DIMETHAZONE AND METRIBUZIN COMBINATIONS FOR WEED CONTROL IN CONVENTIONAL-TILLED SOYBEANS[1]

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ABSTRACT

Two field studies were conducted in 1984 to evaluate possible synergistic activity of dimethazone and metribuzin combinations on soybean yield and to evaluate rates, application method and weed control of dimethazone. Preemergence and preplant incorporation applications of dimethazone were equally effective in controlling redroot pigweed, common lambsquarters, and fall panicum at 0.84 and 1.12 kg/ha, respectively. Combinations of dimethazone and metribuzin produced a broad spectrum of weed control; however, increasing rate combinations did not synergistically enhance soybean yield. Dimethazone did not control carpetweed. Preemergence dimethazone and metribuzin at 0.84 and .20 kg/ha, respectively, and preplant incorporated dimethazone and metribuzin at .84 and 0.14 kg/ha, respectively, were equally effective for weed control.

INTRODUCTION

Many new selective soybean [*Glycine max* (L.) Merr. 'Midstates 250'] herbicides have become available or are being developed for weed control in soybeans. Dimethazone [2-(2-chlorophenyl) methyl-4,4-dimethyl-3-isoxazolidone] is a selective preplant incorporated or preemergence herbicide which controls both annual grass and broadleaf weeds (2,3,4,5). Combinations of dimethazone and metribuzin [4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5 (4H)-one] have demonstrated excellent weed control in soybeans in New Jersey(1). Beale et. al. (1) recently observed significantly greater soybean yields with increasing rate combinations of dimethazone and metribuzin, however, increased soybean yield could not be attributed to increased weed control. Synergistic activity of dimethazone-metribuzin combinations was suggested. The objective of this study was to evaluate possible synergistic effects on soybean yield as affected by increasing rates of dimethazone plus metribuzin combinations. Secondly, to evaluate weed control, method of herbicide application, and efficacious rates of dimethazone alone or in combination with metribuzin, for weed control in soybeans in New Jersey.

MATERIALS AND METHODS

Two field studies with soybeans were conducted during 1984 at the Adelphia Research Center, New Jersey Agricultural Experiment Station, Adelphia, New Jersey. The soil typein both studies was a Holmdel loam with 1.5% organic

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matter and a pH of 6.5. Seed bed preparation consisted of plowing followed by two discings and final fitting with a rotera. Midstates 250 were planted 4 cm deep at 67 kg/ha in both studies with a conventional planter. Herbicide treatments were applied with a hand-held CO_2 sprayer in 374 l/ha water at 221 kPa using 730616 flat fan spray tips. Individual treatments consisted of four rows, 4.88 m long with 76 cm spacing between the rows. The entire plot areas were treated in both studies. Dominant weeds in both studies in order of importance were common lambquarters *(Chenopodium album* L. #CHEAL); fall panicum *(Panicum dichotomiflorum* Michx. #PANDI), redroot pigweed *(Amaranthus retroflexus* L. #AMARE) and carpetweed *(Mollugo verticillata* L. #MOLVE). Weeds were visually rated using a scale of 0 to 10, with 0 = no effect on weeds or crop and 10 = complete kill.

In Study I, levels of dimethazone and metribuzin were arranged factorially in a complete, randomized block design with four replications. Sweet corn *(Zea mays* L.) was grown in the plot areas the year preceding Study I. Soybeans were planted June 21 and preemergence treatments were applied the following day. Soil temperature was 31.1 C at 2.5 cm with ample moisture below and soil surface dry. Winds were calm with an air temperature of 28.8 C. Percent weed control was visually rated July 29 and August 13. Soybean heights were recorded October 15.

In Study II, plots were arranged in a randomized complete block design with three replications. Soybeans were grown in the plot areas the previous year. Treatments were preplant incorporated with a rotera to a depth of 6.7 cm followed by planting on June 15. Soil surface was dry with ample moisture below. Soil temperature was 25.5 C at 2.5 cm. Air temperature was 25.5 C, clear and calm with westerly winds. Percent weed control was visually rated July 31.

The center two rows of plots were harvested October 25 with a small plot combine. All data were subjected to analysis of variance. Weed control ratings were subjected to arc-tangent transformations prior to the analysis of variance and means were compared using Duncan's multiple range test. Means of soybean yield were compared using Tukey's Studentized range test.

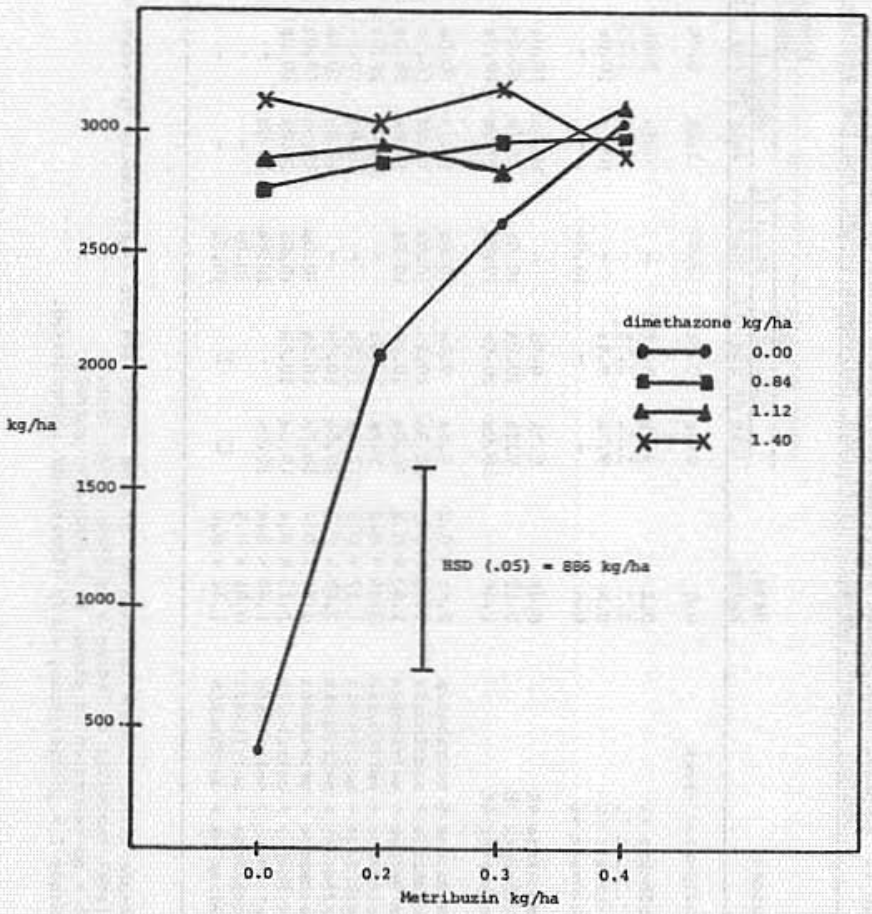
RESULTS AND DISCUSSION

Summarized in Table 1 are weed control ratings, herbicide rates and formulation for both studies. There was no significant crop injury from any of the herbicide treatments. Dimethazone at 0.84, 1.12, and 1.40 kg/ha produced excellent control of redroot pigweed, common lambsquarters and fall panicum; however, no control of carpetweed was observed. Metribuzin at 0.2, 0.3, 0.4 and 0.6 kg/ha was generally less effective than dimethazone for common lambsquarters, redroot pigweed and fall panicum control, although metribuzin was effective in controlling carpetweed. Combinations of metribuzin plus dimethazone resulted in similar weed control of dimethazone alone, with the exception of increased control of carpetweed. Combinations of preemergence (Study I) dimethazone plus metribuzin greater than 0.84 plus 0.2 kg/ha respectively, did not result in greater weed control than dimethazone applied alone, however, combinations resulted in increased weed spectrum control. Similar weed control was noted for either preplant incorporated or preemergence applications of dimethazone alone or combined with metribuzin. Dimethazone was equally effective as a preplant incorporated and as a preemergence herbicide.

Increased weed control in Study I (Table 1) resulted in corresponding yield increase of soybean (Figure 1), indicating a high degree of weed competition without herbicide treatment. Dimethazone at 0.84 kg/ha increased soybean yield 784% over the control. Higher rates of dimethazone or combinations with metridid not increase soybean yield (Figure 1). Soybean height was unaffected by treatment.

Yield of soybean was not affected synergistically by increased rate combinations of dimethazone and metribuzin, however, the spectrum of weed control was increased by the addition of metribuzin. Preemergence applications of dimethazone and metribuzin at 0.84 and 0.2 kg/ha respectively provided excellent weed control of common lambsquarters, redroot pigweed, carpetweed and fall panicum with yields similar to higher rate combinations. Similarly, preplant incorporated treatments at 0.84 plus 0.2 kg/ha of dimethazone plus metribuzin, respectively, were equally effective.

Figure 1. Soybean yield (kg/ha) as affected by dimethazone and metribuzin combinations (Study I), Adelphia, New Jersey. 1984[a].



[a] Minimum significant difference according to Tukey's Studentized range test.

Table 1. Preplant incorporated and preemergence combinations of dimethazone and metribuzin on weed control of redroot pigweed (AMARE), common lambsquarters (CHEAL), carpetweed (MOLVE) and fall panicum (PANDI) in soybeans, Adelphia, N.J. 1984[a].

Treatment	Rate, kg/ha	Weed Control(b)										
		AMARE			CHEAL			MOLVE		PANDI		
		Study I		Study II	Study I		Study II	Study I		Study I		Study II
		July 29	Aug. 13	July 31	July 29	Aug. 13	July 31	July 29	Aug. 13	July 29	Aug. 13	July 31
Uncultivated check	0.0	0.0c	0.0c	0.0b	2.2b	0.0c	0.0c	0.0b	0.0b	0.0c	0.0d	0.0b
metribuzin 4L	0.2	9.0a	8.2b	-	6.5a	8.8b	-	7.2b	9.0a	6.7b	6.2c	-
metribuzin 4L	0.3	8.7a	8.8b	-	8.7a	9.2ab	-	9.8a	9.5a	7.9a	9.5a	-
metribuzin 4L	0.4	9.7a	9.8a	-	10.0a	10.0a	-	10.0a	10.0a	8.7a	8.0b	-
metribuzin 4L	0.6	-	-	10.0a	-	-	9.9a	-	-	-	-	0.0b
dimethazone 4E	0.84	9.5a	9.8a	-	10.0a	10.0a	-	0.0b	0.0b	10.0a	10.0a	-
dimethazone 4E	1.12	9.2a	10.0a	10.0a	9.7a	10.0a	10.0a	0.2b	0.0b	10.0a	10.0a	10.0a
dimethazone 4E	1.40	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	0.0b	0.0b	10.0a	10.0a	10.0a
dimethazone + metribuzin	0.84 + 0.2	9.5a	9.8a	10.0a	10.0a	10.0a	10.0a	9.7a	8.5a	10.0a	10.0a	10.0a
dimethazone + metribuzin	1.12 + 0.2	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	9.9a	8.5a	10.0a	10.0a	10.0a
dimethazone + metribuzin	1.40 + 0.2	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	7.5a	10.0a	10.0a	10.0a	10.0a
dimethazone + metribuzin	0.84 + 0.3	9.9a	10.0a	-	10.0a	10.0a	-	10.0a	10.0a	10.0a	10.0a	-
dimethazone + metribuzin	1.12 + 0.3	10.0a	10.0a	-	10.0a	10.0a	-	9.8a	9.8a	10.0a	10.0a	-
dimethazone + metribuzin	1.40 + 0.3	10.0a	10.0a	-	10.0a	10.0a	-	9.9a	10.0a	10.0a	10.0a	-
dimethazone + metribuzin	0.84 + 0.4	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	9.7a	10.0a	10.0a	10.0a	10.0a
dimethazone + metribuzin	1.12 + 0.4	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a
dimethazone + metribuzin	1.40 + 0.4	10.0a	-	10.0a	10.0a	-	10.0a	10.0a	10.0a	10.0a	-	10.0a
dimethazone + metribuzin	0.84 + 0.6	-	-	10.0a	-	-	10.0a	-	-	-	-	10.0a
dimethazone + metribuzin	1.12 + 0.6	-	-	10.0a	-	-	10.0a	-	-	-	-	10.0a

(a) Means within columns followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.
(b) 0 = no reduction in stand, 10 = complete control.
(c) Study I = preemergence, study II=preplant incorporated.

