sprinkler irrigated immediately after spraying. The plots were examined for weed growth and crop injury on August 19 and September 29, 1982.

The predominant weeds in decreasing order of frequency were yellow foxtail (Setaria lutescens Hubb), field pepperweed (Lepidium campestre R. Br.), field pennycress (Thlaspi arvense L.), fall panicum (Panicum dichotomiflorum Michx), smooth pigweed (Amaranthus hybridus L.), yellow woodsorrel (Oxalis stricta L.), Pennsylvania smartweed (Polygonum pensylvanicum L.), Canada thistle (Cirsum arvense Scop.), tumble pigweed (Amaranthus albus L.), common dandelion (Taraxacum officinale Weber) and shepardspurse (Capella bursa-pastoris Medic.). Five weeds after herbicide application the weed control in all treated plots was excellent. After 10 weeks the weed control was excellent in all treated plots except the oryzalin sprayed plots where there were some Canada thistle,

Table 2. Effect of postplant applications of preemergent herbicides on woody evergreen liners, five and ten weeks after application, 1982.

Chemical	Rate	Barberry 5W	Barberry 10W	Boxwood 5W	Boxwood 10W	Cotoneaster 5W	Cotoneaster 10W	Jasmine 5W	Jasmine 10W	Juniper 5W	Juniper 10W	Pachysandra 5W	Pachysandra 10W	Pyracantha 5W	Pyracantha 10W
Control	0	0.13[a/]	0.22	0.88	0.38	0.81	0.89	2.25	1.16	0.53	0.10	0.66	1.50	1.22	0.50
Control-Handweed	0	0.03	0.16	0.38	0.19	0.41	0.56	1.84	1.30	0.25	0.25	2.34	2.00	1.09	0.31
Alachlor,4E	4+0.8#/A			1.88	2.50							0.91	2.26		
+ Simazine,80W	16+3.2#/A			2.54	4.16							1.53	2.47		
Metolachlor,8E	3+0.8#/A			1.38	1.18							1.00	2.33	2.25	1.45
+ Simazine,80W	12+3.2#/A			2.69	3.95							1.38	2.66	2.54	2.44
Napropamide,10G	4+2#/A			0.79	0.28					0.32	0.13	1.32	2.35		
+ Oxadiazon,2G	16+8#/A			1.10	0.66					0.38	0.19	1.50	2.38		
Oryzalin,75W	2#/A	0.10	0.13					0.50	0.47						
	8#/A	0.07	0.31					0.69	0.63						
Oxyfluorfen,2E	2#/A					2.19	2.28					1.41	2.75		
	8#/A					2.13	3.19					1.22	2.19		

a/ 0 = No Injury
1 = Very Slight Injury
2 = Slight Injury
3 = Moderate Injury
4 = Severe Injury
5 = Dead

yellow foxtail and quackgrass but the weed control was still good. The average total time spent weeding an untreated plot over 10 weeks was 44 minutes. Mentor barberry had good vegetative growth and exhibited no injury from oryzalin at 2 and 8 pounds per acre. Common boxwood had less growth than control when treated with recommended rates of alachlor and simazine or metolachlor and simazine. The older leaves had chlorosis at the leaf margins but the new growth was normal. Both of these combinations at four times the recommended rate caused extensive injury or death and limited new growth. Boxwood treated with the recommended rate of napropamide and oxadiazon had good vegetative growth with no injury and at the higher rate the growth was less and some of the new leaves were distorted. Oxyfluorfen sprays at 2 pounds per acre reduced vegetative growth on cranberry cotoneaster and caused leaf drop of most of the original leaves. At 8 pounds per acre the cotoneaster had more severe injury on the shoot tips and leaves. Bluerug juniper when treated with napropamide and oxadiazon showed no injury and had good vegetative growth. Japanese pachysandra when sprayed with either alachlor and simazine or metolachlor and simazine had some chlorotic leaf margins at the lower rates and less vegetative growth with some distortions on the new leaves at the higher rates. Napropamide and oxadiazon had some chlorotic leaves and leaf distortion at the lower rates, which was intensified at the higher rates. Oxyfluorfen sprays caused vegetative growth to be reduced on the pachysandra along with some leaf chlorosis and distortion. The buds were distorted and dead on many plants. Pyracantha sprayed with metolachlor and simazine at the recommended rates had some interveinal and tip chlorosis on the older leaves with good new vegetative growth similar to the controls. At the higher rates pyracantha had more older leaves which were chlorotic or necrotic. The new vegetative growth was not injured but there were some with little new growth and this growth had chlorotic leaves. Winterjasmine in the weed infested control plots had poorer growth than the hand weeded plots. Winterjasmine sprayed with oryzalin at 2 pounds per acre had good vegetative growth with no injury. At 8 pounds per acre the vegetative growth was still good but some of the leaves were discolored.

POSTPLANT PREEMERGENCE WEED CONTROL ON NURSERY LINERS, 1982

A. Bing[1/]

ABSTRACT

Newly planted nursery liners were very tolerant to preemergence applications of alachlor 15G, napropamide 5G, metolachlor 8E, metolachlor 8E plus simazine 4L and oxyfluorfen 1G granular.

INTRODUCTION

This experiment is a continuation of a series (1, 2, 3, 4) to find safe effective postplant preemergence herbicides for newly planted nursery liners in production nurseries and to relate this information to landscape plantings. The assumption is that what is safe on small plants would be safe on larger plants. This project is partly funded by IR-4, with the objective of making compounds which are labeled for other uses available for ornamental use.

MATERIALS AND METHODS

The nursery liners shown in Table 1 were mostly donated by local nurserymen who are interested in expanding their knowledge of herbicide efficiency and safety. The land was rototilled and rows marked 34 in. apart with a potato planter. The liners were planted on May 12 at two ft apart within a row. The treatments were to be applied to plots containing 3 plants per row across 5 rows. The plants were set in the ground in each row so that the desired treatments would fall on the plants to receive that treatment. Irrigation was readily available and used whenever needed.

Postplant preemergence treatments utilizing the herbicides shown in Table 2 were applied May 13. Liquids were applied with a hand-pumped sprayer using a Spraying Systems 80003 nozzle. Preweighed granules were applied with a hand shaker. Each plot contained 3 plants in a row (6 ft) across 5 rows. Each treated area was 6 ft x 5 x 34/12 ft = 85 sq ft. There were 4 blocks each with 17 treatments.

Weed control was evaluated on July 14 using a rating system of 10 = no weeds, 7 = satisfactory control, to 1 = full of weeds. High ratings could be due to a lack of natural weed population or to control by the herbicide used. Early in the season the weed pressure was very low and this is evident by the high weed control ratings in all plots as shown in Table 3.

Growth ratings were made on all the liners on July 14. The rating system was 1 = a dead or missing plant, 7 = satisfactory appearance, and 10 = optimum growth and appearance. The ratings shown in Table 4 are the averages of 4 replicates of 3 plants each.

Later in the season oats were planted in the whole area for winter protection of plants and soil and to evaluate residues.

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RESULTS AND DISCUSSION

No conclusions can be drawn about weed control because of the low weed pressure which may have been due to the lower than normal temperatures.

Table 4 shows the tolerance of the treated plants to the herbicides. The high tolerance ratings indicate the safety of oxyfluorfen granular to azalea, cotoneaster and holly; alachlor granular to andromeda, oak, hemlock, rhododendron and viburnum; napropamide granular to andromeda, oak and viburnum; metolachlor to rhododendron and rose; and metolachlor plus simazine to andromeda, oak, hemlock, rhododendron and rose. Viburnum with ratings of 8, 8 and 6 may be sensitive to alachlor.

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.

3. Bing, A. 1981. 1980 preemergence weed control in nursery liners. NEWSS 35:235-39.

4. Bing, A. 1982. Preemergence weed control on nursery liners, 1981. NEWSS 36:271-275.

Table 1. Nursery liners treated with herbicides in 1982 at Riverhead, New York.

Common Name	Scientific Name
Japanese andromeda	Pieris japonica Thunb.
Evergreen azalea cv Hino Crimson	Rhododendron obtusum (Lindl.) Planch. cv. Hino Crimson
Cotoneaster	Cotoneaster adpressus Bois & Berthault var praecox
Boxleafed holly	Ilex crenata Thunb. var convexa
Canadian hemlock	Tsuga canadensis (L.) Carriere
Red oak	Quercus rubra L.
Rhododendron cv Roseum Elegans	Rhododendron catawbiense Michx. cv Roseum Elegans
Hybrid tea rose cv. American Bride	Rosa sp.
Japanese snowball	Viburnum plicatum Thunb. var Tomentosum

Table 2. Herbicides used post-plant preemergence on nursery liners 1982 at Riverhead, New York.

Common Name	Scientific Name	Formulation
Alachlor	2-chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide	15G
Metolachlor	2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxyl-1-methylethyl)acetamide	8E
Napropamide	2-(a-naphthoxy)-N,N-diethylpropionamide	5G
Oxyfluorfen	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene	2E
Simazine	2-chloro-4,6-bis(ethylamino)-s-triazine	4L

Table 3. Postplant preemergence weed control on nursery liners planted May 12, treated May 13 and rated on July 14, 1982, at Riverhead New York.

Treatment			Weed control[a]		
Herbicide	Formulation	lb ai/A	General	Non-Grasses	Grasses
Alachlor	15G	4	10	10	10
		8	9	9	10
		16	10	10	10
Oxyfluorfen	1G	2	10	10	10
		4	9	10	9
		8	9	10	9
Napropamide	5G	4	10	10	10
		8	10	10	10
		16	10	10	10
Metolachlor 8E + Simazine 4L		3 + .8	10	10	10
		6 + 1.6	10	10	10
		12 + 3.2	10	10	10
Metolachlor 8E		3	9	9	10
		6	10	9	10
		12	10	10	10
Untreated 1			7	8	8
2			6	7	7
Handweeded 1			10	10	10
2			10	10	10

(a) Ratings are the average of 4 replicates 85 ft^2 each.

Rates are from 1 = full of weeds, 7 = satisfactory control to 10 = no weeds

Table 4. Tolerance of nursery liners to postplant preemergence herbicides, planted May 12, treated May 13, rated on July 14, 1982 at Riverhead, New York.

Treatment			Plant growth ratings[a]								
Herbicide	Formulation	Rate lb ai/A	Azalea	Andromeda	Oak	Cotoneaster	Holly	Hemlock	Rhododendron	Viburnum	Rose
Alachlor	15G	4		9	9			9	9	8	
		8		9	10			8	9	8	
		16		8	9			8	8	6	
Oxyfluorfen	1G	2	9			10	10				
		4	10			10	10				
		8	10			9	10				
Napropamide	5G	4			9					9	
		8			10					9	
		16			9					9	
Metolachlor + Simazine	8E 4L	3 + .8		9	10			10	8		10
		6 + 1.6		9	10			9	9		10
		12 + 3.2		9	9			8	8		9
Metolachlor	8E	3							10		10
		6							9		10
		12							8		9
Untreated 1			10	9	9	10	10	10	9	9	10
2				10	10			10	9	9	10
Handweeded 1			10	9	8	10	10	9	9	10	10
2				10	10			10	10	10	10

[a] Ratings are the average of 4 replicates of 3 plants each. Rating is from 1 = dead or missing to 7=acceptable growth to 10=optimum growth. A blank indicates no treatment.

1982 STUDIES ON TOLERANCE OF FIELD GROWN ANNUALS TO POSTPLANT PREEMERGENCE HERBICIDES

1982

A. Bing[1/]

ABSTRACT

Napropamide 5G and oryzalin 75WP were most effective in controlling weeds. Chlorpropham and trifluralin were least effective. Chloramben and diaphenamid were nearly adequate. Impatiens may be sensitive to napropamide; Sweet William, salvia, portulaca and pansy to chloramben; salvia is sensitive to oryzalin.

INTRODUCTION

Landscape contractors and cutflower growers are interested in safe, effective herbicides for outdoor plantings of annuals. There is a great variety of plants started in the greenhouse and transplanted outdoors to provide color in beds or cutflowers once the danger of frost is past. It is expensive to hand weed these plantings until they provide enough cover to successfully compete with weeds. This is the fourth year of this series of experiments (1, 2, 3).

MATERIALS AND METHODS

Flats of seedlings, empty flats and inserts were donated by Ivy Acres Greenhouses, Calverton, New York. Students in the Ornamental Horticulture Program of the State University at Farmingdale planted the seedlings in the inserts and took care of them until they were planted outdoors at Riverhead on May 18. The plants used are listed in Table 1. The plants were set 1 ft apart in rows, with 34 in between rows. The treatments were to be applied to 6 plants in each row across 10 rows. The plants were arranged in each row so that the desired treatments would fall on the plants to receive that treatment. Each treatment area was $6 \times 1 \times 10 \times \frac{34}{12} = 170$ sq ft. There were 4 blocks each with 22 treatments.

Postplant preemergence applications were applied May 21 using a hand shaker for applying granules and a 1.5 gallon hand-pumped sprayer for liquids. All quantities of the herbicides shown in Table 2 were measured ahead of time and then applied to the 170 sq ft plots.

The weed growth was evaluated on July 9 using a rating system of 10 for no weeds, 7 for commercial control to 1 is full of weeds. The major weeds were barnyardgrass (*Echinochloa crus-galli* (L.) Beauv), common purslane (*Portulaca oleracea* L.) and common groundsel (*Senicio vulgaris* L.). There was some Pennsylvania smartweed (*Polygonum pensylvanicum* L.) and large crabgrass (*Digitaria sanguinalis* (L.) Scop.) and common lanbsquarters (*Chenopodium album* L.). After evaluation the weeds were allowed to grow and by late summer most plots were well covered.

The growth of the bedding plants was evaluated on July 9 using a rating of 1 for a dead or missing plant to 7 for acceptable growth to 10 for optimum growth and appearance.

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RESULTS AND DISCUSSION

The results of the weed control evaluation are shown in Table 3 as averages of 4 replicates of 6 plants each. The best weed control was from napropamide and oryzalin with ratings of 8 at the normal rates of 4 & 2 lb ai/A and 9 at twice the recommended rates of 8 & 4 lb ai/A. Both napropamide and oryzalin were a little weak on groundsel with a rating of 8. Chloramben rated 7, chlorpropham rated 6, diphenamid rated 7, and trifluralin rated 7 were weak on groundsel. Chlorpropham was not effective against barnyardgrass with a rating of 6.

Plant tolerance information is in Table 4. If the rating for a treatment is much lower than the handweeded plants, the herbicide caused injury. Ageratum was safely treated by all herbicides. Alyssum may be sensitive to chloramben, chlorpropham and oryzalin. Begonia appears quite sensitive to chloramben. Impatiens was safest with chlorpropham. Portulaca was damaged by chloramben, diphenamid and oryzalin. Pansies are not safe with chloramben, chlorpropham or diphenamid but are safe with napropamide. Petunia was safe with napropamide and trifluralin but not chloramben. Sweet William was safest with oryzalin. Salvia may only be safe with napropamide.

LITERATURE CITED

1. Bing, A. 1980. Weed control in field grown bedding plants. Bedding Plant News, Sept. 1980, 12-13.

2. Bing, A. 1980. Weed control in annual flowering plants. NEWSS 35: 262-266.

3. Bing, A. 1982. Postplant preemergence weed control in field grown bedding plants, 1981. NEWSS 36:216-265.

Table 1. Bedding plants used in herbicide test at Riverhead, New York 1982.

Common Name	Scientific Name
Ageratum cv Blue Danube	Ageratum houstonianum Mill
Alyssum, cv Wonderland	Lobularia maritima L. (Desx.)
Begonia, cv Derby	Begonia semperflorens Hort.
Coleus cv Vulcan	Coleus blumei Beuth.
Geranium seedlings cv Sprinter series	Pelargonium x hortorum L. H. Bailey
Impatiens, mixed	Impatiens balsamina L.
Marigold, dwarf French	Tagetes patula L.
Moss Rose, mixed	Portulaca grandiflora Hook.
Pansy, mixed	Viola tricolor var hortenis DC
Petunia, Blue Flash	Petunia X hybrida Hort Vilm Andr.
Salvia, scarlet cv Carabiniere	Salvia splendens F. Sellow ex Roem & Schult
Sweet William, dwarf mix	Dianthus barbatus L.

Table 2. Herbicides used on bedding plants in the field at Riverhead, 1982.