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PREPLANT INCORPORATED PRODIAMINE-METRIBUZIN COMBINATIONS IN SOYBEANS[1]

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ABSTRACT

A relatively new preplant soil-incorporated dinitroaniline herbicide, prodiamine, was evaluated for weed control and soybean tolerance in 1983 and 1984 at rates of 0.28, 0.43, 0.56, 0.70, 0.84, and 1.12 kg/ha alone and with metribuzin applied sequentially at 0.43 kg/ha following preplant soil-incorporated prodiamine at 0.28, 0.43, and 0.56 kg/ha. Metribuzin was also applied alone at 0.43 and 0.56 kg/ha preemergence. Weeds in the experimental areas included common lambsquarters *(Chenopodium album* L.), velvetleaf *(Abutilon theophrasti* Medic.), and fall panicum *(Panicum dichotomiflorum* Michx.) in 1983 and 1984; also redroot pigweed *(Amaranthus retroflexus* L.) in 1983 and common ragweed *(Ambrosia artemisiifolia* L.) in 1984.

In 1983 prodiamine alone effected excellent control of common pigweed at all rates evaluated, excellent control of fall panicum at rates above 0.43 kg/ha, fair control of lambsquarters at 0.70 kg/ha, and poor control of velvetleaf at all rates. Metribuzin produced excellent control of all broad-leaf weeds at 0.56 kg/ha, fair control of velvetleaf at 0.43 kg/ha and poor to fair control of fall panicum at the two rates studied. Excellent control of all weeds was produced by prodiamine at 0.38 kg/ha followed by a sequential preemergence application of metribuzin at 0.43 kg/ha.

In 1984, control of the same weeds by prodiamine and metribuzin was comparable to that in 1983 and acceptable control of ragweed was produced at rates of 0.71 kg/ha and higher of prodiamine and at both rates of metribuzin. Excellent control of all weeds was obtained by prodiamine and metribuzin at 0.28 kg/ha and 0.43 kg/ha, respectively.

From this study it was concluded that control of common soybean weeds in New Jersey may be effectively controlled with preplant incorporated prodiamine followed by an overlay of preemergence metribuzin at 0.28 kg/ha plus 0.43 kg/ha, respectively.

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PRODIAMINE - USES IN SOYBEANS AND CARRY-OVER POTENTIAL

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ABSTRACT

Field experiments were conducted in 1983 and 1984 to compare prodiamine's weed control efficacy and crop injury potential to standard preplant incorporated and preemergence grass herbicides in soybeans. In 1984, additional studies were conducted to examine possible carryover of prodiamine to subsequent rotational crops, and potential use in double crop soybeans after application of prodiamine in standing wheat (var. 'Severn').

All experiments were established on a Matapeake silt loam soil at the Wye Research and Education Center at Queenstown, MD. Soil pH was 6.2 with 1.5% organic matter. Individual plots were generally four rows wide (30 inch centers) by either 20 or 25 feet in length. Design in all cases was a randomized complete block with three replications. All herbicide applications were made in water with a CO_2 pressurized backpack sprayer that delivered 18 gpa at 20 psi utilizing SS-8003 flat fan nozzles. Visual ratings of weed control or crop injury were made throughout the growing season based on a scale of 0 (no control or injury) to 100 (total control or crop dessication). Yields were obtained with a standard field combine.

For the incorporated studies, treatments were double disced in the same direction to a depth of 4 to 6 inches, 1 to 2 hours after application. For the rotational crop studies, spring oats (var. 'Otee') were no-till planted on April 5, 1984, and corn (var. 'Pioneer 3184') was no-till planted on May 11, 1984, on ground previously treated with prodiamine in 1983. For the double crop soybean study, paraquat plus linuron (0.5 plus 0.5 lb ai/A) were applied over the entire test at soybean planting time.

Initial findings showed prodiamine to exhibit good annual grass control at the 1x (0.5 lb ai/A) use rate. Under heavy annual grass pressure, data indicated that prodiamine's use rate may have to be increased to 0.6 lb ai/A. Prodiamine also displayed better common lambsquarters (*Chenopodium album* L.) control than other labeled preemergence grass herbicides studied. No significant soybean injury was expressed in any of the studies.

In the carryover studies, crop injury was evident with spring oats. At normal use rates, carryover did not occur. Yet, when rates were increased to a 2x or 4x use rate, significant injury and crop yield reduction occurred. For corn, crop injury in the form of stunting was noted with 1x use rates of prodiamine and greater when applied the year before. While yields were variable, data seemed to indicate yield depression with rates of prodiamine as low as 0.4 lb ai/A.

In the double crop soybean study, minimal wheat injury was noted. Heavy lodging was experienced where prodiamine was sprayed but may be a function of applying the herbicide too early in standing wheat. Yet, wheat yields were not reduced. Annual grass control in double crop soybeans was good, and thus a potential may exist for using prodiamine in this manner.

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FOMESAFEN COMBINATIONS FOR WEED CONTROL IN SOYBEANS[1]

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ABSTRACT

Several field studies were conducted to determine the effectiveness of fomesafen applied postemergence at various rates and in combination with other postemergence herbicides and following preemergence alachlor for weed control in soybeans. Fomesafen applied alone controlled velvetleaf, common lambsquarters, ivyleaf morningglory and yellow nutsedge. Fomesafen applied postemergence to preemergence alachlor effected excellent grass control. Tank-mixes with bentazon or acifluorfen did not adversely affect herbicidal performance. Sequential applications of fomesafen after acifluorfen or acifluorfen after fomesafen were equally effective as tank-mixing both herbicides. All combinations evaluated resulted in excellent weed control without crop injury.

INTRODUCTION

Use of postemergence soybean herbicides has grown in popularity with soybean growers. Postemergence applications can be used successfully with various preemergence herbicides for a broader weed control spectrum (4). An advantage of postemergence applications is that applications can be made when unexpected weed problems arise and are visible giving a reserve weed control strategy when preemergence or preplant incorporated treatments fail. For these reasons plus the increasing spectra of weed control, postemergence herbicides are becoming increasingly important in soybean weed control programs.

Fomesafen [5-[2-chloro-4-(trifluoromethyl)phenoxy]-*N*-(methylsulfonyl)-2-nitrobenzamide] has been demonstrated to provide control of many broadleaf weeds in soybeans (1,3). Combinations with bentazon [3-isopropyl-1*H*-2,1,3-benzothiadiazin-4(3*H*)-one 2,2-dioxide], another broadleaf herbicide, have been reported by Palmer et. al. (4) to synergistically enhance weed control at lower than normal use rates applied alone. They reported the combination of 0.14 + 0.56 kg/ha of fomesafen and bentazon, respectively, was the most frequently reported synergistic rate. An additional combination of alachlor [2-chloro-2,6-diethyl-*N*-methoxymethyl)acetanilide], applied preemergence, followed by postemergence tank-mixed fomesafen and bentazon increased annual grass control. Acetanilide herbicides combined with postemergence broadleaf herbicides have been demonstrated to be excellent combinations for weed control in soybeans (2). Other alternatives to tank-mixing with bentazon could be the addition of acifluorfen [5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoic acid] to

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fomesafen applied postemergence. Acifluorfen controls many broadleaf weeds and when used early postemergence can provide control of grasses (5). The objective of this study was to evaluate postemergence fomesafen alone, fomesafen tank-mixed with acifluorfen or applied separately at two different application times, fomesafen in combination with bentazon, and fomasefen-bentazon tank-mixes in conjunction with alachlor applied preemergence.

MATERIALS AND METHODS

Two field studies with soybeans were conducted during 1984 at the Adelphia Research Center, New Jersey Agricultural Experiment Station, Adelphia, N.J. The soil type in both studies was a Freehold sandy loam with 1.5% organic matter and a pH of 6.6. Seed bed preparation consisted of plowing followed by two discings. Final seed bed preparation was done using a rotera. Midstates 250 soybeans were planted 4 cm deep at 67 kg/ha in both studies with a conventional planter. Herbicide treatments were applied with a hand-held CO_2 sprayer in 374 l/ha water at 221 kPa using 730616 flat fan (Spraying Systems Co., Chicago, Ill.) spray tips. Both studies were arranged in a randomized complete block design with three replications. Entire plot areas were treated in both experiments.

Individual plot areas in Study I consisted of two rows, 4.88 m long with 76 cm spacing between rows. Soybeans were grown in the plot areas the year preceding this study. Soybeans were planted and preemergence treatments applied on June 14. Weather conditions at planting were as follows: soil temperature 30 C at 2.5 cm, soil surface dry with ample moisture below, air temperature 29 C with winds westerly at 6-8 km/h. Postemergence treatments were applied July 2 and 5 when soybeans were at the 1st to 2nd trifoliate leaf stage. Weed stages of growth were as follows: common lambsquarters (*Chenopodium album* L. #CHEAL), 5 to 8 cm at 4-leaf stage; velvetleaf *(Abutilon theophrasti* Medic. #ABUTH), 5 to 8 cm at 4-leaf stage and fall panicum *(Panicum dichotomiflorum* Michx. #PANDI) 15 cm at 3- to 4-leaf stage. Weather conditions at time of treatment were: soil surface wet above and below the surface, soil temperature 28 C (2.5 cm) and air temperature 27 C with calm winds. Plots were visually rated July 6 and August 13.

Individual plot areas in Study II consisted of four-row plots, 4.88 m long with 76 cm spacing between rows. Soybeans were cropped consecutively for three years previous to this study. Soybeans were planted and preemergence alachlor treatments were applied June 12. Postemergence treatments were applied when soybeans were at the 1st to 2nd trifoliate leaf stage on July 2. Weeds present were velvetleaf 10 cm at 3- to 4-leaf stage; yellow nutsedge *(Cyperus esculentus* L. #CYPES) 20 cm at 6-leaf stage; common lambsquarters 10 cm at 6- to 10-leaf stage; ivyleaf morningglory *[Ipomoea hederacea* (L.) Jacq.], 8 cm at the 4- to 6-leaf stage; and fall panicum 2 to 15 cm at 4- to 6-leaf stage. Plots were visually rated July 25.

Both soybean rows in Study I were harvested with a plot combine. One of the two center rows of Study II was hand-harvested and threshed using a plot thresher. All data were analyzed by analysis of variance. Weed control ratings were subjected to arc-tangent transformations prior to analysis of variance. All means were compared using Duncan's multiple range test.