Common Name	Chemical Name	Formulation
Chloramben	3-amino-2,5-dichlorobenzoate methyl ester	10G
Chlorpropham	isopropyl-m-chlorocarbanilate	20G
Diphenamid	N,N-dimethyl-2,2-diphenylacetamide	90WP
Napropamide	2-(a-naphthoxy)-N,N-diethylpropionamide	5G
Oryzalin	3,5-dinitro-N^4,N^4-dipropylsulfanilamide	75WP
Trifluralin	a,a,a-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine	5G

Table 3. Weed control from postplant preemergence herbicides applied to outdoor annuals planted May 18, treated May 21, and rated on July 9, 1982, at Riverhead, New York.

Treatment			Weed Control[a]							
Herbicide	Formulation	Rate lb ai/A	General	Grasses	Non-Grasses	Barnyd-grass	Crab-grass	Lambs-quarters	Smart-weed	Ground-sel
Chloramben	10G	3	6	8	7	9	9	10	9	7
		6	8	9	8	9	10	9	10	8
		12	9	10	9	10	10	10	10	9
Chlorpropham	20G	4	4	6	5	6	8	9	9	6
		8	6	8	6	8	9	9	10	6
		16	6	8	7	8	10	8	10	7
Diphenamid	90WP	8	7	9	7	10	10	10	9	7
		16	8	9	8	9	10	10	9	8
		32	9	10	9	9	10	10	10	9
Napropamide	5G	4	8	9	8	9	10	10	9	8
		8	9	9	9	10	9	10	9	9
		16	10	10	10	10	10	10	10	9
Oryzalin	75WP	2	8	8	7	9	10	10	10	8
		4	9	10	9	10	10	10	10	9
		8	10	10	9	10	10	10	10	10
Trifluralin	5G	4	6	9	7	9	10	10	9	7
		8	6	7	7	8	8	9	10	7
		16	6	9	7	9	10	10	10	7
Untreated			3	4	5	5	8	8	8	6
Handweeded			10	10	10	10	10	10	10	10

[a] Average of 4 plots, 6 ft X 28.3 ft.
Rating is 1=full of weeds to 7=commercial control to 10=no weeds.

Table 4. The effect of postplant preemergence herbicides on a field planting of annual flowers, planted May 18, treated May 21, rated on July 9, 1982 at Riverhead, New York.

Treatment			Plant Growth[a]											
Herbicide	Formulation	Rate lb ai/A	Ageratum	Alyssum	Begonia	Coleus	Geranium	Impatiens	Marigold	Moss Rose	Pansy	Petunia	Sweet William	Salvia
Chloramben	10G	3	9	6	6	4		7		5	4	6	5	3
		6	8	5	5	4		7		4	5	6	4	4
		12	7	3	2	4		3		3		3		2
Chloropropham	20G	4	8	6	7	5		9	9		7	7	5	5
		8	9	3	5	4		7	9		6	4	4	6
		16	9	5	5	3		7	10			6	5	5
Diphenamid	90PW	8	9			4		5		6	5			
		16	9			3		6		7	5			
		32	9			3		5		6	5			
Napropamide	5G	4	10	8	6		7	7	8		9	9	6	6
		8	9	6	6		5	5	7		6	9	9	7
		16	10	8	6		4	3	8			9	6	7
Oryzalin	75WP	2	9	6					10	7			9	3
		4	9	4					8	5			7	2
		8	9	3					8	8			8	2
Trifluralin	5G	4		7	6	3						10		
		8		7	6	3						10		
		16		9	7	3						9		
Untreated			9	8	8	4	6	10	10	9	9	5	7	7
Handweeded			9	7	7	5	10	9	10	9	10	8	10	6

[a] Ratings are an average of 4 replicates of 6 plants each. Rates are from 1=dead or missing to 7=satisfactory growth to 10=optimum growth. A blank indicates no test.

EFFECTIVE WEED CONTROL PRACTICES THAT MINIMIZE SOIL EROSION

Thomas. E. Corell[1/] and Arthur Bing[2/]

ABSTRACT

Chemical weed control programs for commercial nursery growers evolved that provided effective weed control yet left field soils exposed to severe wind and water erosion. This report outlines efforts to tailor herbicide programs and grower application practices to attain satisfactory weed control with minimal soil erosion.

INTRODUCTION

Nationally, soil erosion has been touted in journals such as Newsweek as the greatest factor limiting further agricultural production yield increases. Agricultural economists question whether production declines attributed to soil erosion can continue to be offset by technological advances (cultural innovations, new varieties, agricultural chemicals...). One example cited in a recent issue of Agrichemical Age quoted wheat crop yield reductions attributed to soil erosion. On a 10" deep soil, wheat yields would be reduced 1.8 bu. after a loss of 1" of soil; a 3.0 bu. reduction would be expected on a 5" deep soil experiencing the same 1" loss. Nurserymen remove tons of top soil with each harvest of every crop resulting in a need for more drastic soil conservation practices. These soil losses and growing successive crops on the remaining inferior soil would result in the need for more expensive cultural practices, poorer root systems, fertilizer waste, less than top quality crop and a loss in the productive capacity of the soil.

Nurserymen for years removed weeds by hand or mechanically. This time consuming process became overwhelming as labor became more expensive. In the fall, weeds were allowed to regrow and hold soil in place through the winter as well as insulating plant roots. Then came herbicides, and after a shakey start at soil sterilant levels (high rates) which scared off many nursery growers, a dedicated group of researchers evolved herbicide programs and practices safe on perennial woody ornamental crops. More herbicides became available and rates were refined. The evolution from weed filled fields, to clean fields in spring and summer to year long chemical weed control programs followed. Effective and affordable weed control has arrived; today growers are successfully using more frequent herbicide applications at reduced rates of combinations of herbicides, rotating different ones to avoid building up populations of tolerant weeds.

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Successful weed control leaves the soil surface bare throughout the fall and winter months. These bare fields are susceptible to erosion from wind and water. Wind erosion is the major concern at it removes a thin layer of soil from entire fields. Blowing soil particles abrade plant tissues and cause considerable plant injury. Water erosion causes more visible effects with major cuts and gullies being the worst extreme. Wind caused surface soil transport and deposition is a far more serious though less dramatic result of erosion.

Nursery growers are not immune to or protected from soil erosion. However, they can avoid the problem by adapting current cultural practices and altering chemical weed control programs to allow for establishing cover crops in nursery rows.

Erosion can be reduced in some situations by employing methods specified by the U.S. Soil Conservation Service. Most of the SCS techniques did not gain wide acceptance in nurseries due to the high investment land moving requires to implement them and the large area that was taken out of production to meet their specifications. Today planting on the contour, terraces capable of being planted over and grassed water ways make them less costly and more easily manageable. These practices along with subsoiling to root prune ornamentals and simultaneously break below surface layers and allow water penetration and tailoring herbicide programs to permit the establishment of oats (*Avena sativa* L) between the rows of nursery stock can virtually prevent soil erosion caused by wind or water.

Oats are an ideal choice in that they are inexpensive, germinate quickly, grow well in wide range of soils, tie up nitrogen that would otherwise be lost to leaching, hold soil in position and, most importantly, winter kill in northern climates. Unfortunately it is also very susceptible to herbicide residues in the soil which often restrict germination, growth or establishment. Herbicide programs must be altered to enable this companion planting program to be implemented.

A major obstacle to the success of this effort evolves around the satisfactory oat germination and establishment necessary to prevent erosion. Growers using herbicides have had varying degrees of success in establishing oats depending upon the time elapsed between last herbicide application, seasonal weather conditions and the early September desired planting date for the oats. This project was designed to assess that residual/successful establishment question.

MATERIALS AND METHODS

Common nursery preemergence herbicides, see Table 1, were applied to crop free haven loam soil on April 24 and June 21. Each 68" X 60" unplanted area was treated on April 24 at the rates in Table 1. On June 21, untreated plots were treated at the indicated rates, however, simazine was not reapplied. The entire area was disced twice during the season to control weeds. A sequence of plantings of seed oats followed on September 4, 18 and October 5.

April 24 treatment with simazine at rates in excess of 1 lb./A caused injury to oats. June 21 treatments of napropamide and oxyzalin also stunted and injured oats. Simazine at 1 lb./A applied April 24 and oxadiazon and alachlor from both treatments caused no visible injury.

Subsequent tests applying simazine 1 lb. plus oxadiazon 2 lb., metolachlor 4 lb., oryzalin 2 lb., oxyflurfen 4 lb., simazine 1 lb. plus alachlor 4 lb., simazine 1 lb., 2 lb., alachlor 4 lb., oxadiazon 2 lb. 4 lb., napropramide 4 lb. Applications made in similar fashion in early May and repeated in late June. Results are reported in Table 2. Growers that desire to establish oats in nursery rows for erosion prevention should apply longer residual herbicides (such as simazine, napropamide, oryzalin) only early in the season. Subsequent applications should be of a shorter residual herbicides such as alachlor or oxadiazon.

NURSERY APPLICATION OF THIS INFORMATION

Knowing soil residual and effect on oat establishment, one is now able to put this information to use with growers. Equipment to seed and incorporate oats in the rows of nursery plants is now practical if the summer treatment is one of the less persistant herbicides or one with little effect on oats. Minimal preemergence herbicide residuals create a new problem - the fall crop of weeds such as marestail (*Conzya canadensis* L.) and common chick weed (*Stallaria media*) now encroach and proliferate.

Practical solutions evolve when working with knowledgeable and innovative growers. Higher rates of simazine 2-4 lb./A on tolerant crops applied after the oats are at the desired height (November) will eliminate many undesirable weeds without sacrificing the oat cover and ability to hold soil. Band applications of spray herbicides applied with drop nozzles from a boom sprayer directed at the base of the crop prevents weed encroachment in the rows between plants and does not adversely effect oat establishment in rows.

The result has been to virtually eliminate soil losses and crop injury from wind and water erosion. Additional benefits also have become evident - fields are now more accessible to personnel and equipment due to added ability of soil to carry loads, enabling workers nearly year round access, fewer puddles form as water penetrates soil quickly, reduced herbicide consumption and laborers more eagerly and effeciently work in planted fields. These factors, along with the need to preserve soil, justify this research and application approach to sensibly modernize nursery practices.

Table 1. Herbicides used in these experiments

Herbicide Common Name	Formulation	Chemical Name
Simazine	4G	[2-chloro-4,6-bis (ethylamino)-s-triazine]
Napropamide	50WP	[2-(a-naphtoxyl)-N,N-diethylpropionamide]
Alachlor	15G	[2-chloro-2',6'-diethyl-N-(methoxymethyl) acentanilide]
Oxadiazon	2G	[2-tert-butyl-4-(2,4-dichloro-5-isopropoxyphenyl-Δ^2-1,3,4-oxadiazolin-5-one]
Oryzalin	75WP	[3-5-dinitio N^4,N^4-dipropylsulfamilamide]
Metolachlor	6E	[2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxyl-1-methylethyl) acetamide]
Oxyflurfen	1G	[2-chloro-1-(3-ethoxy-4-nitrothenoxy)-4-(trifluromethyl)Benzene]

Table 2. Effect of rate and time of herbicide application to establishment of inter-row plantings of oats.[a] Rated March 31.

Treatment Herbicide	Rate lb/A	Application	Rating[a] September 5	September 22
Simazine	1 lb. plus	May	9	1
Oxadiazon	2 lb.	June	10	9
Metolachlor	4 lb.	May	9	8
		June	10	9
Oryzalin	2 lb.	May	10	7
		June	10	8
Oxyflurfen	4 lb.	May	9	7
		June	7	7
Simazine	1 lb. plus	May	8	8
Alachlor	4 lb.	June	10	7
Simazine	1 lb.	May	9	7
		June	6	7
Simazine	2 lb.	May	7	7
		June	7	6
Alachlor	4 lb.	May	10	10
		June	10	10
Oxadiazon	2 lb.	May	10	9
		June	10	10
Oxadiazon	4 lb.	May	9	7
		June	9	5
Napropamide	4 lb.	May	3	4
		June	2	6

a/ Scale 10 optional establishment and growth, 1 no establishment or growth, 7 acceptable.

WEED CONTROL ON PERENNIALS

A. Bing[1/]

ABSTRACT

There was considerable variation in the response of different perennials to postplant preemergence herbicides. In field grown Hosta and daylilies oxyfluorfen granular caused considerable burn from which the plants did not completely recover. On these same varieties oryzalin caused some burn from which they recovered. Seedling perennials in containers were more sensitive to oryzalin, oxadiazon, oxyfluorfen and the combination of oxyfluorfen and pendimethalin.

INTRODUCTION

Perennials are grown for a long time in the same location during production and especially during landscape use by the consumer. Weeds are a serious problem both as competitors and for visual effects. Previous experiments by Bing and Corell (1) showed a wide variation in the tolerance of perennials in containers to herbicides. Oxadiazon was fairly safe on many established container-grown perennials. Alachlor, oryzalin and oxadiazon were safe on field grown Hosta and daylilies. Because there is a great increase in the production and use of perennials further weed control studies are necessary both for field and container grown perennials. Many perennials are commonly called by their scientific rather than common names.

MATERIALS AND METHODS

For the field experiment young plants in flats were donated by Martin Viette nursery. The plants listed in Table 1 were set 1 foot apart on May 27 in the rows with 34 inches between rows. Each row contained one kind of plant; a 2-foot space after every 6 plants separated the treatments across all 5 rows in each block. There were 4 blocks each with the same plants and 12 treatments randomized as to location. There were only 3 replicates of columbine. Postplant preemergence treatments were applied June 3 using a hand shaker for granules and a hand-pumped sprayer for liquids. All quantities of the herbicides shown in Table 2 were measured ahead of time and the determined amount applied to the 7-foot length of row across the 5 rows covering an area of 7 x 5 x 34/12 = 99 sq ft. On July 14, weed control was evaluated using a rating of 10 for no weeds, to 7 for satisfactory control, to 1 for full of weeds. High ratings may be due to control or lack of weed pressure, so all figures must be compared with the untreated. The growth of the plants was observed on July 14 using a rating of 1 for a dead or missing plant, to 7 for satisfactory growth, to 10 for optimum growth and appearance. By July 14 all the poppies had lost their leaves so they were evaluated on October 12 when they had made new growth.

For the container test, seedlings were obtained from several growers and planted in 1-quart containers from August 9 to 30. A peat-vermiculite-sand media was used. Part of each replicate had composted sewage sludge in the mix.

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The plants were liquid fed when watered. Preemergence herbicides were applied on September 7. Each plot had 14 pots of each test variety. Applications were made as in the field, only the pots were close together and the covered area was small. There was inadequate weed growth for evaluation but growth ratings were made on September 13 and October 1.

RESULTS AND DISCUSSION

As seen in Table 3 all the herbicides were effective with the light weed pressure in that field. Shortly after treatment oxyfluorfen at 2 and 4 lb AI/A badly burned Hosta and daylily from which they did not completely recover. Oryzalin burned Hosta and daylily slightly but they appeared to recover and the observations on July 14 in Table 4 show no reduction of growth. The poppies showed no ill effects from any of the treatments when they started to grow in October, except from the 8 lb AI/A of napropamide. The iris did poorly and cannot be evaluated.

The oryzalin applied on the container grown plants stunted and yellowed all the plants but they were mostly recovered in about a month, and in Table 5 the only low ratings are at the 4 lb rate for Achillea, Gypsophilia and Campanula. DCPA was safe on all plants except Sweet William. Alachlor at 4 lb is safe but at 8 lb was injurious to alyssum and Rudbeckia according to data in Table 5. Other observations showed all plants stunted and slowed up at the 8 lb rate with Bellis badly hurt and even the 4 lb rate slowed growth of alyssum, Physallis and Dianthus.

Oxadiazon at 4 lb badly hurt Digitalis, Rudbeckia, Bellis, and Achillea by slowing growth. At the 8 lb rate there was greatly reduced growth by Digitalis, alyssum, Rudbeckia and Bellis. Napropamide appears to have reduced growth in some cases but it was due to slight flooding in the area.

The oxyfluorfen-pendimethalin combination was not safe on perennials except maybe Gypsophilia and pink. It took until late October for plants to begin recovery. There were some dead Rudbeckia and alyssum plants.

Oxyfluorfen alone killed some Rudbeckia and also badly hurt Digitalis, alyssum and Achillea. Other plants were slightly hurt. Injury appeared very soon after treatment but plants were growing well again by late October.

A grower will have to make some very careful selections when using herbicides on seedling perennials.

Table 1. Perennials used in weed control studies at Riverhead, New York 1982.