RESULTS AND DISCUSSION

There was no significant crop injury from any of the treatments in the two studies. Herbicide rates, formulations, time of application, weed control ratings and soybean yield for Study I are presented in Table 1. Fomesafen at 0.14 to 0.56 kg/ha provided excellent velvetleaf and common lambsquarters control. Fall panicum control was increased by the addition of 0.28 to 0.70 kg/ha acifluorfen to fomesafen. Acifluorfen alone produced excellent broadleaf weed control at rates of 0.42 kg/ha or greater. Velvetleaf control was significantly lower when acifluorfen was used alone at 0.28 kg/ha at the August 13 rating. Any rate of fomesafen added to 0.28 kg/ha of acifluorfen increased velvetleaf control significantly. Tank-mixed fomesafen plus acifluorfen combinations were equally effective as sequentially applied fomesafen or acifluorfen combinations. Although weed control of any combination of fomesafen plus acifluorfen was significantly greater than the control, there was no increase in yield.

Fomesafen applied alone at any rate in Study II (Table 2) resulted in significantly greater weed control of velvetleaf, common lambsquarters, yellow nutsedge, and ivyleaf morningglory compared to the control. Fomesafen at 0.28 and 0.42 kg/ha did not significantly increase control of fall panicum when compared to the control. Bentazon applied alone did not control fall panicum; however, in combination with preemergence alachlor, grass control was improved significantly. Postemergence applications of fomesafen, acifluorfen, or combinations of the two produced significantly greater ivyleaf morningglory control than preemergence alachlor plus linuron. The low rate combinations of alachlor plus bentazon or alachlor plus fomesafen were equally effective for weed control as high rates of any tank mix combination of fomesafen-bentazon following preemergence alachlor. Synergism from low rates of fomesafen plus bentazon were not observed.

Fomesafen effected excellent control of velvetleaf, common lambsquarters, ivyleaf morningglory and yellow nutsedge. Combinations of fomesafen plus alachlor resulted in excellent control of fall panicum. Combinations of fomesafen plus other postemergence herbicides did not adversely affect herbicidal performance and were not injurious to soybeans.

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Table 1. The effect of postemergence fomesafen and acifluorfen combinations on weed control of velvetleaf (ABUTH), Common lambsquarters (CHEAL), and fall panicum (PANDI) in soybeans, Adelphia, N.J., 1984 (Study I)[a].

Herbicide	Rate, kg/ha[b]	Soybean kg/ha	Weed Control[c] ABUTH July 6	ABUTH Aug. 13	CHEAL July 6	CHEAL Aug. 13	PANDI July 6	PANDI Aug. 13
fomesafen 4E	0.14	2806e	9.6a	9.9a	10.0a	9.6a	3.0bc	5.0ab
fomesafen 4E	0.28	3630a-c	10.0a	10.0a	9.8ab	8.8a	5.0ab	6.8a
fomesafen 4E	0.42	2832de	9.8a	10.0a	9.6ab	9.5a	4.0ab	6.8a
fomesafen 4E	0.56	3600a-d	10.0a	10.0a	10.0a	9.9a	5.6ab	6.5ab
acifluorfen 2S	0.28	3378a-e	9.7a	6.6b	9.8ab	7.7a	5.0ab	2.8bc
acifluorfen 2S	0.42	3059c-e	10.0a	9.8a	10.0a	10.0a	9.0a	8.2a
acifluorfen 2S	0.56	3632a-c	10.0a	9.4a	10.0a	10.0a	8.6a	9.5a
acifluorfen 2S	0.70	3228b-e	10.0a	10.0a	10.0a	9.9a	9.3a	9.7a
fomesafen + acifluorfen	0.14 + 0.42	3894ab	9.8a	9.8a	10.0a	9.9a	9.0a	9.4a
fomesafen + acifluorfen	0.14 + 0.56	3343a-e	9.8a	9.9a	10.0a	10.0a	8.6a	9.3a
fomesafen + acifluorfen	0.28 + 0.28	3562a-e	10.0a	10.0a	10.0a	10.0a	6.3ab	6.5ab
fomesafen + acifluorfen	0.28 + 0.42	3475a-e	10.0a	10.0a	10.0a	10.0a	8.8a	9.5a
fomesafen + acifluorfen	0.28 + 0.56	3288a-e	10.0a	9.3a	10.0a	9.1a	8.3a	6.6ab
fomesafen + acifluorfen	0.28 + 0.70	3344a-e	10.0a	9.7a	10.0a	10.0a	9.6a	10.0a
fomesafen + acifluorfen	0.42 + 0.28	3566a-e	10.0a	10.0a	10.0a	10.0a	8.5a	9.9a
fomesafen + acifluorfen	0.42 + 0.42	2795e	10.0a	10.0a	10.0a	10.0a	9.2a	9.9a
fomesafen + acifluorfen	0.42 + 0.56	4032a	10.0a	10.0a	10.0a	9.8a	9.0a	9.4a
fomesafen + acifluorfen	0.42 + 0.70	3298a-e	10.0a	9.9a	10.0a	9.9a	9.4a	9.9a
fomesafen + acifluorfen	0.56 + 0.42	3428a-e	10.0a	10.0a	10.0a	10.0a	9.3a	9.9a
fomesafen + acifluorfen	0.56 + 0.42	3057c-e	10.0a	10.0a	10.0a	10.0a	9.3a	10.0a
fomesafen + acifluorfen	0.28 + 0.42*	3360a-e	9.8a	10.0a	10.0a	8.2ab	6.5a	9.2a
acifluorfen + fomesafen	0.42 + 0.28**	3349a-e	10.0a	9.8a	10.0a	10.0a	10.0a	10.0a
acifluorfen + fomesafen	0.42 + 0.28*	3396a-e	10.0a	10.0a	10.0a	10.0a	9.3a	9.8a
Uncultivated Check	-	3527a-e	0.0b	0.0c	0.0c	0.0c	0.0c	0.0c

[a] Means within columns followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.
[b] All treatments were applied July 2, excepting (*) which was applied July 5; (**) applied immediately after 1st treatment.
[c] 0 = no reduction in stand, 10 = complete control.

Table 2. The effect of preemergence alachlor and postemergence fomesafen and bentazon combinations on weed control of velvetleaf (ABUTH), common lambsquarters (CHEAL), yellow nutsedge (CYPES), ivyleaf morningglory (IPOHE), and fall panicum (PANDI) in soybeans, Adelphia, N.J. 1984 (Study II)[a].

Herbicide	Rate, kg/ha[c]	Weed Control[d]				
		ABUTH	CHEAL	CYPES	IPOHE	PANDI
fomesafen* 2LC	0.28 PO	10.0a	8.0a	10.0a	10.0a	5.6ab
fomesafen* 2LC	0.42 PO	10.0a	8.0a	9.8a	10.0a	3.0ab
fomesafen* 2LC	0.56 PO	10.0a	9.3a	8.3a	10.0a	7.0a
bentazon** 4E	1.12PO	10.0a	8.2a	4.6ab	9.6a	1.0b
fomesafen + bentazon**	(0.14 + 0.56) PO	10.0a	9.2a	9.9a	10.0a	6.8a
fomesafen + bentazon**	(0.28 + 0.56) PO	10.0a	9.8a	10.0a	10.0a	5.5ab
alachlor 4E	1.68 PE	0.7b	8.3a	10.0a	6.0a	10.0a
alachlor + linuron	1.68 PE + 0.56 PE	6.7ab	9.8a	10.0a	3.3b	10.0a
alachlor + bentazon**	1.68 PE + 0.84 PO	10.0a	9.9a	10.0a	6.5ab	9.9a
alachlor + bentazon**	1.68 PE + 1.12 PO	10.0a	9.7a	9.8a	8.6a	9.8a
alachlor + fomesafen*	1.68 PE + 0.28 PO	10.0a	9.6a	10.0a	9.8a	10.0a
alachlor + fomesafen*	1.68 PE + 0.35 PO	10.0a	10.0a	10.0a	10.0a	10.0a
alachlor + fomesafen*	1.68 PE + 0.42 PO	10.0a	9.8a	10.0a	10.0a	10.0a
alachlor + fomesafen*	1.68 PE + 0.56 PO	10.0a	9.6a	10.0a	9.3a	10.0a
alachlor + fomesafen* + bentazon**	1.68 PE + (0.14 + 0.56) PO	10.0a	9.5a	10.0a	8.3a	10.0a
alachlor + fomesafen* + bentazon**	1.68 PE + (0.28 + 0.56) PO	10.0a	10.0a	10.0a	6.6ab	10.0a
alachlor + fomesafen* + bentazon**	1.68 PE (0.14 + 0.84) PO	10.0a	9.9a	10.0a	10.0a	10.0a
alachlor + fomesafen* + bentazon**	1.68 PE + (0.28 + 0.84) PO	10.0a	10.0a	10.0a	10.0a	10.0a
alachlor + fomesafen* + bentazon**	1.68 PE + (0.35 + 0.84) PO	10.0a	9.9a	10.0a	10.0a	10.0a
Uncultivated Check	-	3.3b	3.3b	3.3b	3.3b	3.3b

[a]Means within columns followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.
[b](*) = a nonionic surfactant 0.25% volume/volume included, (**) = crop oil concentrate 1 qt/A.
[c]PO = Postemergence, PE = Preemergence.
[d]0 = no reduction in stand, 10 = complete control.

EFFICACY OF DPX-F6025 ON BURCUCUMBER IN SOYBEANS

T. Wiepke, B. Hirsh, J. Heimer and S. Glenn[1/]

ABSTRACT

Field studies were conducted in 1983 and 1984 to evaluate burcucumber (*Sicyos angulatus* L.) control in soybeans (*Glycine max* Merr.). Burcucumber control was rated on a 0-100 scale; 0 = no control and 100 = complete control. Early postemergent and split applications of 0.43 or 0.56 kg ai/ha acifluorfen in both years did not provide control 6 weeks after application because of the continuing germination of burcucumber after application. Postemergent applications of 35 g ai/ha DPX-F6025 plus .25% nonionic surfactant gave 90% control of burcucumber (2-3 leaf stage) 6 weeks after application in 1983. In 1984, postemergent applications (2-3 leaf burcucumber) of 9, 18 and 27 g ai/ha DPX-F6025 plus .25% nonionic surfactant provided 90, 88 and 95% control, respectively, 2 weeks after application and 43, 66 and 81%, respectively, 6 weeks after application. Soybean injury from DPX-F6025 was less than 5% in both years.

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NEW HERBICIDES FOR PREEMERGENCE WEED CONTROL IN SOYBEANS

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ABSTRACT

The effectiveness and safety of three new herbicides for use in soybeans was investigated in a field experiment at the University of Massachusetts Experiment Station. Major weed species were large crabgrass [*Digitaria sanguinalis* (L.) Scop.], redroot pigweed (*Amaranthus retroflexus* L.) and common lambsquarters (*Chenopodium album* L.). Soybeans 'Evans' were planted on a Hadley fine sandy loam soil on May 23 at a density of 617,750 plants/ha. Three row plots were 8 m by 2.29 m and rows were 76.2 cm apart. On May 24, herbicide treatments were applied in preemergence with a CO_2 backpack sprayer in 450L/ha at 152 KPa. Treatments were replicated three times in a randomized complete block design. Alachlor, metribuzin, SD 095481 (Shell Devt. Co.) SC 0617 (Stauffer) and DPX F6025 (Dupont) were applied either alone or in combination. An untreated check was included for comparison. Front half of each plot was hand hoed on August 10. Visual injury ratings on a scale of 0 to 100, 0 indicating no injury and 100 indicating completely dead plants, and weed control ratings were taken twice during the summer. Plants were harvested from the front half of each plot on September 21 for soybean seed yield.