Common Name	Scientific Name
Baby's Breath	Gypsophila paniculata L.
Basket of Gold (alyssum)	Aurinia saxatilis L. Desv.
Blackeyed Susan	Rudbeckia hirta L.
Canterbury Bells	Campanula medium L.
Chinese Lantern	Physalis Alkekengi L.
Columbine, McKanna's hybrids	Aquilegia sp.
Coreopsis cv Sunburst	Coreopsis L. grandiflora Hogg ex Sweet
Daisy, English	Bellis perennis L.
Daylily, mixed seedlings	Hemerocallis fulva & flava hybrids
Delphenium, Pacific Coast hybrids	Delphenium X cultorum Voss
Iris, German	Iris germanica L.
Pink	Dianthus sp. L. Caesius
Poppy, Oriental	Papaver orientale L.
Spurge, Japanese	Pachysandra terminalis Siebold & Zucc.
Sweet William	Dianthus barbatus L.
Yarrow, golden	Achillea filipendulina Lam.
Plaintain lily	Hosta sp.
Foxglove	Digitalis purpurea
Pink	Dianthus sp.

Table 2. Herbicides applied to field and container grown perennials at Riverhead, New York in 1982.

Common Name	Chemical Name	Formulation
Alachlor	2-chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide	15G
DCPA	dimethyl tetrachloroterephthalate	75WP
Napropamide	2-(a-naphthoxy)-N,N-diethylpropionamide	5G, 50WP
Oxadiazon	2-tert-butyl-4-(2,4,-dichloro-5-isopropoxyphenyl) Δ^{2}-1,3,4-ozadiazolin-5-one	
Pendimethalin	N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobezenamine	2G & 1G
Oryzalin	3,5-dinitro-N^4,N^4-dipropylsulfanilamide	75WP
Oxyfluorfen	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene	1G

Table 3. Control of weeds in field grown perennials planted May 27, treated June 3, -- rated July 14, 1982 at Riverhead, New York.

Treatment			Control of Weeds[a]						
Herbicide	Formulation	Rate la ai/A	General	Non-Grasses	Grasses	Crabgrass	Purslane	Groundsel	Pineapple-weed
Alachlor	15G	4	9	8	9	9	9	9	9
		8	9	9	10	10	10	9	10
Napropamide	5G	4	9	9	9	9	9	9	10
		8	10	10	10	10	10	10	10
Napropamide	50WP	4	9	9	10	10	10	9	10
		8	10	10	10	10	10	10	10
Oryzalin	75WP	2	8	8	9	10	9	9	9
		4	9	9	9	10	9	9	9
Oxyfluorfen	1G	2	9	9	9	9	9	9	10
		4	9	9	9	9	9	9	9
Untreated			6	6	9	9	7	8	8
Handweeded			10	10	10	10	10	10	10

[a] Ratings are the average of 4 replicates, plot size is 99 sq ft. Ratings are from 1=full of weeds to 10=no weeds. The high rating may represent control or a lack of weeds.

Table 4. The effect of postplant preemergence herbicides on a field planting of annual flowers, planted May 18, treated May 21, rated on July 9, 1982 at Riverhead, New York

Treatment			Plant Growth[a]											
Herbicide	Formulation	Rate lb ai/A	Ageratum	Alyssum	Begonia	Coleus	Geranium	Impatiens	Marigold	Moss Rose	Pansy	Petunia	Sweet William	Salvia
Chloramben	10G	3	9	6	6	4		7		5	4	6	5	3
		6	8	5	5	4		7		4	5	6	4	4
		12	7	5	7	4		3		3		3		2
Chloropropham	20G	4	8	6	7	5		9	9		7	7	5	5
		8	9	5	5	4		7	9		6	4	4	6
		16	9	5	5	3		7	10			6	5	5
Diphenamid	90PW	8	9			4		5		6	5			
		16	9			3		6		7	5			
		32	9			3		5		6	5			
Napropamide	5G	4	10	8	6		7	7	8		9	9	6	6
		8	9	6	6		5	5	7		6	9	9	7
		16	10	8	6		4	3	8			9	6	7
Oryzalin	75WP	2	9	6					10	7			9	3
		4	9	4					8	5			7	2
		8	9	3					8	8			8	2
Trifluralin	5G	4		7	6	3						10		
		8		7	6	3						10		
		16		9	7	3						9		
Untreated			9	8	8	4	6	10	10	9	9	5	7	7
Handweeded			9	7	7	5	10	9	10	9	10	8	10	6

[a] Ratings are an average of 4 replicates of 6 plants each. Rates are from 1=dead or missing to 7=satisfactory growth to 10=optimum growth. A blank indicates no test.

Table 5. Tolerance of container grown perennials to postplant preemergence herbicides. Planted August 9-30, treated September 7 and rated September 13 and October 1, 1982.

Treatment		Plant Tolerance[a]											
Herbicide	Rate lb ai/A	Dig[d]	Aly	Rud	Ach	SW	Bel	Del	Cor	Gyp	Car	Cam	Phy
Oryzalin 75WP	2	9[b]	10	8	8	10	8	10	10	8	8	6	(c)
	4	10	8	9	7	9	9	9	10	6	9	6	(c)
DCPA 75WP	10	10	10	10	10	8	10	10	10	10	10	9	(c)
	20	9	9	10	10	6	9	9	10	10	10	8	(c)
Alachlor 15G	4	8	7	8	8	9	7	9	10	10	10	7	7
	8	8	3	4	6	9	6	8	10	8	8	7	7
Oxadiazon 2G	4	5	8	7	7	10	5	9	9	9	9	7	7
	8	4	4	5	6	8	5	8	9	9	9	8	6
Napropamide 5G	4	7	9	9	9	9	8	7	10	9	9	9	7
	8	7	9	8	10	8	9	8	10	7	10	8	(c)
Oxyfluorfen + pendimethalin 2G	2+	5	4	3	6	7	4	7	7	10	10	8	2
Oxyfluorfen 1G	2	7	5	3	5	8	7	7	9	10	10	8	(c)
Untreated		10	10	10	10	10	10	10	10	9	10	10	9
Handweeded		10	10	10	10	10	10	9	10	10	9	9	(c)

(a) Plant tolerance ratings: 1=dead or missing, 7=acceptable to 10=optimum growth.
(b) Average of 14 plants.
(c) No plants treated.
(d) Dig=Digitalis, Aly=Alyssum, Rud=Rudbeckia, Ach=Achillea, SW=Sweet William, Bel=Bellis, Del=Delphenium, Cor=Coreopsis, Gyp=Gypsophila, Car=Carnation, Cam=Campanula, Phy=Physallis.

Chemical Weed Control in Bedding Plants

C. Haramaki and L. J. Kuhns[1/]

ABSTRACT

Recommended rates of granular chloramben and napropamide; and diphenamid, napropamide and oryzalin sprays gave excellent control of grasses. Recommended rates of granular chlorpropham; and napropamide and oryzalin sprays also gave excellent control of broadleaved weeds. Ageratum and aster were tolerant to all herbicides. Begonia sprayed with diphenamid had the least damage of any of the herbicides. Oryzalin severely affected coleus growth. Impatiens was severely affected by all herbicides. Marigold had good to excellent flowering and growth with recommended rates of chloramben, chlorpropham and diphenamid. Portulaca treated with diphenamid and napropamide had good flowering and vegetative growth. Sweet williams sprayed with diphenamid and napropamide had good growth and flowering.

Introduction

The use of bedding plants has always been popular in home gardens, parks, institutional grounds, and around business establishments because of their colorful and attractive appearance. The control of weeds in these plantings has been difficult and control has been primarily limited to the use of mulches such as organic material, gravel and plastic sheets. The use of herbicides to control weeds in annual flower plantings has been investigated by many researchers but crop tolerance to many of the herbicides have been a problem (1-11). Further investigations to find herbicides which are compatible with the many bedding plants which are popular today are needed.

Methods and Materials

On July 7, 1982, eight different bedding plants were transplanted into a Hagerstown silt loam which had been disc plowed and rototilled. The plants were Blue Blazer ageratum (Ageratum houstonianum Blue Blazer), Dwarf Queen aster (Callistephus chinesis Dwarf Queen), Scarlanda begonia (Begonia x semperflorens cultorum Scarlanda), common coleus (Coleus blumei), Cinderella impatiens (Impatiens wallerana Cinderella), Yellow Boy marigold (Tagetes patula Yellow Boy), Sunnyside Double portulaca (Portulaca grandiflora Sunnyside Double), and Wee Willie sweet williams (Dianthus barbatus Wee Willie). On July 13, 1982 the plots were treated with the following herbicides: chloramben 4G (3-Amino-2,5-dichlorobenzoic acid), chlorpropham 20G (isopropyl m-chlorocarbanilate), diphenamid 50W (N,N-dimethyl-2,2-diphenylacetamide), napropamide 50W and 10G (2-(a-naphthoxyl)-N,N-diethylpropionamide) and oryzalin 75W (3,5-dinitro N^4,N^4-dipropylsulfanilamide). These herbicides were applied at the recommended rate and at four times this rate. The treatments were replicated four times. There were eight control and eight handweeded plots. Each of the 182 square feet plots had ten plants of the eight different bedding plants. The temperatures were: air - 78°F, soil surface - 90°F, and 2" below - 76°F. The soil was at field capacity, the wind was from

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Table 1. Effect of preemergent herbicides on weed growth five weeks after application, 1982.

Chemical	Rate	Grasses	Broad-leaves	All Weeds	Weed Height
Control	0	2.38[a/]	6.88	9.25	1.75[b/]
Control-Handweed	0	2.63	6.50	9.13	1.94
	Weeding time per plot = 90 minutes				
Chloramben,4G	3#/A	0.25	2.50	2.75	1.25
	12#/A	0	0	0	0
Chlorpropham,20G	4#/A	2.00	1.00	3.00	1.38
	16#/A	0	0	0	0
Diphenamid,90W	8#/A	0.25	3.50	3.75	0.63
	32#/A	0	1.25	1.25	0.50
Napropamide,50W	4#/A	0	0.50	0.50	0.25
	16#/A	0	0	0	0
Napropamide,10G	4#/A	0.50	1.75	2.25	0.15
	16#/A	0	0	0	0
Oryzalin,75W	2#/A	0	0	0	0
	8#/A	0	0	0	0

a/ 0 = No Weeds, 2 = 25% Weed Coverage, 4 = 50% Weed Coverage, 6 = 75% Weed Coverage, 8 = 100% Weed Coverage, Light Infestation, 10 = 100% Weed Coverage, Heavy Infestation.

b/ In Feet.

5-7 miles per hour, and the weather was clear and sunny. The 1/4" high weed seedlings were either sprayed with an AZ CO_2 powered 4 nozzle boom sprayer at 20 PSI with LP8002, 50 mesh nozzles at 24 gallons per acre or had granules hand broadcasted. One half inch of water was sprinkler irrigated on the plots immediately after herbicide application. The plots were examined on August 19, 1982 for weed prevalence and crop growth.

Results and Discussion

The predominant weeds in the control plots in decreasing order of frequency were smooth pigweed (*Amaranthus hybridus* L.), common purslane (*Portulaca oleracea* L.), green foxtail (*Setaria viridis* Beav.), tumble pigweed (*Amaranthus albus* L.), common lambsquarters (*Chenopodium album* L.), field pepperweed (*Lepidium campestre* R. Br.) and common ragweed (*Ambrosia artemisiifolia* L.). After five weeks the total hand weeding time per plot averaged 90 minutes in the control handweed plots. Chloramben at 3 pounds per acre

Table 2. Effect of postplant applications of preemergent herbicides on bedding plants five weeks after application, 1982.

Chemical	Rate	Ageratum	Aster	Begonia	Coleus	Impatiens	Marigold	Portulaca	Sweet Williams
Control	0	0.21[a/]	0.34	0.79	2.04	1.93	0.25	2.18	2.34
Control-Handweed	0	0.35	0.48	0.74	1.43	2.44	0.54	2.57	2.70
Chloramben,4G	3#/A	0.08	0.55	4.65	1.60	3.08	0.50	2.63	4.80
	12#/A	0.48	1.73	5.00	2.85	3.28	1.90	3.55	5.00
Chlorpropham,20G	4#/A	0.08	0.58	1.95	1.53	2.75	0.13	2.75	3.60
	16#/A	0.08	0.83	3.68	2.28	3.83	0.23	3.90	4.25
Diphenamid,90W	8#/A	0.18	0.50	1.98	2.30	2.80	0.85	0.80	2.10
	32#/A	0.05	0.65	3.45	1.88	4.03	1.35	1.50	2.55
Napropamide,50W	4#/A	0.13	0.28	2.30	2.28	3.98	1.30	0.73	2.80
	16#/A	0.23	0.95	2.83	2.68	4.73	2.93	1.68	2.43
Napropamide,10G	4#/A	0.10	0.43	2.00	2.33	3.25	0.63	1.45	2.90
	16#/A	0.18	0.80	3.60	1.68	4.43	1.23	1.78	3.18
Oryzalin,75W	2#/A	0.15	0.85	2.83	2.30	2.75	0.48	2.58	2.65
	8#/A	0.18	0.85	3.65	2.83	4.20	1.55	3.38	2.83

a/ 0 = No Injury
1 = Very Slight Injury
2 = Slight Injury
3 = Moderate Injury
4 = Severe Injury
5 = Dead

controlled the grasses well but was only fair in controlling common purslane and smooth pigweed. At 12 pounds per acre chloramben gave excellent control of all weeds. Chlorpropham at 4 pounds per acre gave fairly good control of the broadleaved weeds such common purslane but poor control of grasses such as green foxtail. At 16 pounds per acre chlorpropham gave excellent control of all weeds. Diphenamid at 8 pounds per acre gave excellent control of grasses such as green foxtail and fairly good control of the broadleaved weeds except common purslane and common lambsquarter. At 32 pounds per acre diphenamid controlled the grasses but there were still a few common purslane and common lambsquarter plants. Napropamide at 4 pounds per acre gave excellent control of grasses and good control of broadleaved weeds when applied as a spray and good control of grasses and fair control of broadleaved weeds when applied as granules. At 32 pounds per acre napropamide gave excellent weed control when applied either as a spray or granules. Oryzalin at 2 and 8 pounds per acre gave excellent weed control of both grasses and broadleaved weeds. Ageratum had good to excellent vegetative growth and flowering under all control and herbicide treatments although there was a slight reduction in plant size when treated with chloramben at 12 pounds per acre and oryzalin at 2 and 8 pounds per acre. Aster plants were spindly and loose with fair flowering and slightly smaller flowers in the control plots due to the competition and shade from the weeds. In the chloramben treated plots the asters were slightly smaller at the higher rates but the flowering was good. Good growth and flowering was observed in the chlorpropham treated plots. Diphenamid treated asters had fair to good flowering with a slight reduction in plant size. Very good flowering was observed in both the sprayed and granular applied napropamide treatments and a very slight reduction in growth in the granular treated plants. Asters treated with oryzalin had good flowering and vegetative growth. Begonias in the control plots had good vegetative growth and flowering. At 3 pounds of chloramben per acre fair flowering was noted on the plants which did not die and at 12 pounds all of the plants were dead. Chlorpropham at 4 pounds per acre produced plants with fair vegetative growth and flowering and at 16 pounds the plants which did not die also had fair flowering. Diphenamid treated begonias had fair to good vegetative growth with good flowering. Napropamide sprays produced begonias with poor to good growth and good flowering. Napropamide granules killed some of the begonias and reduced flowering. Begonias treated with oryzalin were either dead or had poor growth and few flowers. Coleus in control plots or treated with diphenamid, granular napropamide had good growth. Those treated with chloramben and chlorpropham had good growth at the lower rates and fair at the higher. Napropamide when sprayed produced plants with fair growth and short lateral shoots. Oryzalin treated coleus in general had poor growth. Impatiens in check plots had good vegetative growth but poor flowering. Impatiens sprayed with napropamide or oryzalin at the lower rates and chloramben at both rates had fair growth with poor flowering. Diphenamid at the lower rate had good growth but poor flowering. Impatiens in all other treatments had poor growth with little or no flowering. Marigold with excellent growth and flowering were observed in plots treated with the lower rate of chloramben, granular napropamide and both rates of chlorpropham; good to excellent flowering but smaller plants with the lower rate of diphenamid, napropamide spray, and both rates of granular napropamide. The other treatments had poor or fair flowering with reduced sized marigolds. Portulaca treated with both rates of diphenamid, napropamide spray and granules had good vegetative growth

and flowering. Portulaca at higher rates of chloramben, chlorpropham and, oryzalin were severely damaged. Sweet williams treated with diphenamid, and napropamide sprays had good growth with fair to good flowering. Oryzalin treated plants had fair growth and flowering. Chloramben and chlorpropham severely injured sweet williams.

Literature Cited

1. Bing, A. 1981. Weed control in annual flowering plants. Proc. N.E. Weed Sci. Soc. 35:262-266.

2. Bing, A. 1982. Postplant preemergence weed control in field grown bedding plants, 1981. Proc. N.E. Weed Sci. Soc. 36:261-265.

3. Fretz, T. A. 1976. Herbicide performance on transplanted annual bedding plants. HortScience 11(2):110-111.

4. Haramaki, C. 1962. Preplant weed control in marigold plantings. Proc. N.E. Control Conf. 16:212-217.

5. Haramaki, C. 1963. Preplant weed control in annual flowers. Proc. N.E. Weed Control Conf. 17:213-217.

6. Haramaki, C. 1963. Posttransplant applications of granular herbicides in annual flowers. Proc. N.E. Weed Control Conf. 17:221-224.

7. Haramaki, C. 1965. Seasonal weed control in annual flowers. Proc. N.E. Weed Control Conf. 19:175-179.

8. Haramaki, C. and S. Atmore. 1964. Effect of posttransplant applications of granular herbicides on marigold. Proc. N.E. Weed Control Conf. 18:214-219.

9. Haramaki, C. and G. Koch. 1966. Preemergence herbicide applications in transplanted annual flowers. Proc. N.E. Weed Control Conf. 20:200-203.

10. Haramaki, C. and R. P. Meahl. 1964. Chemical weed control in transplanted annual flowers. Proc. N.E. Weed Control Conf. 18:204-207.

11. Wilfret, G. J. and D. S. Burgis. 1977. Weed control in petunia, ageratum and gladiolus grown in open fields. Proc. Southern Weed Sci. Soc. 30:197-204.

WEED CONTROL IN FIELD GROWN POT CHRYSANTHEMUM

A. Bing[1/]

ABSTRACT

The most effective herbicides applied under the containers were napropamide 50WP, oxadiazon 50WP, metolachlor 8E, oryzalin 75WP, and oxadiazon 2G at recommended rates. Heavy woven green cloth and black plastic were completely effective. Over the container applications were not effective. Soil applications made before placing pots in ground and again over the top were effective with oxadiazon EC under + WP over, metolachlor 15G, oxafluorfen 1G, oxadiazon 2G and oryzalin 75WP. All treatments were safe except metolachlor 8E and oxadiazon WP over the plants or under and over the plants.

INTRODUCTION

In 1981 herbicides were tested on field grown mums (chrysanthemums) planted directly in the soil (1). They grew well with herbicide treatments of DCPA, chlorpropham and napropamide. However, most mums for sale are grown in containers. This experiment was designed to use the best cultural practices and see if herbicides could be used successfully on container grown mums.

MATERIALS AND METHODS

Rooted chrysanthemum cuttings of the variety Jackpot were donated by Yoder Brothers. The original shipment was to arrive the week May 24, but they were lost in shipment. They were replaced by a shipment that arrived June 22 and were placed 1 cutting per 7 inch plastic mum pot. All the plants were grown close together under overhead irrigation until placed in the experimental area on June 30. They were watered with a weak fertilizer solution by means of a small tube in each pot which supplied water through a Gewa proportioner and larger plastic tubing called a "spaghetti system". All plants were pinched twice and crown buds were removed during the growing season.

There were 3 rows of 13 plots each 10 X 10 feet. The herbicides used are shown in Table 1. In anticipation of receiving cuttings on the week of May 24, below pot treatments were applied May 24. Because of a 9-inch rain on June 5 & 6 and a long wait, all plots were hoed and retreated on June 30. Below pot treatments were made, then 14 pots were put on each plot followed by over the pot treatments. The weed control was rated on July 15 using a rating system of 1=full of weeds to 7=satisfactory control to 1=no weeds. Plant injury was recorded on July 9 using a rating of 1 for a dead or missing plant to 7 for a satisfactory plant to 10 for optimum growth and appearance.

On September 10 when the buds were just showing color, the width and height of all plants were measured. It was a very good crop and the plants were sold shortly after measurements were made.

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RESULTS AND DISCUSSION

Oxadiazon injury was not visible until after the heavy rain of 1.12 in. on July 28. The rain may have splashed the material on the leaves causing leaf burn and temporarily stunted the plants. This is shown by a tolerance rating of 4 in Tables 6 and 7. Metolachlor 8E also was harmful if applied over the plants giving a rating of 6 in Table 6 and 4 in Table 7. All other above container treatments appeared safe. Table 5 data shows that all under pot treatments were also safe.

The predominant weed was purslane (Portulaca oleracea L.) with some common groundsel (Senecio vulgaris L.) and crabgrass (Digitaria sanguinalis (L.) Scop.). Weed control was best with materials applied before setting out the plants. The black plastic and the woven cloth gave excellent weed control. Napropamide WP, oxadiazon WP, oryzalin WP and oxadiazon 2G were very effective under the pots. There were no consistent differences in size of plants as related to treatment except the metolachlor 8E and untreated plots had smaller growth indices (Tables 5, 6, 7).

Applying herbicides before placing the containers in the growing area will safely reduce the weeds coming from the infested soil. The planting media is relatively weed free and would have to receive weed seeds from weeds nearby to be a factor with a short term crop like chrysanthemums that cover the container after the second pinch.

LITERATURE CITED

1. Bing, A. 1982. Postplant preemergence weed control in field grown bedding plants. NEWSS 36:261-265.

Table 1. Herbicides applied preemergence to container grown chrysanthemums.

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-methoxyl-1-methylethyl)acetamide	6E 15G
Napropamide	2-(a-naphthoxy)-N,N-diethylpropionamide	50WP 10G
Oxadiazon	2-tert-butyl-4-(2,4-dichloro-5-isopropoxyphenyl)Δ^{2-}1,3,4-ozadiazolin-5-one	2G, 2EC, 75WP
Oxyfluorfen	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene	1G
Oryzalin	3,5-dinitro-N^4,N^4-dipropylsulfanilamide	75 WP
Chloroxuron	3-[p-(p-chlorophenoxy)phenyl]-1,-dinethyl-urea	50WP

Table 2. Weed control by treatments applied before placing chrysanthemum plants on the soil surface, treated June 30, plants placed June 30, weed growth rated on July 15, 1982 at Riverhead, New York.

Treatment		Weed control					
Herbicide	Rate lb ai/A	General	Grass	Non-Grass	Purs[b]	Gro	Crab
Handweeded		10[a]	10	10	10	10	10
Oryzalin 75WP	4	8	10	8	9	9	10
Oxadiazon 2G	4	8	10	8	8	9	10
Napropamide 50WP	4	10					
Chloroxuron 50WP	3	7	9	7	7	10	9
Metolachlor 8E	3	9	9	9	9	9	10
Untreated		2	6	3	3	10	7
Black plastic		10					
Oxadiazon 50WP	4	10					
Napropamide 5G	4	3	8	3	3	9	8
Metolachlor 15G	3	7	10	7	7	10	10
Oxyfluorfen 1G	0.5	5	6	6	6	9	7
Green cloth		10					
Green cloth		10					

(a) Weed control rating is 1 = full of weeds to 7 = acceptable control to 10 = no weeds (a high rating may be due to good control or lack of weeds in the area). Each plot is 10 X 10 feet.

(b) Purs = purslane, Gro = groundsel, Crab = crabgrass.

Table 3. Weed control by treatments applied over the containers of chrysanthemum plants after being placed in the growing area. Pots set and treatments made June 30, ratings were made July 15, 1982 at Riverhead, New York.

Treatment		Weed control					
Herbicide	Rate lb ai/A	General	Non-Grass	Grass	Purs[b]	Gro	Crab
Oryzalin 75WP	4	6[a]	6	7	6	7	9
Metolachlor 8E	3	6	6	6	6	9	6
Oxyfluorfen 1G	0.5	6	7	7	7	8	10
Oxadiazon 2G	4	7	8	7	7	8	10
Metolachlor 15G	3	6	8	6	7	8	10
Untreated		3	8	3	3	10	8
Napropamide 50WP	4	5	7	5	5	10	8
Handweeded (not weeded)		2	7	2	2	10	7
Oxadiazon 50WP	4	7	7	8	8	10	8
Napropamide 5G	4	4	9	4	4	9	10
Chloroxuron 50WP	3	6	8	6	6	10	8

[a] Weed control rating is 1 = full of weeds to 7 = acceptable control to 10 = no weeds (a high rating may be due to good control or lack of weeds in the area). Each plot is 10 x 10 feet.

[b] Purs = purslane, Gro = groundsel, Crab = crabgrass.

Table 4. Weed control by treatments made on bed before and again over plants when placed on the growing area. Treated and plants set out on June 30, 1982, weeds rated July 15 at Riverhead, New York.

Treatment							
Herbicide	Rate lb ai/A	General	Grass	Non-Grass	Purs[b]	Gro	Crab
Napropamide 50WP	4	7[a]	8	7	7	9	8
Chloroxuron 50WP	3	7	7	8	8	10	7
Untreated		2	5	3	4	8	6
Oxadiazon 2G	4	8	9	9	9	9	10
Handweeded		10					
Napropamide 5G	4	10					
Oxyfluorfen 1G	0.5	8	8	10	10	10	8
Oxadiazon 2EC under	4						
50WP over	4	10					
Metolachlor 15G	3	10					
Oryzalin 75WP	4	9	10	9			

[a] Weed control rating is 1 = full of weeds to 7 = acceptable control to 10 = no weeds (a high rating may be due to good control or lack of weeds in the area). Each plot is 10 X 10 feet.

[b] Purs = purslane, Gro = groundsel, Crab = crabgrass.

Table 5. Tolerance of container grown chrysanthemum plants var. Jackpot potted June 21-22 to herbicides placed on the soil June 30, pots placed on soil June 30, rated on July 9 and measured September 10, 1982 at Riverhead, New York.

Treatment			Growth index		
Herbicide	Rate lb ai/A	Tolerance[a]	Width in inches	X height in inches	= index
Handweeded		10[b]	15[b]	17	255
Oryzalin 75WP	4	10	15	15	225
Oxadiazon 2G	4	10	18	13	234
Napropamide 50WP	4	10	17	13	221
Chloroxuron 50WP	3	10	17	12	204
Metolachlor 8E	3	10	15	12	180
Untreated		10	16	11	176
Black plastic		9	16	13	208
Oxadiazon 50WP	4	10	17	13	221
Napropamide 5G	4	10	17	13	221
Metolachlor 15G	3	10	17	13	221
Oxyfluorfen 1G	0.5	10	16	12	192
Green cloth		10	17	13	221
Green cloth		10	17	14	238

[a] Rating of 1 = dead or missing to 7 = acceptable growth to 10 = maximum growth.

[b] Average of 14 plants in each treatment.

Table 6. Tolerance of container grown chrysanthemum var Jackpot planted June 21-22 to herbicides applied over the containers. Pots set in bed and treated June 30, rated on July 9, and measured September 10, 1982 at Riverhead, New York.

Treatment			Growth index		
Material	Rate lb ai/A	Tolerance[a]	Width X heigth in inches=index		
Oryzalin 75WP	4	10[b]	15	11	165
Metolachlor 8E	3	6	15	11	165
Oxyfluorfen 1G	0.5	10	17	12	204
Oxadiazon 2G	4	9	31	12	216
Metolachlor 15G	3	10	18	12	216
Untreated		10	17	12	204
Napropamide 50WP	4	10	16	11	176
Handweeded		10	16	12	192
Oxadiazon 50WP	4	4	16	12	192
Napropamide 5G	4	10	18	13	234
Chloroxuron 50WP	3	10	18	13	234

(a) Rating of 1 = dead or missing to 7 = acceptable growth to 10 = maximum growth.

(b) Average of 14 plants in each treatment.

Table 7. Tolerance of container grown chrysanthemums var Jackpot planted June 21-22 to herbicides applied to the soil June 30, plants placed June 30, treatment over the containers June 30, rated July 9 and measured September 10, 1982.

Treatment			Growth index		
Herbicide	Rate lb ai/A	Tolerance	Width X height in inches=index		
Napropamide 50WP	4	10	17	13	221
Chloroxuron 50WP	3	10	18	12	216
Untreated		10	16	13	208
Oxadiazon 2G	4	10	18	13	234
Metolachlor 8E	3	4	15	11	165
Handweeded		10	17	14	238
Napropamide 5G	4	10	17	13	221
Oxyfluorfen 1G	0.5	9	18	14	252
Oxadiazon under 2EC	4				
over 50WP	4	4	14	11	154
Metolachlor 15G	4	10	17	13	221
Oryzalin 75WP	4	10	17	13	221

A ROTARY HERBICIDE WIPER--A NEW CONCEPT IN WIPING

W. V. Welker, Jr. and D. L. Peterson

ABSTRACT

Great strides have been made in recent years in the selective placement of herbicides. Directed sprays and granular formulations place the herbicide beneath the crop while the recirculating sprayer, the roller applicator, the ropewick applicator, and the endless belt wiper selectively control weeds that are taller than the crop. A need still exists for equipment to selectively apply herbicides beneath certain crops. We will describe a wiper that we developed that facilitates the application of herbicides beneath horticultural crops utilizing a rotary principal.

The wiper consists of a circular manifold made of pipe or tubing embedded in a polyurethane foam pad. Very small holes, 10 cm apart, in the manifold distribute the herbicide in the foam pad. The herbicide is fed from a reservoir through a pipe swivel joint which allows a connecting pipe and manifold to be rotated. The pad is covered with a protective material that is held in place by a wooden disk above and below the horizontal surfaces of the wiping pad. The bottom wooden disk is smaller in diameter than the upper disk to allow more surface contact of the weeds.

A hydraulic motor, drive sprocket, and chain power the rotating wiper member. The rotation speed of the wiper member is variable by conventional hydraulic means. A free-wheeling wheel that is larger in diameter than the wiping pad is mounted just above the rotating pad. The wiper is mounted on a frame support arm which pivots in a horizontal plane. The support arm is spring-loaded thus causing the wiper to move around a tree trunk or other non-targeted shrub while the free-wheeling wheel prevents contact with the wiper pad.

Many variations using the basic principal of delivering the herbicide internally to a rotating wiper surface are possible. We have had success with both a circular manifold and a cross manifold. A great deal of flexibility to obtain the desired degree of wetting of the weeds is possible such as varying the ground speed of the unit, varying the rotation speed, or changing the configuration of the wiping surface. Automatic moisture sensing equipment can be added to maintain a constant desired moisture level. The circular configuration, while rotating, greatly increases the wiping surface. Excellent contact with weeds is obtained due to the combination of rotation of the wiping disk and the forward motion of the wiper.

The use of weed wiping equipment such as this affords selectivity unobtainable with conventional equipment, while increasing safety to the operator and reducing environmental hazards.