On June 21, all herbicide treatments provided excellent (above 90%) control of both annual grasses and broadleaf weeds. Alachlor at 2.24 kg/ha provided 100 and 90% control of grasses and broadleaf weeds, respectively. Metribuzin at 0.28 kg/ha provided only 63 and 85% control of grasses and broadleaf weeds, respectively. On August 24, annual grass control was 63% for SD 095481 plus metribuzin at 0.67 + 0.28 kg/ha, followed by 53% control with SD 095481 at 1.01 kg/ha as compared to the untreated check. All treatments failed to provide any acceptable crabgrass control on August 24, 1984 in the rear half of each plot where no cultivation was used. This may have been due to heavy infestation of large crabgrass as well as unusual rainfall (11.7 inches in May and 15.9 inches during the months of April, May and June, 1984).

No visual injury to soybeans was noted on June 21. However, some stunting of soybean plants indicating reduced vigor with smaller leaves was observed. The treatments included were low and high rates (0.56 and 1.01 kg/ha) of SD 095481, SC 0617 plus metribuzin at 0.84 + 0.28 kg/ha, and SC 0617 at 1.68 kg/ha.

The highest soybean yield (3850 kg/ha) was obtained from the treatment of alachlor plus metribuzin at 1.96 + 0.28 kg/ha. Soybean yield increased 66% when the rate of SD 095481 increased from 0.56 to 1.01 kg/ha. Soybean yield decreased (35%) when the rate of SC 0617 increased from 0.84 to 1.68 kg/ha. DPX F6025 at 17.5 and 35.0 gm/ha in combination with alachlor at 1.96 kg/ha resulted in comparable soybean yield (2675 kg/ha). The treatment combination of SD 095481 and metribuzin at 0.67 + 0.28 kg/ha resulted in 2685 kg/ha of soybean seed yield as compared to that of the untreated check (780 kg/ha). Soybean yield reduction (80%) was recorded when no weed control method was used as compared to the yield obtained from the best treatment combination of alachlor and metribuzin at 1.96 + 0.28 kg/ha.

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Timing of Application of AC 263,499 for Spurred Anoda (*Anoda cristata* L. Schlecht.) Control in Soybeans (*Glycine max* L. Merr.).

R. M. Herrick and R. D. Ilnicki[1]

ABSTRACT

AC 263,499, a new herbicide from the American Cyanamid Company, was evaluated under field conditions for control of spurred anoda in soybeans. Field experiments showed that AC 263,499 provided excellent preplant incorporated, preemergence, and postemergence control of spurred anoda when applied in a rate range of 32 to 250 g/ha. Soybean yield was significantly increased at these application rates compared to metribuzin, linuron, acifluorfen, or the check. Preplant incorporated or preemergence treatments of AC 263,499 at 250 g/ha caused slight dwarfing (<10%) of soybeans without adversely affecting soybean yield. The results also showed that 70% control of spurred anoda may be the economic threshold of this weed.

INTRODUCTION

Spurred anoda, a member of the Malvaceae, is a warm season species that is native to the southeastern United States, Central America, and South America (2). However, this annual broadleaf weed is also becoming a problem in the northern United States. A possible reason for the increased occurrence of this species in the north is the widespread use of weed control programs that reduce tillage and remove annual weeds that previously interferred with spurred anoda growth. Also, the species is resistant to many herbicides used for weed control in soybeans (1).

The imidazolinones are a new class of herbicides recently discovered by the American Cyanamid Co. (3). AC 263,499 (5-ethyl-2-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl) Nicotinic acid), a compound within this chemical class, provides broad spectrum weed control with selectivity in soybeans (4). Consequently, Cyanamid is developing this compound for use in soybeans and other leguminous crops. Although AC 263,499 is active against many annual broadleaf weeds, its effect against spurred anoda has not been examined. Therefore, the objective of this study was to determine the optimum timing of application of AC 263,499 for control of spurred anoda.

MATERIALS AND METHODS

Small plot field studies were conducted at the Soils and Crops Research Center, New Jersey Agricultural Experiment Station, Adelphia, NJ. The plots were established on a Holmdel loam soil containing 2.5% organic matter. The field was plowed and disked in the spring and received a broadcast application of 560 g/ha of 5-10-10 fertilizer which was incorporated by disking. The field then received a 840 g/ha application of trifluralin (α,α,α-trifluro-2,6-dinitro-N-N-dipropyl-p-toluidine) which was incorporated with a rotovator to control annual grasses. Spurred anoda seed was distributed over the field using a cyclone spreader and incorporated with a rotovator into the upper 1.27 cm of the soil. Broadleaved weeds other than spurred anoda were hand-pulled from each plot.

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The experiment was established in a randomized complete block design with three replications. Treatments to spurred anoda were applied preplant incorporated, preemergence, and at the cotyledon, 1st, 3rd, or 5th leaf stages of growth. Preplant incorporated treatments were incorporated with a rotovator. Soybeans (cv. Midstates 250) were planted immediately after incorporation in 76 cm rows. Plot size was 3.1 m x 5.8 cm with four rows per plot. Preemergence treatments were applied 2 hours after planting. Postemergence treatments were applied when the spurred anoda was at the desired stage of growth while soybeans were at the unifoliate, 2nd trifoliate, or 6th trifoliate stage. Treatments were applied at a spray volume of 187 L/ha with a CO_2 powered hand-held sprayer at 8, 16, 32, 63, 125, or 250 g ai/ha. The AC 263,499 used was a 2 EC (22.5%) formulation and postemergence applications included 0.25% (v/v) Tween 20 to aid penetration. Herbicidal ratings were taken 4 weeks after treatment.

RESULTS AND DISCUSSION

Small plot field studies showed that AC 263,499 applied preplant incorporated or preemergence in a rate range of 32 to 250 g/ha provided excellent control of spurred anoda (Table 1). Weed control in this rate range was significantly greater than that of either metribuzin or linuron applied at 209 and 560 g/ha respectively (Table 1). A slight dwarfing ($<$ 10%) of soybeans was evident at the 250 g/ha rate from both preplant incorporated and preemergence applications of AC 263,499. However, soybean yield was not significantly different from the hand-hoed check (Table 2). Both preplant incorporated and preemergence applications of AC 263,499 in the 32 to 250 g/ha rate range significantly increased soybean yield compared to metribuzin, linuron, and the check (Table 2). It is interesting to note that although AC 263,499 applied at 16 g/ha did not provide commercially acceptable control ($\geq$ 80%) of spurred anoda, a significant increase in soybean yield was obtained (Table 2). This result would indicate that 70% control of this weed may be the economic threshold.

AC 263,499 applied postemergence at 125 or 250 g/ha provided excellent control of spurred anoda through the 5th leaf stage of growth (Table 1). Soybean yield was significantly increased compared to acifluorfen applied at 560 g/ha or to the check (Table 2). Application of AC 263,499 below 125 g/ha did not provide commercially acceptable control (Table 1). However, a significant increase in soybean yield was obtained at the 63 g/ha rate of application (Table 2), indicating again that 70% control of spurred anoda may be the economic threshold of this weed.

The results of this study show that AC 263,499 provides excellent preplant incorporated, preemergence, and postemergence control of spurred anoda when applied in a rate range of 32 to 250 g/ha without adversely affecting soybean yield.

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Table 1: The Effect of AC 263,499 Applied at 187 L/ha on Field Grown Spurred Anoda Treated at Different Growth Stages[1].

Treatment	Rate (g a.e./ha)	Stage of Treatment				
		PPI	PRE	Coty./1st-leaf	3rd-leaf	5th-leaf
		Control[2]				
1. AC 263,499	250	9.6 a	9.8 a	9.6 a	9.6 a	9.5 a
2. AC 263,499	125	9.3 a	9.5 ab	9.5 a	8.7 b	8.3 b
3. AC 263,499	63	9.2 a	9.3 ab	7.8 b	7.3 c	7.5 c
4. AC 263,499	32	8.3 b	8.2 c	4.7 c	4.0 d	4.2 d
5. AC 263,499	16	7.2 c	7.4 d	3.3 d	2.7 e	3.2 e
6. AC 263,499	8	5.4 d	5.2 e	2.2 e	1.8 e	2.4 f
7. metribuzin	209	4.3 e	-	-	-	-
8. linuron	560	-	3.3 f	-	-	-
9. acifluorfen	560	-	-	0.8 f	0.8 f	0.7 g
10. Check-trifluralin	840	0.0 f	0.0 f	0.0 f	0.0 f	0.0 g

[1] Data represent the mean of 3 replications. Numbers followed by the same letters within a column are not significantly different at the 5% level as determined by Duncan's multiple range test.

[2] Based on scale 0 to 10: 0 = no control, 10 = complete control.

Table 2: Soybean Yield as Affected by AC 263,499 Applied at 187 L/ha Under Field Conditions[1].

Treatment	Rate (g a.e./ha)	Stage of Treatment				
		PPI	PRE	Unifoliate	1st TRF.[2]	6th TRF.[3]
		kg/ha[4]				
1. AC 263,499	250	2763 a	2655 ab	2746 ab	2653 b	2572 b
2. AC 263,499	125	2814 a	2758 a	2836 a	2669 b	2515 b
3. AC 263,499	63	2811 a	2748 a	2851 a	2613 b	2418 b
4. AC 263,499	32	2768 ab	2668 ab	2094 c	2105 c	2048 c
5. AC 263,499	16	2641 ab	2530 ab	1967 c	1884 d	1781 cd
6. AC 263,499	8	2110 cd	2131 c	1832 cd	1788 de	1594 d
7. metribuzin	209	2263 c	-	-	-	-
8. linuron	560	-	2045 c	-	-	-
9. acifluorfen	560	-	-	1764 d	1648 de	1409 e
10. Check - trifluralin	840	1918 d	1859 d	1635 d	1450 e	1255 e
11. Check - hand-hoed	-	2785 a	2732 ab	2831 a	2765 a	2752 a

[1] Data represent the mean of 3 replications. Numbers followed by the same letters within a column are not significantly different at the 5% level as determined by Duncan's multiple range test.

[2] TRF = Trifoliate

[3] IBID.

[4] Soybean yield at 12.5% moisture.