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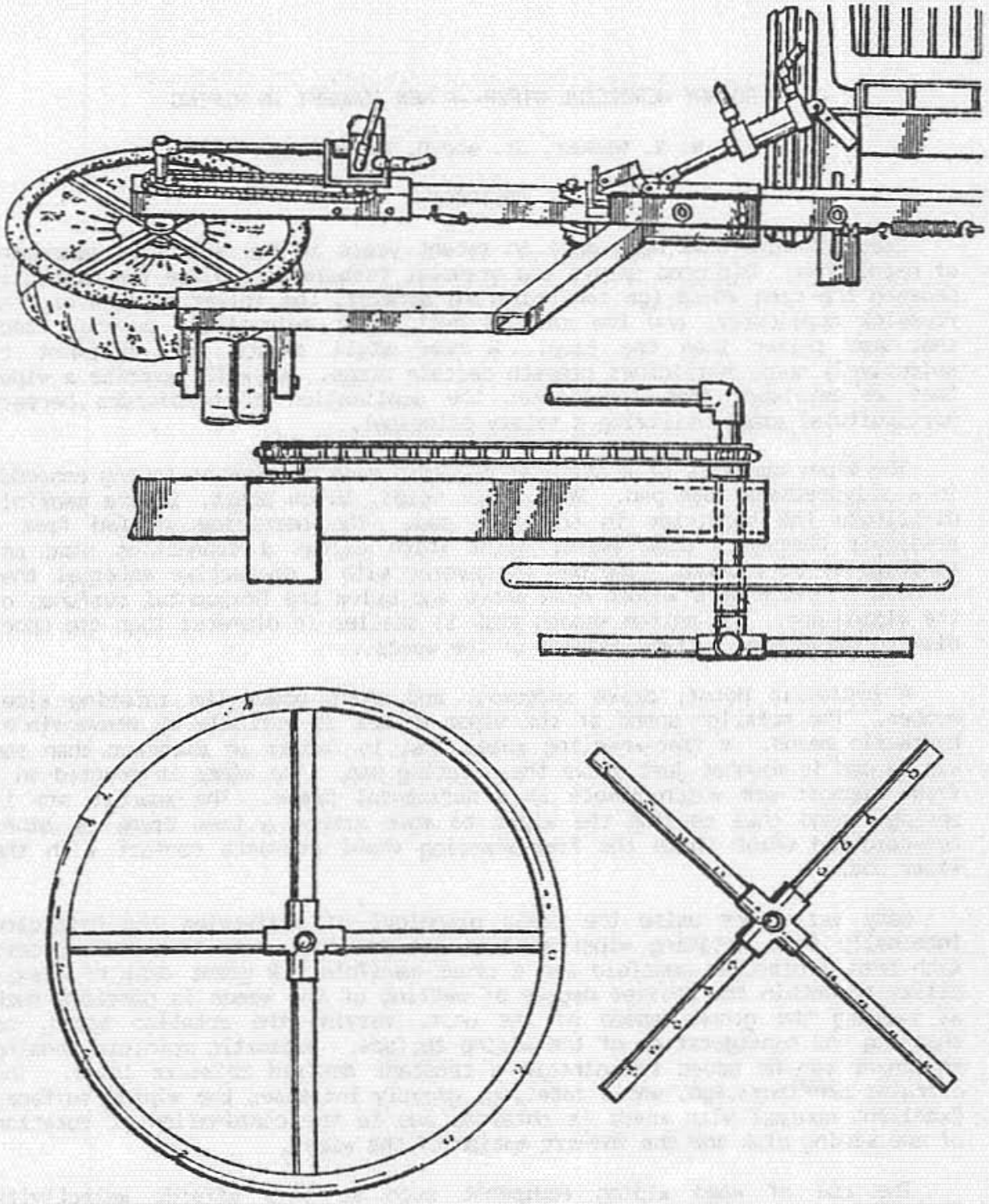

Figure 1. Components of rotary herbicide wiper: (top) tractor mounted rotary wiper in operating position including height control wheels and support frame; (center) diagram showing rotary drive and herbicide feed to exposed manifold without sponge cover as well as free-wheeling protective wheel above manifold; (lower left) circular manifold; (lower right) cross manifold.

TURF RENOVATION WITH SC-0224, SC-0545, AND GLYPHOSATE

J. Ray Frank[1/]

ABSTRACT

Established turf areas may require renovation because of poor stand or extensive weed competition. A non-selective, rapid acting non-residual herbicide can be a valuable tool for establishing new turf.

An established field of meadow fescue (Festuca pratensis Hudson) containing a mixture of broadleaf weeds was spray treated with SC-0224, SC-0545, or glyphosate at 2.2 or 4.5 kg/ha on August 9, 1982. The experimental design was a randomized complete block with four replicates. Each plot was 8.9 sq meters.

The percentage weed cover and the major species present in each plot were determined after 9 and 35 days. After nine days the weed cover in plots treated with 4.5 kg/ha of glyphosate, SC-0224, or SC-0545 was reduced 92, 90, and 85%, respectively. The same compounds applied at 2.2 kg/ha reduced the weed cover 80, 77, and 79%, respectively. These compounds at 4.5 kg/ha reduced the percentage weed cover by 96% after 35 days. The compounds at 2.2 kg/ha reduced the weed cover by 94.5, 93.5, and 92.5%.

Sixty days after treatment the entire field was overseeded with Italian ryegrass (Lolium multiflorum Lam.) at 112 kg/ha. Percentage weed cover, weed density, and percentage of major species were determined 21 days after overseeding. An excellent stand of ryegrass was obtained with no significant difference in percentage cover, or number of Italian rye seedlings/0.1 m^2 observed with any of the three compounds at either rate.

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EFFECT OF PP-333 AND FLURPRIMIDOL (EL-500) ON TALL FESCUE IN AN APPLE ORCHARD

J. M. Breuninger, T. L. Watschke and L. D. Tukey[1/]

ABSTRACT

PP-333 and flurprimidol were evaluated for growth retardation of a tall fescue alleyway in an apple orchard. On June 6, 1980, PP-333 50W was applied with a hand-held boom at rates of 2.2, 3.4 and 4.5 kg a.i./ha. PP-333 caused a significant height reduction for 14 weeks following application and eliminated 12 mowings. Plots were differentially discolored during this period with the most discoloration arising in plots treated with the highest rates of PP-333.

In October, samples were removed from each plot and studied for morphological changes. PP-333 at the 3.4 kg a.i./ha rate increased tiller density by 54%. PP-333 applications also increased the number of leaves per tiller and increased leaf widths. The highest rate reduced leaf length.

Flurprimidol 50W was applied to the area on June 6, 1981, at the same rates as PP-333. In 1981, the treatments decreased canopy height for 12 weeks and improved color ratings. Samples removed in 1981 showed tiller density to be increased by the 4.5 kg a.i./ha rate.

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GROWTH REGULATORS, NITROGEN LEVELS, AND HERBICIDES ON TURF

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ABSTRACT

The response of Kentucky bluegrass (Poa pratensis L.) turf to growth regulators as effected by three levels of nitrogen treatment and three herbicides was evaluated in 1981 and 1982. Treatments were applied to the same plots both years. Main plots in three replications were three nitrogen treatments in strips, and three herbicide treatments in square blocks. Subplots were five growth regulator treatments in nine replications. Treatments were randomized.

Height of foliage six weeks after treatment, and just before mowing for yield, was significantly affected by nitrogen rates and growth regulators. The interaction of nitrogen x growth regulator was significant. All growth regulators reduced growth 25 to 40%. Mefluidide had least growth followed by fluprimidol. Height of foliage treatments made at two-week intervals after treatment showed differential rates of growth.

Bluegrass was heading out by four weeks after treatment and was fully headed by six weeks. Two treatments, mefluidide and MH + chlorflurenol, reduced percent heading 99 and 85%, respectively. Fluprimidol reduced heading 15%. Height of heads in the check was 37 centimeters. Heads in treated plots were about 30% less in height than the check.

Yields six weeks after treatment were a comprehensive measure of growth and were significantly affected by nitrogen and growth regulators. The nitrogen x growth regulator interaction was also highly significant. Reductions in yield ranged from 15 to 39%. Mefluidide had greatest reduction followed by fluprimidol.

Differences in turf quality ratings were large soon after treatment. Mefluidide almost completely prevented growth and reduced the green color when evaluated 2 and 6 weeks after treatment. The differences in quality among growth regulators were not great for regrowth after mowing but fluprimidol received significantly the best rating. In 1981 a severe epiphytotic of leaf spot was evident by six weeks after treatment being particularly severe in plots treated with mefluidide, fluprimidol, and MH + chlorflurenol. Oxadiazon caused an off-color of foliage two weeks after treatment especially in plots treated with mefluidide. Later in the growing season quality differences for herbicides were not significant.

Significant weed problem did not develop in either year because of dry summers and falls and excellent turf at the beginning of the experiment.

It is possible that in future studies growth regulators such as chlorsulfuron and fluprimidol, which in addition to reducing growth also had weed control potential, could be advantageously combined with mefluidide and MH + chlorflurenol which greatly reduced both heading percent and growth.

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EVALUATION OF GROWTH RETARDANTS FOR ROADSIDE TURF[1/]

C.D. Sawyer, R.C. Wakefield and J.A. Jagschitz[2/]

ABSTRACT

A mixed stand of red fescue (Festuca rubra L. 'Pennlawn') and Colonial bentgrass (Agrostis tenuis Sibth. 'Exeter') was treated with mefluidide, MH, MH plus CF, or combinations of mefluidide with PP333 or EL500. Combinations of mefluidide with PP333 or EL500 were the most effective treatments in reducing shoot growth. All treatments resulted in excellent suppression of bentgrass seedheads, however, only MH and MH plus CF provided lasting control of red fescue seedheads. Turf injury was minimal and considered to be within acceptable limits for roadside turf. PP333 and EL500 appeared to provide preemergent crabgrass (Digitaria spp.) control.

INTRODUCTION

Plant growth retardants (PGR's) provide an effective means of reducing mowing requirements and are particularly useful in roadside maintenance where extensive hand-mowing is costly and often dangerous. Objectionable discoloration of turf has prevented widespread use of PGR's on homeowner and other high-maintenance lawns, however, injury has often been within acceptable limits for use on roadside turf (2,3). The following test was established to evaluate several PGR's for roadside use in Rhode Island.

MATERIALS AND METHODS

Plots were established on a six-year-old stand of 65% red fescue, 30% Colonial bentgrass and 5% Kentucky bluegrass (Poa pratensis L. 'Park') and perennial ryegrass (Lolium perenne L. 'Manhattan') located at the University of Rhode Island Agricultural Experiment Station, Kingston, R.I. The stand had not been fertilized or limed since seeding and was maintained at a mowing height of 4.5-5.1 cm.

A split plot design was used with four replications. Main plot treatments consisted of two dates of fertilizer application. Half of each block was fertilized April 20 or May 10 with 10-6-4 fertilizer applied at 48.8 kg/ha (1 lb. N/1000 ft^2).

PGR's were applied to 1.4 by 1.8 m subplots May 3 with a CO_2 pressurized sprayer delivering 75 gpa at 20 psi. The following growth regulators were used: mefluidide 2S [N-[2,4-dimethyl-5-[[(trifluoromethyl)sulfonyl]amino] phenyl]acetamide], PP333 (proposed common name: paclobutrazol) 50WP [(2RS,3RS)-1-(4-chlorophenyl)-4,4-dimethyl-2-1,2,4-triazol-L-yL-)pentan-3-ol], EL500 50WP [a-(1-methylethyl)-a-[4-(trifluoromethoxy)phenyl]-5-pyrimidine methanol], MH (1,2-dihydro-3,6-pyridazinedione), and chlorfluranol (methyl-2-chloro-9-hydroxyfluorene-9-carboxylate). Rates and combinations of materials are given

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1/ Contribution No. 2116 , Agricultural Experiment Station, Kingston, R.I.

2/ Research associate, Professor and Associate Professor respectively, Dept. of Plant and Soil Science, Univ. of Rhode Island, Kingston, R.I. 02881.

in Table 1.

Half of each plot was mowed to 6.5 cm June 15 (six weeks after treatment) with a rotary mower. Regrowth and the previously unmowed portion of each plot were mowed July 13 (10 weeks after treatment). Clippings from each mowing were collected, dried in an oven at 50°C, and weighed. Seedheads in a 645 cm^2 (1 ft^2) quadrat were clipped and counted July 12.

Turf injury and density were rated on a scale of 0 through 10 with 10 indicating no injury or optimum density. A rating of 6 was considered to be acceptable for roadside turf.

Two hours after the last treatment was applied, 0.5 mm of rain fell in a brief shower. The test area was irrigated (13 mm) May 12.

RESULTS AND DISCUSSION

Growth suppression

All treatments were effective in reducing clipping weight and height (Table 1). Combinations of mefluidide with the high rates of PP333 and EL500 were most effective. Grass regrowth was higher in plots treated with MH or MH plus CF than in control plots.

Seedhead suppression

As with growth suppression, all treatments resulted in fewer seedheads than in untreated plots (Table 1). MH and MH plus CF were effective in controlling red fescue seedheads. Both rates of mefluidide alone (0.42 and 0.56 kg/ha) suppressed seedheads more effectively than when combined with PP333, suggesting that the 0.14 kg/ha rate of mefluidide may not have been adequate.

Injury

Discoloration of grass was minimal and well within acceptable limits for roadside turf (Table 2). Three weeks after treatment discoloration was most noticeable in MH and MH plus CF treatments, particularly in treatments fertilized at the early date (4/20). Seven weeks after treatment injury was more noticeable in treatments containing PP333 and EL500.

Density and crabgrass cover

All PGR treatments resulted in turf that was less dense than that in control plots (Table 2).

No herbicides had been used for weed control, and plots were colonized by weedy annual grasses, primarily crabgrasses (*Digitaria sanguinalis* (L.) Scop. and *D. ischaemum* (Schreb.) Muhl.) (Table 2). Both PP333 and EL500 appeared to provide preemergent crabgrass control, supporting observations previously reported by Dernoeden (1).

Table 1. Response of red fescue-Colonial bentgrass turf to growth regulators applied May 3, 1982.

Treatment		Clipping Weight			Height		Seedheads	
		6/15	7/13	7/13	7/12		7/12	
Chemical	Rate		Unmowed	Regrowth	Unmowed	Regrowth	Fescue	Bent
	kg/ha		kg dry wt/ha		cm		seedheads/m²	
Mefluidide	0.42	700 b*	1425 a-c	480 a	13.7 b	7.6 ab	351 cd	15 b
Mefluidide	0.56	550 b-d	1099 b-d	342 a-c	13.7 b	7.1 a-c	339 cd	7 b
PP333 + mefluidide	0.42 + 0.14	625 bc	965 cd	387 a-c	9.7 e	6.6 cd	718 b	70 b
PP333 + mefluidide	0.84 + 0.14	430 cd	783 d	284 c	8.1 f	6.1 d	764 ab	52 b
EL500 + mefluidide	0.84 + 0.14	573 bc	1200 b-d	401 a-c	10.4 de	7.1 a-c	591 bc	59 b
EL500 + mefluidide	1.68 + 0.14	354 d	735 d	269 c	8.1 f	6.1 d	467 bc	71 b
MH	4.48	574 bc	1031 cd	468 a	11.4 cd	7.9 a	23 e	48 b
MH + CF	3.36 + 1.12	595 bc	1572 ab	452 ab	12.4 bc	7.9 a	79 de	74 b
Untreated	-	1429 a	1891 a	307 bc	22.9 a	6.9 b-d	1040 a	552 a

*Means (4 replications) within columns followed by different letters are significantly different at the .05 level according to Duncan's Multiple Range Test.

Table 2. Response of red fescue-Colonial bentgrass turf to growth regulators applied May 3, 1982.

Treatment		Injury[1]				Annual Grass Cover
		5/25		6/21	Density[1]	
Chemical	Rate	Fert. 4/20	Applic. 5/10		6/21	8/24
	kg/ha					%
Mefluidide	0.42	8.5 c*	9.0 b	9.2 a	8.9 b	22 ab
Mefluidide	0.56	9.0 b	9.0 b	9.2 a	8.6 b	14 bc
PP333 + mefluidide	0.42 + 0.14	9.0 b	9.0 b	7.8 c	7.5 d	3 c
PP333 + mefluidide	0.84 + 0.14	9.0 b	9.0 b	7.2 c	7.3 d	2 c
EL500 + mefluidide	0.84 + 0.14	9.0 b	9.0 b	7.9 bc	8.3 bc	2 c
EL500 + mefluidide	1.68 + 0.14	9.0 b	9.0 b	7.6 c	7.5 d	1 c
MH	4.48	7.2 d	8.5 c	7.9 bc	7.9 cd	22 ab
MH + CF	3.36 + 1.12	8.2 c	8.5 c	8.4 b	8.6 b	32 a
Untreated	-	10.0 a	10.0 a	9.6 a	9.6 a	20 ab

*Means (4 replications) within columns and between fertilizer columns followed by different letters are significantly different at the .05 level according to Duncan's Multiple Range Test.

[1]Rated on a scale of 1 through 10, with 10 indicating no injury or optimum density. A rating of 6 was considered acceptable for roadside turf.

Fertilization

Time of fertilizer application (two weeks before PGR treatment vs. one week after treatment) had no effect on clipping weight, height, regrowth, seedhead suppression, or turf density. Injury ratings made three weeks after PGR application indicated that discoloration was less noticeable in plots treated with MH where fertilizer had been applied on week after the PGR's (Table 2).

REFERENCES

1. Dernoeden, P.H. 1982. Effects of growth retardants applied three successive years to a Kentucky bluegrass turf. Proc. NEWSS 36:336-343.

2. Duell, R.W., R.M. Schmit and S.W. Cosky. 1980. Growth retardant effects on grasses for roadsides. pp. 311-323. Proc. Third Int. Turfgrass Res. Conf. ASA-CSSA-SSSA, 677 South Segoe Rd., Madison, WI 53711.

3. Wakefield, R.C. and S.L. Fales. 1980. Effects of growth retardants on the shoot and root growth of roadside turfgrasses. pp. 303-309. Proc. Third Int. Turfgrass Res. Conf. ASA-CSSA-SSSA, 677 South Segoe Rd., Madison, WI 53711.

PROBLEMS IN MUGWORT CONTROL IN LAWNS

A. Bing[1/]

ABSTRACT

Mugwort (Artemesia vulgaris L.) is often called chrysanthemum weed because the young shoots resemble a chrysanthemum. It is a perennial occasionally reproducing by seeds but mostly by extensive vigorous rootstocks. This weed has become a serious problem in recent years. It is a frequent invader of nurseries being spread by the pieces of rootstock in the soil that is moved with plants. When mugwort infested soil is brought with plants to landscape plantings around private homes, business properties, parks and cemeteries, it quickly becomes established and spreads. Regrading or other moving of infested soil on a property spreads the mugwort.

Mowing does not effectively control mugwort. The usual broadleaf weed control treatments have not been successful in preventing the rapid infestation of turf grass areas.

A series of tests were carried out in 1981 and 1982 on the grounds of the State University at Farmingdale, New York and at nearby St. Charles Cemetery to evaluate some herbicides for mugwort control. The following sprays were found to be ineffective: triethylamine salt of triclopyr, butoxyethyl ester of triclopyr, 2,4-D plus triclopyr, bromoxynil, 2,4-D + MCPP, dicamba, dicamba + 2,4-D and granular applications of combinations of 2,4-D, MCPP and dicamba. Single spray applications of 2,4-D + 2,4-DP and three-way combinations of 2,4-D + MCPP + dicamba gave variable but reasonable control at different times of the year.

Repeat treatments of 2,4-D + 2,4-DP and the three-way combination of 2,4-D, MCPP and dicamba reduced the stand of mugwort to only a few shoots per 100 sq ft plot.

Several materials will cause a temporary burning of the mugwort foliage but it grows back again. A systemic must be picked up by the leaves and be moved down to the rootstocks to be effective. Spraying during periods of water stress could be ineffective.

In nurseries glyphosate treatments have to be repeated several times to bring mugwort under control. On turfgrass repeat treatments of 2,4-D + 2,4-DP or the three-way combination of 2,4-D, MCPP and dicamba may be necessary for acceptable control. This must be done along with a careful look at all soil that is brought in as top soil or around plant roots to avoid bringing in more mugwort.

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BROADLEAF WEED CONTROL IN LOW MAINTENANCE TURF

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ABSTRACT

Various single and combination herbicide treatments were evaluated for their control of dandelion (Taraxacum officinale Weber), buckhorn plantain (Plantago lanceolata), and white clover (Trifolium repens L.) in a low maintenance turfgrass stand containing fine fescue (50%), Kentucky bluegrass (30%), tall fescue (10%) and other course species (10%). Herbicides were applied in liquid form on May 11 and September 24, 1982. Fertilizer equivalent to 0.49 kg N/100 M^2 from a 31-3-10 source was applied to half of each treatment at the time of the second application of herbicides.

After the spring application, 2,4-D was rated the best singular applied herbicide for the control of dandelion and buckhorn plantain, while dicamba was the best for controlling white clover. An increase in white clover occurred in plots treated with 2,4-D and an increase in buckhorn plantain occurred where dicamba was used alone. Decreasing the 2,4-D to dicamba ratio from 4:1 to 10:1 resulted in a decline in white clover control from 66 to 31 percent. The combination of 2,4-D and 2,4-DP provided excellent dandelion and buckhorn plantain control and control of white clover comparable to the 4:1 ratio of 2,4-D to dicamba. No difference in the control of any of the weeds existed between the three way combinations of 2,4-D, MCPP, and dicamba regardless of whether the components were tank mixed or premixed. Tank mixing the three components at lower rates did not reduce control of dandelion or buckhorn plantain, but control of white clover declined. The high rates of both triclopyr formulations provided good control of dandelion and white clover, but only fair control of buckhorn plantain. The high rate of the ester formulation of triclopyr caused a temporary discoloration of the fine fescue in the stand.

Ratings taken approximately one month following the fall application showed that control of dandelion and white clover was increased for all treatments over the single spring application. Control of buckhorn plantain was improved for most treatments with the exception of triclopyr. Fertilizer improved the control of white clover, but improvement in buckhorn plantain control was inconsistent. Spring-fall applications of the herbicides used in this study improved control over spring only treatment and fertilization improved efficacy, particularly on white clover.

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Table 1. The control of dandelion, buckhorn plantain, and white clover in turf resulting from sprayed applications of herbicides on May 11, 1982. Ratings were made on June 14, 1982.

Treatments	Rates (lbs. ai/A)	Dandelion	Buckhorn Plantain	White Clover
		% control		
2,4-D	1.12	100	95	-21
2,4-D + Dicamba	1.12 + 0.28	93	84	66
2,4-D + Dicamba	1.12 + 0.14	95	84	56
2,4-D + Dicamba	1.12 + 0.11	80	89	31
Dicamba	0.56	95	-33	93
2,4-D + 2,4-DP	1.12 + 1.12	93	92	70
2,4-D + MCPP + Dicamba*	1.12 + 0.56 + 0.11	95	93	79
2,4-D + MCPP + Dicamba	1.12 + 0.56 + 0.11	98	97	80
2,4-D + MCPP + Dicamba*	0.83 + 0.41 + 0.07	91	87	48
Triclopyr 3A	1.12	76	54	65
Triclopyr 3A	2.24	92	44	91
Triclopyr 4E	0.56	76	8	80
Triclopyr 4E	1.68	95	73	95

*Combinations were tank mixed.

Table 2. The control of dandelion, buckhorn plantain, and white clover in turf resulting from herbicide applications on May 11 and September 24, 1984. Half of each plot was fertilized (F) at 0.49 Kg N/100 m^2 on September 24, 1982. Control rated October 22, 1982.

Treatments	Rates (kg ai/ha)	Dandelion		Buckhorn Plantain		White Clover	
		F	NF	F	NF	F	NF
		% Control					
2,4-D	1.12	100	100	98	100	92	84
2,4-D + Dicamba	1.12 + 0.28	100	88	99	92	100	100
2,4-D + Dicamba	1.12 + 0.14	100	100	100	88	100	100
2,4-D + Dicamba	1.12 + 0.11	100	100	88	84	64	81
Dicamba	0.56	100	100	83	73	100	100
2,4-D + 2.4-DP	1.12 + 1.12	100	100	83	100	100	100
2,4-D + MCPP + Dicamba*	1.12 + 0.56 + 0.11	100	97	89	95	100	100
2,4-D + MCPP + Dicamba	1.12 + 0.56 + 0.11	100	100	92	81	100	98
2,4-D + MCPP + Dicamba*	0.83 + 0.41 + 0.07	100	100	82	78	100	93
Triclopyr	1.12	100	100	53	33	97	100
Triclopyr	2.24	100	100	67	30	100	100
Triclopyr	0.56	100	100	33	7	100	100
Triclopyr	1.68	100	100	55	55	100	100

*Combinations were tank mixed.

THE INFLUENCE OF SEVERAL DICAMBA FORMULATIONS AND 2,4-D PLUS DICHLORPROP ON THE QUALITY OF SEASIDE CREEPING BENTGRASS

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ABSTRACT

Several herbicides were applied sequentially at various rates to evaluate the tolerance of Seaside creeping bentgrass to herbicides. Dicamba-DMA, dicamba-Na and experimental product CN10-4359T were applied at single application rates of 0.25, 0.50, 0.75 and 1.0 lb. a.i./A. A 2,4-D + dichlorprop combination applied 1.0 + 1.0 lb. a.i./A was also included. Treatments were made May 25, June 23, August 3, and September 9, 1982. Materials were applied sequentially, initially to the entire plot, then to 3/4, 1/2, 1/4 on subsequent dates. This corresponds with having 1x, 2x, 3x and 4x rates of the single application. To assess the herbicide effects visual quality ratings were taken within 10 days of treatment. From this study it can be concluded that standard recommended rates of 0.25 lb. a.i./A of dicamba even when applied 4 times during the year caused little or no observable damage to Seaside creeping bentgrass. However, higher rates did cause a reduction of quality and in many cases, unacceptable quality turfgrass.

INTRODUCTION

Dicamba is widely used alone and in combination with 2,4-D and MCPP for control of broadleaved weeds in turfgrass. Creeping bentgrass, (Agrostis palustris) has shown sensitivity to applications of dicamba. There is need for more information on the safety of repeat applications and formulations of dicamba on creeping bentgrass used for golf courses and lawns. The 2,4-D + dichlorprop combination was used for comparison.

MATERIALS AND METHODS

The study was conducted on a 4-year-old stand of bentgrass var. Seaside. The soil was Arkport, a fine sandy loam. The turf was maintained under golf course tee conditions; mowed three times a week at 7/16 in., fertilized annually with 4 lbs. of nitrogen per 1,000 sq. ft. with urea (45-0-0), limed to a pH of 6.0 and irrigated to avoid drought stress.

Three dicamba formulations; dicamba-DMA, 4S, (the dimethylamine salt), 3,6-dichloro-o-anisic acid, dicamba-Na, 2S, (the sodium form) and experimental product CN10-4359T, 50WP, were applied at 0.25 lb., 0.50 lbs., 0.50 lb. plus surfactant (Surfside #37, 17.5 oz/1,000 sq. ft.) and 1.0 lb. of a.i./A, and a combination formulation of 2,4-D (2, 4 dichlorophenoxy acetic acid) plus dichlorprop 1 + 1 EC (2- (2,4-dichlorophenoxy) propionic acid) at 1.0 lb + 1.0 lb of a.i./A. An

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untreated plot was included.

Three reps of each treatment were arranged in a randomized complete block experiment design. Each main treatment plot was 5' x 20'. Materials were applied sequentially, initially to the entire plot, then to 3/4, 1/2, 1/4 on subsequent dates. This corresponds with having 1x, 2x, 3x and 4x rates of the single application. Treatments were made May 25, June 23, August 3 and September 9, 1982 and visual quality ratings were made June 2, June 28, August 12 and September 17, 1982. A final overall observation was made September 28. The rating system used to assess the relative degree of damage was 1 equalled 100% kill, 6 being acceptable turf and 9 best, with no damage. Ratings were made of the treated area only.

RESULTS AND DISCUSSION

Table 1. shows the results after one application. The 0.25 lb a.i./A dicamba treatments produced acceptable turfgrass. The 0.50 lb a.i./A rate with and without surfactant showed questionable acceptance on June 2. However, the turfgrass recovered within 2 weeks of treatment. The 1.0 lb. rate caused greater initial damage. The 2,4-D + dichlorprop combination also caused slight injury but the quality of the creeping bentgrass was still acceptable.

Table 2. shows the results following 2 applications. All rates of the Na dicamba formulations and the 1.0 lb. and 2.0 lb. a.i./A rate of DMA caused unacceptable turfgrass and were significantly lower than the check. The CN10-4359T formulation showed a slight reduction in quality but not significant damage. The 2,4-D + dichlorprop combination produced little or no sign of damage.

Table 3 shows the results following three applications. The DMA and Na dicamba formulations caused severe damage at all rates. The CN10-4359T formulation caused unacceptable turfgrass with less damage at the lower rate. The application of 2,4-D + dichlorprop caused unacceptable turfgrass.

Table 4. shows the effects following 4 applications. The DMA and Na dicamba formulations caused turfgrass quality significantly lower than the check. With the CN10-4359T formulation, the 1.0 lb and 2.0 lb + surfactant a.i./A rates caused turfgrass significantly lower in quality than the check but still acceptable. The 2.0 lb without surfactant and the 4.0 lb a.i./A rates caused reduction in quality. The 2,4-D + dichlorprop caused slight damage but was still acceptable.

Table 5. lists the visual quality ratings made 19 days after the last treatment. By September 28th, all of the lower rates, 1.0 lb., 2.0 lb., and 2.0 lb. with surfactant showed turfs that were acceptable with adequate recovery. The 2,4-D plus dichlorprop combination showed no signs of herbicide damage. The highest rates of the dicamba formulations still resulted in unacceptable turf and had quality ratings ranging from 3.7 to 5.3 depending on formulation.

From this experiment it can be concluded that at the standard total recommended rate of 0.12 to 0.25 lb. a.i./A of dicamba and the 1.0 lb. a.i./A rate of 2,4-D + dichlorprop applied 4 times did not result in permanent injury to the Seaside creeping bentgrass. Four repeat applications of dicamba at 0.50 lb. and the 0.50 lb. + surfactant a.i./A rate, which equals 8 times the normal recommended rate, will cause temporary injury. Four repeat applications of dicamba at the 1.0 lb. a.i./A rate which equals 16 times the standard recommended rate, caused injury that lasted longer.

Results of this study showed that little or no damage of several herbicide formulations applied at standard recommended rates would occur on Seaside creeping bentgrass. However, it is not known whether the damage would occur on other creeping bentgrass cultivars or species of bentgrass.

Table 1. Effect of several herbicide formulations on the visual quality of creeping bentgrass. Treatment was made on May 25 and evaluated on June 2.

	Quality ratings after treatment lb a.i./A				
Chemical	0	0.25	0.5	0.5+S[t]	1.0
dicamba - DMA (4S)		7.7[+]a-c*	5.7d-f	6.3b-e	4.3f
dicamba - Na (2S)		8.0ab	5.3d-f	5.3d-f	5.0ef
dicamba - CN10-4359T(50 WP)		6.0c-f	7.0a-d	5.3d-f	5.0ef
2,4-D + dichlorprop (1+1 EC)					6.0c-f
Check	8.3a				

[t] plots treated with surfactant

[+] rating scale = 1=100& kill, 6=acceptable turf, 9=best, no damage

* Values followed by the same letter are not significantly different at the 5% level according to Waller-Duncan K-ratio T Test.

Table 2. Effect of several herbicide formulations on the visual quality of creeping bentgrass. Split treatments were made on May 25 and June 23 and evaluated on June 28.

	Quality ratings after treatment lb. a.i./A				
Chemical	0	0.5	1.0	1.0+S[t]	2.0
dicamba - DMA (4S)		5.7[+]a-d*	4.0d-f	4.7b-f	3.7ef
dicamba - Na (2S)		4.7b-f	4.3c-f	4.7f	3.7f
dicamba - CN10-4359T(50WP)		5.7a-d	6.0a-c	6.0a-c	5.3a-e
2,4-D + dichlorprop (1+1 EC)					6.3ab
Check	7.0a				

[t] plots treated with surfactant

[+] rating scale = 1=100% kill, 6=acceptable turf, 9=best, no damage.

* Values followed by the same letter are not significantly different at the 5% level according to Waller-Duncan K-ratio T Test.

Table 3. Effect of several herbicide formulations on the visual quality of creeping bentgrass. Multiple applications were made May 25, June 23, and August 3 and evaluated on August 12.

	Quality ratings after treatment lb. a.i./A				
Chemical	0	0.75	1.5	1.5+S[t]	3.0
dicamba - DMA (4S)		4.3[+]c-e*	3.7ef	4.0de	2.7f
dicamba - Na (2S)		4.0de	4.0de	4.3c-e	3.3ef
dicamba - CN10-4359T(50WP)		5.3bc	5.0b-d	6.0b	3.7ef
2,4-D + dichlorprop (1+1EC)					5.7b
Check	7.6a				

[t] plots treated with surfactant

[+] rating scale = 1=100% kill, 6=acceptable turf, 9=best, no damage.

* Values followed by the same letter are not significantly different at the 5% level according to Waller-Duncan K-ratio T Test.

Table 4. Effect of several herbicide formulations on the visual quality of creeping bentgrass. Multiple treatments were made May 25, June 23, August 3, September 9 and evaluated on September 17.

	Quality ratings after treatment lb. a.i./A				
Chemical	0	1.0	2.0	2.0+S[t]	4.0
dicamba - DMA (4S)		5.0[+]b-e*	4.0d-f	4.3d-f	3.3f
dicamba - Na (2S)		5.3b-d	4.7ef	4.7c-f	3.7ef
dicamba - CN10-4359T(50WP)		6.0bc	4.7c-f	6.0bc	4.0d-f
2,4-D + dichlorprop(1+1 EC)					6.3b
Check	8.0				

[t] plots treated with surfactant

[+] rating scale = 1=100% kill, 6=acceptable turf, 9=best, no damage.

* Values followed by the same letter are not significantly different at the 5% level according to Waller-Duncan K-ratio T Test.

Table 5. Effect of several herbicide formulations on the visual quality of creeping bentgrass. Visual quality ratings were made 19 days after last treatment of September 9.