SOME POSTEMERGENCE BROADLEAF HERBICIDES FOLLOWING PREEMERGENCE ALACHLOR IN SOYBEANS[1]

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ABSTRACT

A field study was established to evaluate several new candidate postemergence broadleaf herbicides in soybeans. They were lactofen, PPG 1013, DPX F6025, AC 252214, and fomesafen and these were compared to bentazon, a label-approved proven broadleaf herbicide. It was reasoned that these could be best evaluated by eliminating most of the grassy weeds with preemergence alachlor at 1.56 kg/ha. The broadleaf herbicides were applied at the following rates: bentazon at 0.84, lactofen at 0.11, PPG 1013 at 0.03, DPX F6025 at 0.009, AC 252214 at 0.14, and fomesafen at 0.28 kg/ha. All applications were made when soybeans were in the 2nd trifoliate leaf stage and common lambsquarters *(Chenopodium album* L.), redroot pigweed *(Amaranthus retroflexus* L.), velvetleaf *(Abutilon theophrasti* Medic.), and fall panicum *(Panicum dichotomiflorum* Michx.) were in the 3- to 4-leaf stages and 1 to 2 inches tall. The herbicides were applied alone, alone following preemergence alachlor, alone in combinations with bentazon, and in combination with bentazon following preemergence alachlor, all at the single application rate indicated above.

Bentazon was effective on lambsquarters and velvetleaf but poor on pigweed and fall panicum. Lactofen was effective on pigweed and velvetleaf and ineffective on fall panicum and lambsquarters. PPG 1013 was ineffective on fall panicum and produced excellent control of all broadleaf weeds. DPX F6025 was excellent on all weeds except fall panicum. AC 252214 did not control lambsquarters or fall panicum but was excellent on pigweed and velvetleaf. Fomesafen was ineffective on fall panicum and lambsquarters but excellent on pigweed and velvetleaf.

Of the broadleaf weeds, pigweed was not controlled by bentazon and, as with the candidate herbicides, had no effect on fall panicum. When the new herbicides were combined with bentazon, without the benefit of preemergence alachlor, the spectrum of broadleaf weeds controlled was increased. Almost all weeds in the experimental area were controlled when the new herbicides were combined with bentazon as a sequential application following preemergence alachlor.

Yields were significantly reduced by bentazon, lactofen, bentazon + lactofen, PPG 1013 and bentazon + PPG 1013 but this was the result of poor fall panicum control and not crop injury. DPX F6205 alone or in any combination significantly reduced yield but this was due to crop injury.

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[1]New Jersey Agricultural Experiment Station Publication No. J-15274-7-84.

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CONTROL OF ANNUAL GRASSES IN SOYBEANS WITH POSTEMERGENCE HERBICIDES AND ADJUVANTS[1]

D. Kluchinski and R. D. Ilnicki[2]

ABSTRACT

Four postemergence grass herbicides sethoxydim, haloxyfop-methyl, fluazifop-butyl and SC 1084 were evaluated alone and in conjunction with five adjuvants for control of three annual grasses. The adjuvants were crop oil concentrate, soybean oil, AG-98 and experimentals ARCO 810-5S and ARCO 810-8S. Soybeans tolerated all herbicide treatments and any early injury was rapidly outgrown. Weed control was increased at optimum use rates in comparison to lower rates. Without exception, all adjuvants provided equal or increased weed control. The degree of enhancement varied with herbicide and weed species. Yields with all combinations were not significantly different.

INTRODUCTION

Increased soybean *(Glycine max.* L. Merr.) acreage in New Jersey and nationally has provided impetus for the development of new herbicides for this crop. One of the recent breakthroughs in herbicide technology has been the development of postemergence soybean herbicides for the potential control of annual and perennial grasses. Another advance has been the development of surface active agents to be used with herbicides, not necessarily to reduce the amount of herbicide used, but to increase the herbicidal efficacy.

Since the release of these new postemergence grass herbicides, the question has arisen whether there are any great significant weed control differences between them. In addition, the effects of the new adjuvants also poses a question. It has generally been excepted that adjuvants, regardless of their make-up, can increase herbicide efficacy. However, there are differences between them. For example, there are many different types of adjuvants available for use: nonionic and anionic surfactants, herbicidally active oils of vegetable or mineral origin, oil concentrates consisting of blends of oils and surfactants, and surfactants with varying degrees of propoxylation.

Whether these differences in adjuvant composition have an effect on the performance of these new grass herbicides have never been fully ascertained. Therefore, it was the objective of this study (1) to investigate whether there were any significant differences in herbicide performance of sethoxydim

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[2-[1-(ethoxyamino)butyl)]-5-[2-ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one], haloxyfop methyl (methyl-2-(4-[(3-chloro-*S*-(trifluoromethyl)-2-pyridenyl]oxy] phenoxy]propanoate],fluazifop-butyl[butyl 2-[4-[(5-trifluoromethyl)-2-pyridinyl) oxy]phenoxy]proponate], and SC 1084 (chemistry not released), and (2) to investigate the effects of an anionic surfactant (AG-98), a crop oil concentrate (a mineral oil plus surfactant), soybean oil (soybean oil plus emulsifier), and two experimental surfactants, ARCO 810-5S and ARCO 810-8S (five and eight oxypropylene units, respectively, per molecule) on the performance of these four herbicides.

MATERIALS AND METHODS

This study was conducted at the Soils and Crops Research Center, New Jersey Agricultural Experiment Station, Adelphia, N. J. Soybeans (cv. Midstates 250) were planted on June 21 in 76 cm rows, four rows per plot. The soil was a Sassafras loam soil (organic matter 1.5%). Fall panicum *(Panicum dichotomiflorum* Michx.) was sown at the rate of 3.4 kg/ha of seed combined with sand in the ratio of three parts sand to one part seed with a hand held cyclone seeder to insure a good weed density. Soon after planting, plots 5.8 m in length were established to receive postemergence herbicide treatments. Each treatment was replicated three times in a randomized complete block design. Treatments were applied at 374 l/ha using a backpack CO^2-propelled sprayer with water as the carrier, and included sethoxydim, fluazifop-butyl and SC 1084 at .28 and .43 kg/ha and haloxyfop-methyl at .07 and 0.1 kg/ha. Treatments also included crop oil concentrate at 2.3 l/ha, AG-98 at 0.25% v/v, soybean oil concentrate at 0.25% v/v, and both ARCO 810-5S and ARCO 810-8S at 0.25, 0.5 and 1.0% v/v, used with the higher rate of each herbicide (considered the average use rate). Nozzles used were Unijet flat tips number 730616. The dominant weed species in the area besides the seeded fall panicum included large crabgrass *(Digitaria sanguinalis* Scop.), barnyardgrass *(Echinochloa crus-galli* Beauv.), redroot pigweed *(Amaranthus retroflexus* L.), common lambsquarter (*Chenopodium album* L.), common purslane *(Portulaca oleracea* L.), and carpetweed *(Mollugo verticillata* L.).

Postemergence treatments were applied July 10 when the soybeans were in the second to third trifoliate stage and 20 cm tall. Weeds were in the following stages of growth: large crabgrass - 2 to 6 leaf, 1 - 10 cm tall; fall panicum - 2 to 4 leaf, 5 - 15 cm tall; barnyardgrass - 2 to 4 leaf, 5 - 15 cm tall; redroot pigweed - 2 to 6 leaf, 1 - 5 cm tall; common lambsquarters - 2 to 4 leaf, 1 - 5 cm tall, common purslane - cotyledonary to 2 leaf, 1 cm tall; carpetweed - 2 to 8 leaf, 1 - 2.5 cm tall. Observations were made throughout the growing season. Initial detailed observations were recorded on July 20 with a follow-up rating on August 9 using a scale of 0 to 10 where 0 = no effect and 10 = complete control. The entire field was treated on July 25 with acifluorfen at .42 kg/ha with 2.3 l/ha crop oil concentrate in a total spray volume of 379 l/ha in order to remove broadleaf weeds. This allowed solely grasses in the plots for our study. Soybeans were harvested on October 25. One of the two harvest rows of the four rows in the plot were randomly harvested and threshed with a portable thresher. Soybeans were later cleaned and dried to room temperature. Yields are expressed in kg/ha.

RESULTS AND DISCUSSION

Summarized in Table 1 are the weed control ratings and yields for the grass herbicides used singularly at the optimum use rate and a lower rate. All four herbicides at optimum use rates provided approximately equal or better weed control than the lower rate. Sethoxydim at .28 kg/ha showed particularly poor large crabgrass control, yet better control was obtained at the higher rate of .43 kg/ha. Haloxyfop at .07 kg/ha and SC 1084 at .28 kg/ha both showed initial knockdown of fall panicum and barnyardgrass, but regrowth occurred by the second rating. (Second rating data not included, similar to first rating). Better control was exhibited at the higher rates, .1 kg/ha and .43 kg/ha, respectively. There was no significant difference in soybean vigor or yields with any of the herbicides at either rate.

In Table 2 are summarized the effects of the herbicide at the optimum use rate when used alone and in combination with the five adjuvants. Sethoxydim, haloxyfop, fluazifop and SC 1084 all provided approximately equal or increased weed control with the five adjuvants at all rates when compared to the herbicides alone at the same rate.

From this study, several points deserve comment. Good control of fall panicum, large crabgrass and barnyardgrass in soybeans may be obtained from post-emergence applications of the new grass herbicides studied. In some cases, good control was achieved at the low rate, yet better control was observed at the higher, or average, optimum rate. The best control was achieved through the addition of an adjuvant, whether an oil (soybean oil), oil plus surfactant (crop oil concentrate), anionic surfactant (AG-98) or anionic surfactant with increased propoxylation on its rings (ARCO 810-5S and ARCO 810-8S). The ARCO 810-5S and ARCO 810-8S surfactants at all rates notably enhanced control of all the herbicides without any significant effects on soybean vigor or yields, nor did the other adjuvants studied.

Table 1. The effects of four grass herbicides at two rates on the control of three annual grasses in soybeans.

Herbicide	Rate kg/ha	Weed Control (a) PANDI	DIGSA	ECHCG[b]	Yield kg/ha
sethoxydim	.28	9.9a	6.6	10.0a [c]	2285 bcd
	.43	10.0a	10.0a	10.0a	2539abcd
haloxyfop-methyl	.07	8.6c	9.8b	9.8ab	2075cd
	.10	9.9a	9.9a	10.0a	2609abc
fluazifop-butyl	.28	9.9a	9.9a	10.0a	2613abc
	.43	10.0a	10.0a	10.0a	2831abc
SC 1084	.28	9.0b	9.9a	9.5c	2834ab
	.43	9.3b	9.9a	9.6a	2798ab

[a] Based on a scale of 0 to 10, where 0 = no control; 10 = complete control. Means within corresponding columns followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

[b] PANDI = fall panicum; DIGSA = large crabgrass; ECHCG = barnyardgrass

[c] First rating.

Table 2. The effects of four grass herbicides at the optimum use rate alone and in combination with five adjuvants on control of three annual grasses in soybeans.

Herbicide + Adjuvant	Rate kg/ha	Weed Control (a) PANDI	DIGSA	ECHCG[b]	Yield kg/ha
sethoxydim	.43	10.0	10.0a	10.0a[c]	2539abcd
sethoxydim + COC	.43 + 2.3 l/ha	10.0a	10.0a	10.0a	2628abc
sethoxydim + AG-98	.43 + .25%	10.0a	10.0a	10.0a	2738ab
sethoxydim + Soy oil	.43 + .25%	10.0a	10.0a	10.0a	2340abcd
sethoxydim + 810-5S	.43 + .25%	10.0a	10.0a	10.0a	2459abcd
sethoxydim + 810-5S	.43 + 1.0%	10.0a	10.0a	10.0a	2835ab
sethoxydim + 810-8S	.43 + .25%	10.0a	10.0a	10.0a	2678abc
sethoxydim + 810-8S	.43 + 1.0%	10.0a	10.0a	10.0a	2841ab
haloxyfop-methyl	0.1	9.9a	9.9a	10.0a	2609abc
haloxyfop-methyl + COC	0.1 + 2.3 l/ha	10.0a	10.0a	10.0a	2726ab
haloxyfop-methyl + AG-98	0.1 + .25%	10.0a	10.0a	10.0a	2718ab
haloxyfop-methyl + Soy oil	0.1 + .25%	9.9a	9.9a	10.0a	2290bcd
haloxyfop-methyl + 810-5S	0.1 + .25%	10.0a	10.0a	10.0a	2751ab
haloxyfop-methyl + 810-5S	0.1 + 1.0%	10.0a	10.0a	10.0a	2556abc
haloxyfop-methyl + 810-8S	0.1 + .25%	9.9a	9.9a	10.0a	2447abcd
haloxyfop-methyl + 810-8S	0.1 + 1.0%	10.0a	10.0a	10.0a	2843ab

Table 2 (cont'd)

Herbicide + Adjuvant	Rate kg/ha	Weed Control (a) PANDI	DIGSA	ECHCG[b]	Yield kg/ha
fluazifop-butyl	.43	10.0a	10.0a	10.0a	2831ab
fluazifop-butyl + COC	.43 + 2.3 l/ha	10.0a	10.0a	10.0a	2959a
fluazifop-butyl + AG-98	.43 + .25%	10.0a	10.0a	10.0a	2492abcd
fluazifop-butyl + Soy oil	.43 + .25%	10.0a	10.0a	10.0a	2600abc
fluazifop-butyl + 810-5S	.43 + .25%	10.0a	10.0a	10.0a	2570abc
fluazifop-butyl + 810-5S	.43 + 1.0%	10.0a	10.0a	10.0a	2597abc
fluazifop-butyl + 810-8S	.43 + .25%	10.0a	10.0a	10.0a	2624abc
fluazifop-butyl + 820-8S	.43 + 1.0%	10.0a	10.0a	10.0a	2704abc
SC 1084	.28	9.0b	9.9a	9.6c	2881ab
SC 1084	.43	9.3b	9.9a	9.6bc	2798ab
SC 1084 + COC	.43 + 2.3 l/ha	10.0a	10.0a	10.0a	2533abcd
SC 1084 + AG-98	.43 + .25%	10.0a	10.0a	10.0a	2575abc
SC 1084 + Soy oil	.43 + .25%	9.9a	10.0a	9.9a	2599abc
SC 1084 + 810-5S	.43 + .25%	9.9a	10.0a	9.9a	2627abc
SC 1084 + 810-5S	.43 + 1.0%	10.0a	10.0a	10.0a	2459abcd
SC 1084 + 810-8S	.43 + .25%	9.9a	9.9a	9.9a	2763ab
SC 1084 + 810-8S	.43 + 1.0%	9.9a	10.0a	9.9a	2522abcd

Table 2 (cont'd)

Herbicide + Adjuvant	Rate kg/ha	Weed Control (a) PANDI	DIGSA	ECHCG(b)	Yield kg/ha
Check - alachlor + linuron	1.68 + .56	9.9a	10.0a	10.0a	2831ab
Check - cultivated		10.0a	10.0a	10.0a	2984a
Check - uncultivated		0.0d	0.0c	0.0d	1928d

(a) Based on a scale of 0 to 10 where 0 = no control; 10 = complete control. Means within corresponding columns followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

(b) PANDI = fall panicum; DIGSA = large crabgrass; ECHCG = barnyardgrass.

(c) First rating.

EFFECTS OF SELECTED PREEMERGENCE AND POSTEMERGENCE HERBICIDES IN SOYBEANS FOLLOWING PASTURE

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ABSTRACT

The development of short-season soybean cultivars prompted an assessment of their performance under varied levels of weed management in Maine during 1984. The cultivars `Evans' and `Maple Amber' were drill-seeded (18 cm rows) on June 17 into a tilled, former pasture site in Houlton which contained significant levels of quackgrass (Agropyron repens L.) rhizomes. A seeding of Evans at two row spacings (50 and 76 cm) was made at a similar site in Stillwater on May 17. Selected rates and combinations (Table 1) of chloramben, chloramben + alachlor, chloramben + metolachlor and FMC-57020 were made within 48 hours of seeding. Fluzifop-butyl and sethoxydim were applied to selected plots in Houlton on July 19 at 0.84 and 0.42 kg ai/ha, respectively. All plots at Stillwater received an application of fluzifop-butyl (0.84 kg ai/ha) on June 19. Treatments were evaluated on 2.8 m by 6 m plots and were replicated three or more times using a randomized complete block design. Herbicides were applied with a CO_2 pressurized sprayer which delivered a 206 L H_2O/ha equivalent at 220 KPa.

Average yields for `Maple Amber' and `Evans' were 1.68 and 1.40 Mg/ha at Houlton. Cultivar by herbicide interactions were nonsignificant (0.05 level). Highest soybean yields were associated with FMC-57020, chloramben + alachlor, chloramben + metolachlor and these three preemergence treatments in combination with sethoxydim. FMC-57020 was most effective in supression of early-season quackgrass growth. Control of quackgrass was good with the evaluated rates of sethoxydim and fluzifop-butyl; although yield depression was noted with the latter treatment. All preemergence combinations provided satisfactory control of wild mustard (Brassica spp.).

Increasing row-width of soybeans from 50 to 76 cm resulted in an average yield reduction of 1.0 Mg/ha (14.8 bu/A) at Stillwater. Yield responses to herbicide treatments were nonsignificant (0.05 level). FMC-57020 generally provided better control of shepherds purse (Capsella Bursa-pastoris L.), smooth crabgrass [Digitaria ischaeman (Schreb.) Muhl.], common lambsquarters (Chenopodium album L.), and oxalis (Oxalis spp.) than applications of chloramben + alachlor or chloramben + metolachlor. Each preemergence treatment provided similar control of redroot pigweed (Amaranthus retroflexus L.) and prostrate pigweed (A. blitoides L.).

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Table 1. Effects of selected preemergence and postemergence herbicides on weed control and yield of soybeans - Maine 1984[1]

Houlton, ME: Seeded 6/18/84

Treatment[2] Pre	Post	Grain Yield (Mg/ha)	QG (7/19)	QG (8/2)	Mustard (8/2)
			Rating 3		
check		1.15 c	0 c	1.6 d	7.9 b
chloramben	no	1.15 c	0.5 c	1.3 d	10 a
chloramben + alachlor	no	1.83 ab	4.3 b	4.3 c	10 a
	fluzifop	1.45 bc	--	8.8 a	9.8 a
	sethoxydim	1.61 abc	--	7.9 ab	10 a
chloramben + metolachlor	no	1.72 ab	6.1 ab	5.0 c	10 a
	fluzifop	1.36 c	--	8.8 a	10 a
	sethoxydim	1.63 abc	--	8.4 ab	10 a
FMC-57020	no	2.05 a	7.8 a	7.0 b	10 a
	fluzifop	1.42 bc	--	9.5 a	10 a
	sethoxydim	2.01 a	--	9.4 a	10 a
$\bar{x}$	no	1.87 a	--	5.4 b	--
	fluzifop	1.41 b	--	9.0 a	--
	sethoxydim	1.75 a	--	8.6 a	--

Stillwater, ME: Seeded 5/17/84

Treatment[5]	Grain Yield bu/A	SP (6/19)	SP (7/12)	RRPW (6/19)	RRPW (7/2)	PW (6/19)	PW (7/2)	SCG (6/19)	SCG (7/2)	LQ (6/19)	LQ (7/12)	Oxalis (6/19)	Oxalis (7/12)
		Rating[2]											
check	2.87	3.2 c	0.5 c	6.5 b	6.8 b	6.5 b	3.3 b	6.0 b	3.3 c	9.0	5 c	5.3 b	3 b
chloramben + alachlor	2.82	7.5 b	5.8 b	8.9 a	9.8 a	8.6 a	7.8 a	9.0 a	8.5 b	9.1	8.8 b	9.0 a	7 b
chloramben + metolachlor	3.14	6.8 b	4.4 b	9.2 a	9.0 a	9.2 a	7.4 a	9.7 a	9.6 ab	9.5	5.8 c	8.0 a	5.2 c
FMC-57020	3.28	9.9 a	10 a	9.8 a	10 a	9.0 a	7.8 a	10 a	10 a	10	10 a	9.8 a	10 a
76 cm Row	2.56 b	6.5	4.8	8.3	8.8	8.3	7.2 b	8.5	7.9	9.2	6 b	7.8	6.2
50 cm Row	3.56 a	7.3	5.5	9.0	9.0	8.5	5.3 a	9.0	8.0	9.6	8.4 a	8.1	6.2

[1]Weed codes (acronym-species): QG - Agropyron repens; Mustard - Brassica spp.; SP - Capsella Bursa-pastoris; RRPW - Amaranthus retroflexus; PPW - Amaranthus blitoides; SCG - Digitaria ischaemon; LQ - Chenopodium album; Oxalis - Oxalis spp.

[2]Chemical (kg ai/ha): chloramben (2), alachlor (2.2), metolachlor (2.2), FMC-57020 (1.1), fluzifop-butyl (0.84), sethoxydim (0.42). Preemergence application on 6/20/84, post emergence application on 7/19/84).

[3]Rating: 10 = excellent control, 0 = no control.

[4]Means within rows and groups followed by a letter in common are not significantly different (P = 0.05).

[5]Chemcial (kg ai/ha): chloramben (2), alachlor (1.7), metolachlor (1.7), FMC-57020 (0.84). Preemergence application on 5/18/84. All plots received 0.84 kg ai fluzifop-butyl/ha on 7/6/84.

THE EFFECTS OF VOLUME AND PRESSURE VARIATION IN THE APPLICATION OF LACTOFEN TO SOYBEANS

Edward J. Spyhalski[1], Howard E. Shepherd[1], Clifford A. Trammell, Jr.[1]

ABSTRACT

The total spray volume and the pressure with which the spray is applied are variants in the uniformity and completeness of soil or foliage coverage by herbicides. Therefore, determining the effects of volume and pressure in applications of lactofen were the objectives of a series of field studies conducted in 1982 and 1984.

The 1982 studies were conducted in Kentucky. Volumes of 20 and 40 gallons per acre (gpa) were used at 15, 30 and 50 pounds per square inch (psi) on soybeans that showed two expanded trifoliate leaves. Rates of lactofen used in the 1982 trials were 0.1 and 0.2 pounds per acre (lb/A), with and without a surfactant at 0.25% volume basis. Lactofen was applied in 1984 to emerged soybeans in spray volumes of 10, 20 and 40 gpa using pressures of 30, 45 and 60 psi. Lactofen was used at 0.15 lb/A with a non-ionic surfactant at 0.25% volume basis. The studies were conducted in Mississippi, Iowa and Kentucky.

The volume differences were attained by using variable-sized nozzles and adjusting the speed of the sprayer. Flat-fan nozzles were used for all applications.

The postemergence applications of lactofen at 10 gpa, using lower pressures, showed a reduced herbicidal effect on weeds and crop compared with increased-pressure applications of 20 or more gpa. With time, the differences in weed control and crop injury tended to equalize. It is believed that this effect resulted from crop regrowth and competition over the stunted weeds receiving the 10 gpa spray treatment. No differences in late-season weed control, crop phytotoxicity or yield of soybeans were seen between treatments when lactofen was applied in spray volumes of 20, 30 or 40 gpa at pressures of 30 to 60 psi.