	Quality ratings after treatment lb. a.i./A				
Chemical	0	1.0	2.0	2.0+S[t]	4.0
dicamba - DMA (4S)		6.3[+]a-c	6.0b-d	7.0a-c	3.7e
dicamba - Na (2S)		6.7a-c	6.0b-d	7.0a-c	4.3de
dicamba - CN10-4359T(50WP)		6.3a-c	6.3a-c	6.3a-c	5.3c-e
2,4-D + dichlorprop(1+1 EC)					7.7ab
Check	8.0a				

[t] plots treated with surfactant

[+] rating scale = 1=100% kill, 6=acceptable turf, 9=best, no damage.

* Values followed by the same letter are not significantly different at the 5% level according to Waller-Duncan K-ratio T Test.

Postemergence Control of Crabgrass in Turf with MSMA and HOE-581[1/]

P.H. Dernoeden and J.A. Grande[2/]

ABSTRACT

Field studies comparing three rates of MSMA (0.56, 1.12, and 2.24 kg ai/ha) and two MSMA application schedules (7 and 14 day intervals), and three rates of HOE-581 (0.17, 0.28, and 0.56 kg ai/ha) applied once were conducted to evaluate their effectiveness in controlling crabgrass [*Digitaria ischaemum* (Schreb.) Muhl.]. A single or two applications (7 day interval) of 2.24 kg ai/ha MSMA provided excellent control of crabgrass in the 2 to 4 tiller stage when applied mid to late July. Two applications of MSMA (1.12 kg ai/ha on a 7 day interval) provided an acceptable level of control; whereas, the third application of 1.12 kg ai/ha furnished an excellent level of control. Three applications of 0.56 kg ai/ha MSMA, applied on 7 day intervals reduced crabgrass populations 78.6%, but control was judged unacceptable. In an initial study a single application of 0.17 or 0.28 kg ai/ha of HOE-581 did not provide an acceptable level of control. This was attributed to mowing treated crabgrass within 48 h of application and dry environmental conditions during the test period. Further testing, however, yielded excellent crabgrass control with HOE-581 regardless of rate (0.17, 0.28, and 0.56 kg ai/ha) or the use of crop oil. High rates of MSMA (2.24 kg ai/ha) caused an unacceptable level of short term (10 to 14 days) discoloration on 'Citation' perennial ryegrass (*Lolium perenne* L.). Similarly, HOE-581 (0.17 and 0.28 kg ai/ha) caused an unacceptable level of discoloration on tee height (0.75 cm) 'Penncross' creeping bentgrass (*Agrostis palustris* Huds.). The discoloration, however, dissipated about 2 weeks after HOE-581 was applied. HOE-581 also caused a slight stunting and mild discoloration on 'Citation' perennial ryegrass, which persisted for about 30 days. No conspicuous, phytotoxic effects were observed on non-irrigated stands of 'Vantage', 'Pennstar', and 'Sydsport' Kentucky bluegrass (*Poa pratensis* L.), or 'Caravelle', 'Citation', and Pennfine' perennial ryegrass treated with 0.17 or 0.28 kg ai/ha of HOE-581.

INTRODUCTION

Many turfgrass managers are annually confronted with the arduous task of postemergence crabgrass (*Digitaria* spp.) control during summer months. The need for postemergence

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control often arises in the transition zone, although preemergence herbicides had been applied in the spring. Some of the reasons for ineffective crabgrass control from preemergence herbicides are as follows: (a) herbicide was applied after crabgrass had begun to germinate, (b) failure to apply a repeat application of those herbicides having a short residual, (c) absence of rain or proper irrigation following herbicide application, (d) use of improper rates or faulty spray equipment , and (e) disturbance of the herbicide barrier by renovation practices following herbicide application.

Organic arsenicals are the only commercially available postemergence herbicides that effectively control crabgrass in turf. Despite 30 years of usage of these herbicides by turfgrass managers, confusion still exists regarding their proper employment for optimum effectiveness concommitant with minimal phytotoxicity. Hence, the objectives of this study were (a) to demonstrate the importance of rate and timing of application of MSMA (monosodium acid methanearsonate) to achieve the desired results; and (b) to evaluate the postemergence crabgrass control and safety of usage on turfgrasses of HOE-581 (HOE-33171, chemistry undisclosed).

MATERIALS AND METHODS

Theses studies were conducted in 1982 at the University of Maryland Plant Research Farm on a 4 year old stand of 'Citation' perennial ryegrass. The two tests reported here-in compared various rates and application dates of MSMA, and various rates of HOE-581 (Test I), and various rates of HOE-581 with and without crop oil (Test II). The statistical design used in Test I was a completely randomized block with four replications. Plot size was 1.5 by 1.5 m. A randomized complete block with three replications and 1.5 by 5.0 m plots was used in Test II.

In Test I, herbicides were applied with a CO_2 powered, single nozzle boom at 40 psi and a dilution of 280 L/ha (30 GPA). MSMA was applied either twice on a 14 day interval (July 12, and July 26) or three times on a 7 day interval (July 12, July 19, July 26). HOE-581 was applied once on July 12 in Test I. On July 19, rain showers occurred within 5 h of herbicide application; no rain occurred within 72 h of all other application dates. Crabgrass was in the 2 to 4 tiller stage on July 12. Turf was mown to a 5.0 cm height on July 9 and again on July 14, and every 7 to 12 days thereafter.

In a third test, cultivar sensitivity to HOE-581 was evaluated. HOE-581 was applied on July 12 at 0.17 and 0.28 kg ai/ha to a four year old stand of Sydsport, Vantage, and Pennstar Kentucky bluegrass; Caravelle, Citation, and Pennfine perennial ryegrass; and tee height (0.75 cm)

Penncross creeping bentgrass. Plot size was 1.5 by 1.5 m and there were three replications per treatment. With the exception of Penncross creeping bentgrass, the other plots received no supplemental irrigation.

In Test II, various rates of HOE-581 alone or tank mixed with oil were evaluated. The oil used was AT Plus 411 F (80% non-phytotoxic oil plus 20% non-ionic surfactant) and was tank mixed at a rate of 2.3 L/ha (1.0 quart/A). Herbicides were applied on August 16 with a CO_2 powered, three nozzle boom sprayer at 50 psi and a dilution of 280 L/ha. The treated crabgrass was mature and in the 4 to 8 tiller stage. A rain shower (2 mm rain) occurred about 30 h after the herbicide was applied. The test area was mown 4 days prior to application on August 12 at a 5.0 cm height. The area was next mown on August 20 (5.0 cm), fertilized with 1.12 kg N/ha from ammonium nitrate, and irrigated. The area was not subjected to drought stress during the test period.

Percent plot area covered by crabgrass was visually estimated using a 0-100% scale, and percent of control was calculated on the dates shown in Tables 1 and 2. Phytotoxicity, in the form of turf discoloration, was visually estimated using a 0 to 5 scale with 0 equalling green, healthy turf, and 5 equalling brown turf. An acceptable level of control was considered to be above 90%; whereas, excellent control was considered to be greater than 95%. All data were analyzed using the analysis of variance, and significant means were seperated using the Bayes Least Significant Difference Mulitple Comparison Test (1).

RESULTS AND DISCUSSION

Test I. Data collected July 26 indicated that both a single and two applications (7 day interval) of MSMA at 2.24 kg ai/ha had provided an excellent level of crabgrass control; whereas, two applications of 1.12 kg ai/ha of MSMA provided an acceptable level of control (Table 1). Single applications of HOE-581 reduced crabgrass populations 74-82%, but two applications of MSMA at 0.56 kg ai/ha had reduced the crabgrass population by only 50%. Data recorded September 10 showed that 2.24 kg ai/ha of MSMA was extremely effective, regardless of application schedule. The third application of MSMA at 1.12 kg ai/ha insured excellent crabgrass control; whereas, three applications of 0.56 kg ai/ha MSMA on a 7 day interval had provided an unacceptable level of control (78%).

There was no significant rate effect observed between HOE-581 treatments, and the level of control (76.4 to 85%) was judged unacceptable (Table 1). HOE-581 treated crabgrass began to turn yellow about 10 days after application. Subsequently, many crabgrass plants developed a purple-red color, but several recuperated by producing new

tillers from axillary buds. HOE-581 appears to be a slow-acting, systemic herbicide and failure to achieve an acceptable level of control was attributed to mowing treated plants within 48 h of application. This reduced the time required to provide effective control. Reduced efficacy may also have been caused by dry environmental conditions throughout most of the test period.

Phytotoxicity was evaluated on July 19, 1 week following the initial application of herbicides (Table 1). Only the 2.24 kg ai/ha rate of MSMA discolored the perennial ryegrass turf significantly. No apparent discoloration was discerned on turf treated with 0.56 kg ai/ha MSMA or either rate of HOE-581. Discoloration caused by the 2.24 kg ai/ha rate of MSMA was of short duration, and no color differences were observed among treatments on July 27, 1 week following the second application of MSMA. Discoloration of turf in the untreated control, HOE-581, and 0.56 kg ai/ha MSMA plots was caused by injury from brown patch disease (*Rhizoctonia solani* Kuhn).

In the HOE-581 cultivar sensitivity test, no conspicuous discoloration was observed among the Kentucky bluegrass and perennial ryegrass cultivars evaluated. Both rates of HOE-581 caused an unacceptable level of discoloration on Penncross creeping bentgrass within 1 week of application (Table 1). The discoloration, however, dissipated about 2 weeks after the herbicide had been applied. Failure to observe any deleterious affects of HOE-581 on the Kentucky bluegrass or perennial ryegrass cultivars may have been due to mowing treated turf within 48 h of application or dry environmental conditions throughout the test period.

TEST II. To further evaluate HOE-581, a new test area was established on August 16, and various rates of the herbicide, with tank-mixed oil treatments, were evaluated. The mature (4 to 8 tiller stage), treated crabgrass plants had begun to develop a yellow or chlorotic coloration on August 25. Between August 25 and September 10 most of the treated crabgrass plants had become debilitated, and tillers were either moribund or a purple-red color. By September 17, the treated crabgrass was obviously dying or dead. All treatments had provided an acceptable or excellent level of control, and there were no significant differences among treatments, regardless of rate or crop oil parameter (Table 2).

The perennial ryegrass turf appeared somewhat discolored and stunted within a week of application. These side-effects were subtle, and only noticeable where treated turf could be contrasted with adjacent, untreated turf. Although the stunting and discoloration were evident for about 30 days, it would not be considered objectionable in most turf situations. Failure to notice these subtle,

phytotoxic effects in the aforementioned cultivar evaluation test was attributed to naturally declining turf quality imposed by heat and drought stress in the non-irrigated test area.

These studies indicate that HOE-581 is an extremely promising, postemergence crabgrass herbicide for use on mature Kentucky bluegrass and perennial ryegrass swards. More information, however, is needed regarding the influence of management practices, particularly mowing, fertility and irrigation, upon the effectiveness of HOE-581.

LITERATURE CITED

1. Steel, R.G.D., and J.H. Torrie. 1980. Principles and Procedures of Statistics. McGraw-Hill Book Co., N.Y. 633 p.

Table 1. Postemergence efficacy of various rates of MSMA and HOE-581 in controlling crabgrass (2 to 4 tiller stage) and phytotoxic effects.

Treatment No./ Formulation	Rate	Applic. Interval.	No. of Applic.	Percent of Plot Area Covered by Crabgrass and Percent Control July 26[1] Cover	Control	Sept. 10 Cover	Control	Phytotoxicity Citation	Penncross
	(kg ai/ha)	(Days)		%				(0 to 5 scale)	
1. MSMA 6L	2.24	14	2	0.4A[2]	97.4	0.1A	99.8	3.0C	*[3]
2. MSMA 6L	0.56	7	3	7.5C	50.6	11.2B	77.6	1.0A	*
3. MSMA 6L	1.12	7	3	1.2AB	92.1	0.2A	99.6	2.4BC	*
4. MSMA 6L	2.24	7	3	0.1A	99.4	0.0A	100	3.6D	*
5. HOE-581 120 gr/L	0.17	N/A	1	3.9B	74.4	10.8B	76.4	1.2AB	2.8B
6. HOE-581 120 gr/L	0.28	N/A	1	2.7AB	82.2	7.5AB	85.0	1.0A	3.7C
7. Untreated Control	---	---	-	15.2D	---	50.0C	---	1.2AB	0.0A

[1]/In treatment number 1, only one application of MSMA was applied prior to July 26; whereas, MSMA treatments 2,3 and 4 had been applied twice prior to July 26.

[2]/Means followed by the same letter in the same column are not significantly different at the 5% level according to the Bayes LSD Multiple Comparison Test.

[3]/*-Treatment not evaluated.

Table 2. Postemergence efficacy of various rates of HOE-581, applied alone or tank mixed with crop oil, in controlling mature, 4 to 8 tiller stage crabgrass.

Treatment/Formulation	Rate	Percent Plot Area Covered by Living Crabgrass and Percent Control Cover Sept.17	Control
	(kg ai/ha)	%	
HOE-581 120 gr/L	0.168	1.4A[1]	93.8
HOE-581 120 gr/L + oil	0.168 + 2.3L	1.0A	95.6
HOE-581 120 gr/L	0.280	0.3A	98.7
HOE-581 120 gr/L + oil	0.280 + 2.3L	0.1A	99.6
HOE-581 120 gr/L	0.560	0.1A	99.6
Untreated Control	----	22.7B	----

[1]/Means followed by the same letter in the same column are not significantly different at the 5% level according to the Bayes LSD Multiple Comparison Test.

CONTROL OF SMOOTH CRABGRASS IN TURF USING PRE- AND POSTEMERGENCE HERBICIDES

T. L. Watschke[1/]

ABSTRACT

Two experiments were conducted (one pre- and one postemergence) to evaluate experimental herbicides for the control of smooth crabgrass [Digitaria ischcaemum (Schreb.) Michx] in cool season turfgrasses. The preemergence test was initiated to evaluate experimental materials against commercial standards for efficacy and phytotoxicity to Kentucky bluegrass and creeping red fescue. Also, different formulations and rates of bensulide were applied on two separate dates to assess the effect of timing on efficacy. Acceptable control (greater than 85%) was achieved by applying DCPA (all formulations and rates), bensulide 7G plus devrinol 5G (6.7 + 1.1 kg a.i./ha), oxadiazon (50W and 2G at both rates), and pendimethalin (both formulations and all rates) to Kentucky bluegrass. The wettable formulations of oxadiazon caused significant injury at the 3.34 kg a.i./ha rate. On creeping red fescue, all herbicides provided acceptable control except both rates of oxadiazon plus Peltech 20% and all rates of UC-77892-B 5G. All formulations and rates of DCPA, oxadiazon 50W and 2G, and oxadiazon plus Peltech 20% caused thinning of creeping red fescue. The wettable formulation of oxadiazon caused the most severe injury to creeping red fescue. UC-77892-B 5G should be evaluated further at higher rates as efficacy improved in this test as the rate was increased without causing injury to desired species. Only the high rate (14 kg a.i./ha) of all bensulide formulations provided acceptable crabgrass control in Kentucky bluegrass when applied early. All bensulide formulations applied on the second date (except the 8.4 kg a.i./ha rate of the 7G) resulted in acceptable control. On creeping red fescue, only the 11.2 and 14 kg a.i./ha rates of the 12.5G provided acceptable control when applied early. The two higher rates of both granular bensulide formulations provided acceptable control when applied on the second date. Consistent, acceptable, bensulide efficacy required a minimum rate of 11.2 kg a.i./ha and application more near the time of crabgrass germination (April 29).

The postemergence test was initiated to evaluate an experimental chemical (HOE-00581) and combinations of an organic arsenical (MSMA) plus broadleaf herbicides (2,4-D, dicamba, and MCPP) against the commercial standard CAMA. Single applications at the two highest rates (0.28 and 0.39 kg a.i./ha) of HOE-00581 provided excellent control of smooth crabgrass in perennial ryegrass with no phytotoxicity to the ryegrass. Split applications of the two lower rates also resulted in excellent control. All organic arsenical and broadleaf combinations required two applications for acceptable control. Lowering the MSMA rate from 3.25 to 2.18 kg a.i./ha in combination with 2,4-D, dicamba, and MCPP caused efficacy to decrease from 87 to 75%. Significant discoloration of the perennial ryegrass occurred following application of the organic arsenical-broadleaf combinations. Further research on smooth crabgrass control in other cool season turfgrasses should be conducted with HOE-00581.

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Table 1. Premergence control of smooth crabgrass and injury ratings for Kentucky bluegrass (KBG) and fine fescue (FF). Ratings for control were taken August 10, and injury ratings were made June 14, 1982. Application dates were April 19 (early) and April 29, 1982.