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WIRESTEM MUHLY CONTROL IN RELATION TO TIMING AND MANAGEMENT

W. Thomas Lanini[1/]

ABSTRACT

Wirestem muhly [Muhlenbergia frondosa (Poir.) Fern.] is a perennial grass species, commonly a problem in no-till fields. A study was conducted to evaluate the efficacy of fluazifop at 0.56 and 1.12 kg/ha, Sethoxydim at 0.56 and 1.12 kg/ha and Glyphosate at 2.25 and 4.5 kg/ha, on wirestem muhly. All treatments were applied to mowed and unmowed areas using 93 and 187 l/ha of water. All chemicals were applied on August 22, and September 22, 1983, to additionally evaluate the effect of spray date.

Fluazifop was most effective on the August treatment date, regardless of rate, spray volume, or mowing condition. Fluazifop was generally more effective in September if the plots had been previously mowed. Glyphosate was very effective regardless of spray date, spray volume, rate of application, or mowing conditions. Sethoxydim was most effective when applied in August at the high spray volume on mowed plots. The lower rate of Sethoxydim application appeared to give equal or better control than the higher application rates. Mowing by itself was partially effective in controlling wirestem muhly.

Table 1. Herbicide efficacy on wirestem muhly in relation to spray timing, spray volume and mowing condition

TREATMENT	RATE kg ai/ha	SPRAY VOLUME l/ha	APPLICATION DATE (1983)	MOWED[a] % CONTROL[c]	UNMOWED[b] % CONTROL[c]
Fluazifop[d]	0.56	93	Aug 22	89.5	96.7
Fluazifop	0.56	93	Sept 22	35.0	13.3
Fluazifop	0.56	187	Aug 22	95.0	71.7
Fluazifop	0.56	187	Sept 22	50.0	13.3
Fluazifop	1.12	93	Aug 22	80.0	96.7
Fluazifop	1.12	93	Sept 22	55.0	13.3
Fluazifop	1.12	187	Aug 22	95.0	94.3
Fluazifop	1.12	187	Sept 22	57.5	61.7
Glyphosate	2.25	93	Aug 22	97.5	96.3
Glyphosate	2.25	93	Sept 22	93.5	96.3
Glyphosate	2.25	187	Aug 22	97.0	99.3
Glyphosate	2.25	187	Sept 22	99.0	95.0
Glyphosate	4.50	93	Aug 22	99.0	98.0
Glyphosate	4.50	93	Sept 22	94.0	99.0
Glyphosate	4.50	187	Aug 22	98.5	99.0
Glyphosate	4.50	187	Sept 22	96.5	96.7
Sethoxydim[d]	0.56	93	Aug 22	35.0	48.3
Sethoxydim	0.56	93	Sept 22	65.0	11.7
Sethoxydim	0.56	187	Aug 22	80.0	50.0
Sethoxydim	0.56	187	Sept 22	72.5	30.0
Sethoxydim	1.12	93	Aug 22	37.5	53.3
Sethoxydim	1.12	93	Sept 22	50.0	15.0
Sethoxydim	1.12	187	Aug 22	75.0	70.0
Sethoxydim	1.12	187	Sept 22	42.5	18.3
Check	-			55.0	11.7
LSD[e] .05					22.8

[a] Wirestem muhly clipped to 6 inch height on August 9, 1983.

[b] Wirestem muhly was 20 inches tall on unmowed plots.

[c] Control was visually evaluated in July, 1984.

[d] Crop Oil Concentrate added at labeled rate to fluazifop and sethoxydim treatments.

[e] Least significant difference value used to compare any two values.

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Fluazifop for Quackgrass Control in Seedling Alfalfa

William B. Duke and Jeffrey H. Birk

ABSTRACT

Control of quackgrass (Agropyron repens L. Beauv.) continues to be a problem associated with legume establishment in the Northeast. Herbicides applied preplant will often provide some initial control but the effects are too transitory. During 1982 and 1983, research was conducted at Etna, N.Y. on Lanford-Erie channery silty loam to evaluate the efficacy of fluazifop for control of quackgrass in seedling alfalfa. Fluazifop was applied each year at rates of 0.28, 0.56 and 1.12 kg/ha at the 3 to 4 or 5 to 6-leaf stages of quackgrass. Sequential treatments of 0.28 and 0.56 kg/ha were applied at each of the mentioned leaf stages. At the time of applications, alfalfa had 1 to 2 or 5 to 6-trifoliate leaves. Results showed that when quackgrass was in the 3 to 4-leaf stage, 0.56 kg/ha was sufficient for control which resulted in significantly increased alfalfa yield. When quackgrass was larger (5 to 6-leaf stage) higher rates of fluazifop were needed. Sequential applications provided better overall quackgrass control than individual treatments at the more advanced weed growth stage.

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Effect of DPX-Y6202, Haloxyfop, and PP005 on Moisture Uptake by Quackgrass

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ABSTRACT

One of the most important perennial weeds in the northeast is quackgrass (Agropyron repens (L.) Beauv.). Recently, several herbicides have been developed that permit postemergence control of quackgrass. Growth of quackgrass treated with these herbicides ceases immediately, but 10 to 14 days are required before the above ground foliage is fully necrotic. Thus, the time after treatment when competition for water from the quackgrass plant is reduced or stopped is unclear.

A quackgrass sod was treated in the spring with DPX-Y6202, haloxyfop, and PP005. Each herbicide was applied in single applications at rates of 0.28 kg/ha and 0.56 kg/ha and also in split applications at rates of 0.14 + 0.14 kg/ha and 0.28 + 0.28 kg/ha. The second treatment of the split applications was applied 16 days after the initial spraying. Soil moisture was monitored with gypsum blocks for 44 days after initial herbicide treatments to determine relative moisture extraction. The degree of quackgrass control was determined by taking wet and dry weights of foliage 43 days after initial herbicide treatments.

In comparing herbicide treatment effects, none of the soils had significantly greater moisture than the control until 11 days after spraying. After this time, all of the treatments remained wetter than the control for the rest of the study. Visually, control with PP005 appeared less effective than with DPX-Y6202 and haloxyfop, but moisture data does not support this observation. At the rates used, all three herbicides were equally effective based on soil moisture determinations. In addition, there did not appear to be an advantage for split applications over single treatments for the three herbicides tested. Quackgrass foliage weight at 43 days was negatively correlated with available soil moisture.

The effect of these herbicides on water uptake by quackgrass was also studied in the laboratory. The time after treatment when water uptake by quackgrass was reduced depended on the herbicide used. DPX-Y6202 was quickest to reduce moisture competition, followed in order by haloxyfop and PP005. As in the field, no advantage was found for split treatments over single applications on the basis of soil moisture.

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Volunteer Wheat Control with Fluazifop, Haloxyfop, and Sethoxydim in Seedling Alfalfa

Richard A. Beardmore and Dean L. Linscott[1/]

ABSTRACT

A limiting factor in alfalfa establishment is availability of moisture for seed germination and early development of the seedling. Weeds, volunteer crops, and companion crops growing in association with the seedling legume, compete for the available soil moisture. Since alfalfa in many cases is planted after small grain harvests, volunteer small grains are often the dominant competitive species, particularly in limited tillage situations. During the summer of 1984, we conducted several studies to correlate the effect of postemergence treatments of fluazifop, haloxyfop and sethoxydim on small grain control and the resulting soil moisture conservation. Oats or wheat were used as the susceptible species and daily soil moisture readings were taken using gypsum blocks located 5 cm deep in the plot row.

Four rates of each compound, fluazifop and sethoxydim at 0.56, 0.28, 0.14, and 0.07 kg/ha, and haloxyfop at 0.14, 0.07, 0.035 and 0.02 kg/ha, were used. Rates, as determined by preliminary log-screen applications, were selected so that the two highest provided control and mortality and the two lowest provided suppression without killing the plants. Correlations were made between the level of small grain control, alfalfa establishment and treatment effects on soil moisture conservation. The mean treatment effect on soil moisture was calculated by taking the matric potential difference from the control and calculating the treatment mean for all days, during the 30 day period, in which a significant F statistic was observed ($\leq$ 0.05).

A late spring planting of oats was treated to observe the effect of treatments on in-field soil moisture conservation. Herbicide treatment resulted in a significant negative correlation ($r = -.90$) between soil moisture conservation and oat dry weight. Only the highest rate of each compound provided adequate control of oats in the field.

Two late summer plantings of alfalfa interseeded with wheat were used to determine treatment effects on establishment of alfalfa seedlings. In both cases significant rainfall occurred after planting. Nevertheless, alfalfa stand obtained was related to herbicide effectiveness and water conserved in the rooting zone. In both studies significant negative correlations between the number of wheat stems and soil moisture conserved were found ($r = -0.70$ and -0.74, respectively). Positive correlations of 0.65 and 0.38 were found between soil moisture conservation and the number of alfalfa seedlings. In both cases a strong negative correlation between the number of wheat stems and number of alfalfa seedlings was found ($r = -0.96$ and -0.85; respectively). The most effective rates for wheat control were 0.56 and 0.28 kg/ha fluazifop, 0.14 kg/ha haloxyfop, and 0.56 kg/ha sethoxydim.

We conclude from these studies that the lower doses of herbicide fail to adequately control small grain competition; only the highest dose of each compound results in satisfactory conservation of soil moisture for the benefit of the alfalfa seedling.

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CONTROL OF ANNUAL GRASSES IN SEEDLING ALFALFA WITH EARLY AND LATE POSTEMERGENCE APPLICATIONS OF GRASS HERBICIDES

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ABSTRACT

Control of annual grasses has been a major problem in the spring establishment of new stands of alfalfa. The rapidly growing annual grasses compete for light, nutrients and water resulting in reduced alfalfa growth. The period of annual grass competition prior to the first cut has been shown to have a detrimental effect on alfalfa yields. Six experimental herbicides were evaluated for postemergence grass control at the Massachusetts Agricultural Experiment Station. The objective was to evaluate both early and late postemergence grass control of annual grasses in seedling alfalfa.

Sethoxydim, fluazifop-P-butyl, haloxyfop-methyl, fenoxyprop-ethyl, SC 1084 (Stauffer) and DPX 6202 (Dupont) were evaluated at 0.14 and 0.28 kg/ha. Alfalfa 'Saranac AR' was conventionally seeded on May 7, 1984 at 16.8 kg/ha. Early postemergence treatments were applied on June 8, 1984 when alfalfa was in the 3-4 trifoliate leaf stage and the annual grasses were in the 2-5 leaf stage. Late postemergence treatments were applied on June 20, 1984 when alfalfa was in the 8-9 trifoliate leaf stage and the annual grasses were in the 5-6 leaf stage and tillering. The most important grass weed species were yellow foxtail (Setaria lutescens L.), barnyardgrass [Echinochloa crusgalli (L.) Beauv.] and large crabgrass [Digitaria sanguinalis (L.) Scop]. Broadleaf weeds were controlled with a blanket application of 2,4-DB at 1.12 kg/ha on June 15, 1984. Plot size was 1.5 by 6m. Treatments were arranged in a randomized complete block design with four replications. All herbicides were applied with a backpack CO_2 sprayer at 152 KPa in 450 L/ha.