Treatment	Rate kg ai/ha	Crabgrass Control KBG	Crabgrass Control FF	Injury Ratings* KBG	Injury Ratings* FF
		%			
DCPA 6F	8.4	90	97	0.0	1.5
DCPA 6F	11.8	92	94	0.0	1.5
DCPA 75W	11.8	87	87	0.0	2.0
DCPA 5G	11.8	88	94	0.0	0.0
Bensulide 4E	8.4 (early)	80	78	0.0	0.0
Bensulide 4E	11.2	90	78	0.0	0.0
Bensulide 7G	8.4 (early)	57	50	0.0	0.0
Bensulide 7G	8.4	75	83	0.0	0.0
Bensulide 7G	11.2 (early)	73	78	0.0	0.0
Bensulide 7G	11.2	93	88	0.0	0.0
Bensulide 7G	14.0 (early)	87	75	0.0	0.0
Bensulide 7G	14.0	85	90	0.0	0.0
Bensulide 12.5G	11.2 (early)	83	90	0.0	0.0
Bensulide 12.5G	11.2	85	85	0.0	0.0
Bensulide 12.5G	14.0 (early)	93	85	0.0	0.0
Bensulide 12.5G	14.0	93	87	0.0	0.0
Bensulide 7G + Devrinol 5G	5.6 + 2.2	80	97	0.0	1.0
Bensulide 7G + Devrinol 5G	6.7 + 1.1	85	95	0.0	0.0
Oxadiazon 50W	2.2	99	99	1.5	7.5
Oxadiazon 50W	3.4	99	99	2.5	8.0
Oxadiazon + Peltech 20%	2.2	85	70	0.0	1.5
Oxadiazon + Peltech 20%	3.4	70	67	0.0	1.5
Oxadiazon 2G	2.2	95	85	0.0	1.5
Oxadiazon 2G	3.4	97	95	0.0	3.0
Pendimethalin 10G	2.8	98	99	0.0	0.0
Pendimethalin (S-353) 2G	1.7	95	99	0.0	0.0
Pendimethalin (S-353) 2G	2.2	99	99	0.0	0.0
Pendimethalin (S-353) 2G	3.4	99	99	0.0	0.0
UC-77892-B 5G	3.4	35	10	0.0	0.0
UC-77892-B 5G	5.6	63	50	0.0	0.0
UC-77892-B 5G	7.8	84	80	0.0	0.0

*Injury refers to discoloration, 10 = completely brown, 0 = no discolor.

Table 2. The effect of four experimental and one commercial herbicide or herbicide combinations on the postemergence control of smooth crabgrass in perennial ryegrass.

Treatment	Rate kg ai/ha	Application Date	Crabgrass Control 8/2	Crabgrass Control 9/20	Injury* 7/26	Injury* 8/25
			%			
HOE-00581	0.17	7/13	94	82	0	0
HOE-00581	0.17	7/13 + 8/17	94	94	0	0
HOE-00581	0.22	7/13	87	80	0	0
HOE-00581	0.22	7/13 + 8/17	87	99	0	0
HOE-00581	0.28	7/13	99	88	0	0
HOE-00581	0.28	7/13 + 8/17	99	99	0	0
HOE-00581	0.39	7/13	99	90	0	0
HOE-00581	0.39	7/13 + 8/17	99	99	0	0
MCPP + 2,4-D + MSMA + dicamba	0.87 + 0.87 3.25 + 0.22	7/13	41	45	4.3	0
MCPP + 2,4-D + MSMA + dicamba	0.87 + 0.87 3.25 + 0.22	7/13 + 8/17	41	87	4.3	2.2
MCPP + 2,4-D + MSMA + dicamba	0.87 + 0.87 2.18 + 0.22	7/13	17	32	4.3	0
MCPP + 2,4-D + MSMA + dicamba	0.87 + 0.87 2.18 + 0.22	7/13 + 8/17	17	75	4.3	2.5
MSMA + 2,4-D	3.25 + 0.87	7/13	48	40	4.5	0
MSMA + 2,4-D	3.25 + 0.87	7/13 + 8/17	48	85	4.5	2.5
CAMA	5.88	7/13	42	47	4.7	0
CAMA	5.88 + 5.88	7/13 + 8/17	42	94	4.7	2.5
Check	0.0	----------	0	0	0	0

*Injury rates - 10 = completely brown, 0 = none.

PREEMERGENCE CRABGRASS CONTROL IN TURFGRASS [1]

Prasanta C. Bhowmik and J. Troll[2]

ABSTRACT

Experiment was conducted on a five-year-old stand of Kentucky bluegras (Poa pratensis L.) and fine fesuce (Festuca rubra L.) to evaluate preemergence herbicides on the control of crabgrass (Digitaria spp.). The effects of rates, formulations, and combination of herbicides were investigated. Performance of the herbicides was based upon injury to turfgrass, efficacy on crabgrass control, and residual activity over the season. Bensulide, napropamide, oxadiazon, DCPA, and butachlor with certain formulations and rates provided excellent season long control. Bensulide at 5.6 kg/ha gave poor control, although 7G formulation consistently resulted in better control compared to the EC formulation. Bensulide at the highest rates (7G at 7.8 and EC at 11.8 kg/ha) gave excellent control 12 and 16 weeks respectively after the application. Napropamide at 3.4 kg/ha gave 90% or better control, while the lower rates proved ineffective. Season long crabgrass control was obtained with combinations of bensulide and napropamide. Oxadiazon (WP)at 3.4 kg/ha proved excellent in crabgrass control with an inital turf injury,while granular or peltech formulation failed to provide adequate control. Turf injury from oxadiazon (WP) treatments was fully recovered after two weeks of growth. DCPA at 11.2 kg/ha provided excellent control over the entire season (16 weeks). Butachlor at 8.4 kg/ha also gave acceptable control upto 12 weeks, while the control was less 16 weeks after the application.

INTRODUCTION

Crabgrass (Digitaria spp.) infestation is a major weed problem in turf. Crabgrass, a C_4 summer weed, is very competitive and therefore qualifies for its seriousness in lawn grasses (4). The selective control of crabgrass can be achieved with preemergent herbicides (1,3,5,7). Experimental herbicides are being developed in the search for effective materials. The effectiveness of preemergent herbicides is based upon its ability to provide a) good control, b) no turf injury, and c) longer residual activity (1). Time of application can greatly influence herbicidal control of crabgrass (6). Herbidcies differing in formulations can also influence herbicidal control of crabgrass (1,3). Early applications of some herbicides have provided less control, indicating a shorter residual activity. Therefore, there is a need to identify selective herbicide that will provide acceptable season long control.

The primary objective of this study was to determine the extent of crabgrass control with various herbicides under Massachusetts conditions. Rates of application, various formulations and combinations of herbicides were investigated in this trial.

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MATERIALS AND METHODS

This study was conducted in 1982 at the Turf Research Farm, University of Massachusetts, Amherst on a five-year-old stand of Kentucky bluegrass (Poa pratensis L.) and fine fescue (Festuca rubra L.). The area was heavily infested with crabgrass. The Soil was a Winooski silt loam (Aquic Udifluvents) with pH 6.4.

The herbicides tested were: bensulide [(0,0-diisopropyl phosphorodithioate S-ester with N-(2-mercaptoethyl) benzenesulfonamide)] 7G and 4EC, napropamide [2-(α-naphthoxy-N, N-diethylpropionamide] 5G, DCPA (dimethyl tetrachloroterephthalate) 75WP, oxadiazon [2-tert-butyl-4(2,4-dichloro-5-isopropoxyphenyl) -Δ^2 -1, 3,4-oxadiazolin-5-one] 2G, 50WP, and peltech 20, and butachlor [(N-butoxymethyl) -2chloro 2', 6' -diethylacetanilide] 5EC. Various rates of each herbicide and combinations of herbicides, as reported in Table 1, were also tested.

All herbicides were applied in preemergence on April 29, 1982. All granular materials were applied by hand. Sprayable materials were applied with a backpack CO_2 sprayer at 152 KPa in 450 L/ha. The plot size was 1 x 3 m. The treatments were replicated four times in a randomized complete block design. Percent plot area covered by crabgrass was determined visually. Percent control of crabgrass was estimated by using the average percent area of control (untreated) plots that were colonized by crabgrass. Turf injury ratings were taken periodically. A visual rating of 0 to 100 was used, 0 indicating no injury and 100 indicating brown, dead turf. These observations were made 2, 4, 12, and 16 weeks after the application of herbicides. All data were analyzed using the analysis of variance and means were separated by LSD test at the 0.05 probability level. An acceptable control should be considered to be above 90% or more.

RESULTS AND DISCUSSION

Most of the herbicide treatments provided excellent crabgrass control (Table 1). These treatments subsequently reduced crabgrass population compared to the untreated control. Certain formulations and rates of the following herbicides provided acceptable control (90 to 100%). They were: bensulide, napropamide, oxadiazon, DCPA, and butachlor. No objectionable turf injury was observed except with the treatment of oxadiazon (50WP) at 3.4 kg/ha. However, the treated turf was fully recovered two weeks after the application.

Bensulide, in general, was effective in crabgrass control. Lower rates, however, gave poor to fair control. Granular formulation of bensulide at 5.6 kg/ha provided better control compared to the EC formulation. Similar results with various herbicides differing in formulations were reported earlier (3). Bensulide 7G at 7.8 kg/ha gave at least 90% control upto 12 weeks. Control was less at 16 weeks and the percentage of plot area covered by crabgrass increased to 29%. Sprayable (EC) formulation of bensulide was only effective at the highest rate (11.2 kg/ha). This treatment provided season long (16 weeks) control of crabgrass.

Table 1. Comparative efficacy of various rates, formulations, and combinations of preemergence herbicides on crabgrass control in 1982.

Treatment	Formulation	Rate	Percentage of Plot Area Covered by Crabgrass and Percent Control						
			5/7	5/27		7/27		8/23	
			Injury	Injury	Control	Cover	Control	Cover	Control
		(kg/ha)	(%)						
Bensulide	7G	5.6	0	0	80	17.4	79	27.5	66
Bensulide	7G	7.8	0	0	90	2.6	94	28.8	71
Bensulide	4EC	5.6	0	0	50	38.4	71	40.0	60
Bensulide	4EC	11.2	0	0	95	1.5	99	4.3	95
Napropamide	5G	1.1	0	0	85	26.8	71	55.5	44
Napropamide	5G	2.2	0	0	85	9.3	80	45.0	50
Napropamide	5G	3.4	0	0	100	2.4	98	17.5	78
Bensulide + Napropamide	4EC + 5G	5.6 + 1.1	0	0	100	5.0	96	10.5	90
Bensulide + Napropamide	4EC + 5G	5.6 + 2.2	0	0	100	2.4	99	6.3	89
Bensulide + Napropamide	4EC + 5G	5.6 + 3.4	0	0	100	0.5	100	7.0	89
Oxadiazon	2G	3.4	0	0	80	4.1	95	10.0	86
Oxadiazon	50WP	3.4	40	0	100	0.0	100	1.0	100
Oxadiazon	Peltch 20	3.4	0	0	30	44.6	29	73.8	30
DCPA	75WP	11.2	0	0	100	1.7	98	5.0	91
Butachlor	5EC	8.4	0	0	100	1.0	99	15.0	81
Untreated check	-	-	0	0	0	99.0	0	100.0	0
LSD 0.05	-	-	-	-	26	19.5	21	15.0	16

[a] Injury refers to browning or discoloration

Napropamide provided 90% or better crabgrass control only at the highest rate (3.4 kg/ha). The acceptable control lasted upto 12 weeks and 78% control was noted 16 weeks after the application. Control was less with the lower rates and the colonization by crabgrass increased to 45-56% at the end of the season.

All treatment combinations of bensulide and napropamide exhibited excellent control over the entire season (Table 1). At 16 weeks, only 7 to 10% of the plot area was reinfested with crabgrass.

Oxadiazon (WP) formulation was the most effective treatment and the control was excellent over the 16 week period. Granular formulation gave good control (80% or more). Peltech 20 formulation of oxadiazon resulted in poor crabgrass control. This may have been due to the mixing problem during spraying.

Crabgrass control with DCPA at 11.2 kg/ha was excellent over the entire season and the reinfestation of crabgrass was minimum. Butachlor at 8.4 kg/ha also provided excellent control upto 12 weeks. Control was less (81%) 16 weeks after the application.

Oxadiazon was the best herbicide treatment that provided excellent season long control and the colonization of crabgrass was lowest in the treated plots compared to any other treatments. Recently, Dernoedon (2) reported that a single application of oxadiazon at 2.2 kg/ha gave season long control of crabgrass.

Longer residual activity of several herbicides was evident. Bensulide (EC) at 11.2 kg/ha, oxadiazon (WP) at 3.4 kg/ha, and DCPA (WP) at 11.2 kg/ha provided excellent control 16 weeks after the application. On the other hand, combination of bensulide and napropamide seemed to provide long residual control compared to the application of bensulide alone at the same rate.

LITERATURE CITED

1. Cooper, R.J. and J.A. Jagschitz. 1980. Crabgrass control and turfgrass injury resulting from pre- and postemergent herbicides. Proc. NEWSS 34:347-352.

2. Dernoeden, P.H. 1982. Single versus repeat application of preemergence crabgrass herbicides using reduced rates the second year. Proc. NEWSS 36:315-319.

3. Hesseltine, B.B. and J.A. Jagschitz. 1978. Control of crabgrass with pre- and postemergence herbicides in turfgrass. Proc. NEWSS 32:308-312.

4. Hull, R. 1982. The lawn weeds of summer. American Lawn Applicator vol. 3 No. 5:12-16.

5. Van Yahres, R.D. and J.A. Jagschlitz. 1982. Pre- and postemergence herbicides for the control of crabgrass in lawn areas. Proc. NEWSS 36:292-297.

6. Watsche, T.L. and D.J. Wehner, and J.M. Duich. 1976. Pre- and post-emergence crabgrass control in turf. Proc. NEWSS 30:358-366.

7. Watsche, T.L. and M.S. Welterlen. 1982. Preemergence crabgrass control in turf. Proc. NEWSS 36:298-300.

DEVELOPING A COLLEGIATE WEED CONTEST FOR THE NORTHEAST - EXPERIENCE AT THE NCCWSC

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ABSTRACT

The collegiate weed science contest provides an educational forum for students to meet with each other, with researchers from universities and industry, and to apply their academic skills in a competitive "real world" environment. Begun by the Southern Weed Science Society in 1980 and organized by Drs. David H. Teem and Wayne L. Currey of the Univ. of Fla., Gainesville, and Dr. Ray B. Cooper of Elanco, the concept spread to the North Central Weed Science Society the following year under the direction of Dr. James S. Ladlie of Agri-Growth Research, Inc., Hollandale, MN.

In 1982 a delegation from the Northeastern Weed Science Society attended the North Central Collegiate Weed Science Contest (NCCWSC) for the purposes of evaluating the benefits of such a contest and outlining procedures for establishing a weed meet in the Northeast region. Approximately 65 students plus their coaches representing 10 universities attended the NCCWSC and competed as 14 four-person teams (10 graduate, 4 undergraduate) plus a number of individual contestants. The teams had varying approaches to contest preparation ranging from a formal credited course to an informal study group just prior to the contest. As presented by the NCCWSC the contest consisted of four sections: I-Weed identification, II-Sprayer calibration, III-Identification of unknown herbicides, and IV-Problem solving and recommendations. Sections I and II tested technical skills, while sections III and IV required situation analysis based on a contestant's total experience. In section III, the contestant was given a list of possible treatments and asked to identify the herbicide applied to unlabeled test plots by observing the condition of various crops and weeds planted in the plot. In section IV, the contestant, assuming the role of a "technical advisor", inspected an actual crop production problem in a field situation and recommended an effective solution to the staff member acting as the "farmer". Scoring was based not only on recognition and correction of the chemical or cultural problem(s) but also on how contestants interacted with the farmer, whose personality ranged from helpful to irate. The contest was planned by a steering committee of regional experts with one leader responsible for each section of the competition. A staff of about 20 persons was needed on the day of the contest.

From a student's perspective, the experience is rewarding and educational. Professional and personal contacts are initiated and one's knowledge broadened by exposure to crops and weeds which may not be found in one's own locale. The role playing section develops one's abilities to synthesize knowledge and to effectively interact with people.

The Executive Committee of the Northeastern Weed Science Society has approved the development of a collegiate weed contest on a trial basis for 1983 to be organized by Dr. Ronald L. Ritter of the University of Maryland.

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