All herbicides applied both early and late postemergence resulted in excellent annual grass control by the time of the first cutting on July 25, 1984. Herbicide treatments reduced average dry matter yields of annual grasses 99% as compared to the dry matter yield of the control (3479 kg/ha). All early and late postemergence applications of sethoxydim, fluazifop-P-butyl, haloxyfop-methyl, fenoxyprop-ethyl, SC 1084, and DPX 6202 significantly increased average first cut alfalfa yields (3642 kg/ha) over that of the control (1872 kg/ha). Early and late postemergence treatments increased average alfalfa yields 100 and 88%, respectively, over that of the control. Results indicate the importance of annual grass control prior to the first cut for increasing alfalfa yield during the establishment year.

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TANK MIX AND SPLIT APPLICATION OF 2,4-DB WITH POSTEMERGENCE GRASS HERBICIDES FOR BROAD SPECTRUM WEED CONTROL IN SEEDLING ALFALFA

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ABSTRACT

Postemergence broadspectrum weed control in seedling alfalfa is possible with postemergence grass herbicides in combination with 2,4-DB. Six experimental grass herbicides were evaluated with 2,4-DB for broadspectrum weed control at the Massachusetts Agricultural Experiment Station. The objectives of the experiment were to compare the efficacy of tank mix combinations with separate applications of these materials and to determine, if any, antogonistic or synergistic effects.

Sethoxydim, fluazifop-P-butyl, haloxyfop-methyl, fenoxyprop-ethyl, SC 1084 (Stauffer) and DPX 6202 (Dupont) were applied each at 0.14 to 0.28 kg/ha either in a tank mix with 2,4-DB at 1.12 kg/ha or in separate applications 24 hours apart. Alfalfa 'Saranac AR' was conventionally seeded on May 7, 1984 at 16.8 kg/ha. Treatments were applied on June 14, 1984 when alfalfa was in the 5-7 trifoliate leaf stage and the annual grasses were in the 3-4 leaf stage and tillering. The most important grass weed species were yellow foxtail (*Setaria lutescens* (L)), barnyardgrass [*Echinochloa crusgalli* (L.) Beauv.], large crabgrass [*Digitaria sanguinalis* (L.) Scop.], common lambsquarters (*Chenopodium album* (L.)), and common ragweed (*Ambrosia artemisiifolia* (L.)). All herbicides were applied with a backpack CO_2 sprayer at 152 KPa in 450 L/ha. Plot size was 1.5 by 6m. Treatments were arranged in a randomized complete block design with four replications.

Tank mixes of sethoxydim, fluazifop-P-butyl, haloxyfop-methyl, fenoxyprop-ethyl, SC 1084 and DPX 6202 with 2,4-DB and separate applications of these materials resulted in excellent grass and broadleaf weed control by the time of the first cut on July 17, 1984. Average dry matter yields of grass weeds were reduced 97 and 100% from the dry matter yields of the control (1774 kg/ha) by the tank mix combinations and separate applications, respectively. Average dry matter yield reduction of broadleaf weeds by the tank mix combinations and separate applications was 98% as compared to that of the control (556 kg/ha). Average first cut alfalfa yields (3115 kg/ha) were significantly increased over that of the control (1975 kg/ha) for all herbicide treatments. Average first cut alfalfa yield increases were 55 and 60% over that of the control for tank mix combinations and separate applications, respectively. Results indicate the potential of postemergence broadspectrum weed control for increasing alfalfa yield during the establishment year.

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CROWNVETCH ESTABLISHMENT FOLLOWING SMALL GRAINS AND PRECEDING WINTER WHEAT

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ABSTRACT

A crownvetch (Coronilla varia L.) living mulch provides permanent ground cover for a primary crop. Ideally, establishing a crownvetch living mulch should not interfere with the cropping schedule. In this study, 'Penngift' crownvetch was seeded during the summer of 1983, immediately following the harvest of 'Pennrad' winter barley (Hordeum vulgare L.), 'Hart' winter wheat (Triticum aestivum L.) and 'Lang' spring oats (Avena sativa L.), which were harvested for both silage and grain. Winter wheat was planted in the fall following the small grain harvests and the crownvetch seeding. Paraquat (1,1'-dimethyl -4,4'- bipyridinium ion), paraquat plus bromoxynil (3,5 dibromo- 4-hydroxybenzonitrile), and bifenox [methyl-5- (2,4-dichlorophenoxy) -2-nitrobenzoate] were applied to suppress weeds and excessive crownvetch growth. An untreated check was left for comparison. Yields of crownvetch, winter wheat, and weeds were measured in the autumn of 1984. Crownvetch establishment was successful following winter wheat and winter barley but not following spring oats, regardless of whether the preceding small grain was harvested for silage or grain. None of the herbicides applied to the succeeding crop of winter wheat affected crownvetch yield. Wheat yields were best when the preceding small grain was harvested for silage. Weed yields were not significantly affected by any of the treatments.

INTRODUCTION

The problems of erosion on sloping soils has been well established, as has the value of vegetative cover in erosion control. This study investigates to use of crownvetch as a living mulch following three small grains and preceding winter wheat.

A living mulch is a permanent living ground cover into which primary crops are interplanted. It is a perennial that can be maintained indefinitely without reseeding. It provides ground cover that is especially crucial during periods of high erosion, such as in the spring before the crop canopy is full and in the fall after harvest.

Crownvetch has several traits that suggest its suitability as a living mulch. First, it is a perennial with creeping rootstocks that enable it to extend six to ten feet from the crown, to form a dense, continuous ground cover (7). It also provides erosion control--an established crownvetch living mulch in no-till corn can reduce soil and water runoff by 95 to 100% compared to conventional tillage and is more effective than no-tillage alone (5). Once established, crownvetch tolerates adverse soil conditions (1) and competes effectively against weeds (7). In its most common use as a ground cover on roadsides, it has been relatively pest-free (3). Another possible advantage of a crownvetch living mulch is the contribution of nitrogen to the main crop (8), although when continually suppressed a crownvetch living mulch may compete with the main crop for nitrogen (2).

The use of crownvetch as a living mulch presents two problems. First, because poor germination and seedling vigor make it slow to establish(9), it is usually spring-sown and allowed a full season without competition to become established (4). Few producers would be willing to remove a field from production to establish a living mulch, since it will not generate a return the first year. Also, because crownvetch spreads extensively

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once established, it can compete excessively against the main crop and reduce yield (5) unless it is herbicidally suppressed (6).

In this study, crownvetch was seeded during the summer, immediately following the harvest of winter wheat, winter barley and spring oats for either silage or grain. Winter wheat was planted into the crownvetch in the fall, and four herbicide treatments were applied to suppress the crownvetch and control weeds.

The primary objective was to determine which combination of preceding small grain, harvest stage (silage vs. grain), and herbicide treatment applied to the succeeding crop of winter wheat allowed crownvetch establishment without permitting enough growth for excessive competitiveness. Secondary objectives were to find which combination gave acceptable wheat yields and adequate weed control.

MATERIALS AND METHODS

This study was located at the Rock Springs Research Center in central Pennsylvania. The soil was a Murrill silt loam (typic hapludult) with a textural analysis of 16% sand, 67% silt, and 14% clay. The organic matter content was 2.5%, and the pH was 7.0. The area used was in spring oats the year before this study. All seedings were no-tillage.

The experimental design was a split-split-plot design in a randomized complete block design with four blocks and four replications. The species of small grain was the main plot, the harvest as silage or grain was the subplot and the herbicide was the sub-subplot. Each block was 13.7 m by 30.5 m (45 feet by 100 feet). Each plot was 4.6 m by 30.5 m (15 ft by 100 ft), each subplot was 2.3 m by 30.5 m (7.5 ft by 100 ft) and each sub-subplot was 2.3 m by 7.6 m (7.5 ft by 20 ft)

Each block consisted of 'Pennrad' winter barley, 'Hart' winter wheat, and 'Lang' spring oats in randomly assigned plots. The winter barley and winter wheat were seeded on 20 September 1982 at 150.5 kg/ha and 194.9 kg/ha respectively (134.0 and 174.0 lb/a). The spring oats was seeded on 17 March 1983 at 107.5 kg/ha (96 lb/a). All were seeded with a no-tillage Bettison drill. Half of each plot for each small grain was harvested for silage and the other half for grain. Harvest dates for silage were 15 June for winter barley, 30 June for winter wheat, and 8 July for spring oats. Harvest dates for grain were 7 July for winter barley, and 22 July for winter wheat and spring oats.

'Penngift crownvetch was seeded into each plot following each silage and grain harvest. The crownvetch planting dates were 17 June following winter barley harvested for silage, 20 June following winter wheat harvested for silage, 8 July following spring oats harvested for silage and winter barley harvested for grain, 29 July following winter wheat harvested for grain, and 9 August following spring oats harvested for grain.

'Hart' winter wheat was planted as the succeeding crop on 4 October 1983, at a rate of 145.6 kg/ha (130 lb/a). A broadcast application 280 kg/ha (250 lb/a) of 10-10-10 was made on 4 October.

For the herbicide treatments, each 2.3 m by 30.5 m (7.5 ft by 100 ft) plot was divided latitudinally into four 6.1 m (20 ft) segments, with a 1.5 m (5 ft) alley between each segment. This division made the final plot size 2.3 m by 6.1 m (7.5 ft by 20 ft).

Four herbicide treatments, including a check, were applied to randomly assigned sub-subplots. The treatments, rates, and application dates were: paraquat (1,1'-dimethyl

-4,4'- bipyridinium ion), at 0.3 kg ai/ha (0.25 lb ai/a) on 14 September 1983; fall-applied paraquat at 0.3 kg ai/ha on 27 September plus spring-applied bromoxynil (3,5 dibromo- 4-hydroxybenzonitrile) at 0.6 kg ai/ha (0.5 lb ai/ha) on 18 May 1984; bifenox (methyl 5-(2,4-dichlorophenoxyl) -2-nitrobenzoate) at 1.1 kg ai/ha (1.0 lb ai/a) on 7 October 1983; and an untreated check. All the herbicides were applied with a CO_2 backpack sprayer using 8001 nozzles at a pressure of 1.3 kg/cm^2 (18 psi), in 84.1 liter/ha (9 gal/a).

The winter wheat was harvested on 26 July 1984, cleaned, and weighed to determine yield. One-half square meter areas were harvested on 28 and 30 September to determine dry matter yields of crownvetch and weeds.

RESULTS AND DISCUSSION

Crownvetch yield

Crownvetch yields in September one year after seeding were significantly higher following winter wheat and winter barley than following spring oats (Table 1). Overall, crownvetch yield following small grains harvested for silage was higher than for grain, although the difference was not statistically significant. Crownvetch yield was greatest for bifenox, but none of the herbicide treatments differed significantly. Bifenox performed consistently, regardless of the preceding small grain or harvest stage.

Weed yield

Weed yields (Table 1) in the year after crownvetch seeding were highest following spring oats and were lowest when no herbicide was applied, but none of the differences were significant.

Table 1. Crownvetch and weed yields one year after seeding as affected by preceding small grain, harvest stage of preceding small grain, and herbicide applied to succeeding winter wheat.

Variable	Crownvetch yield	Weed yield
Small Grain	(kg/ha)	(kg/ha)
spring oats	50 B [a/]	1050 A
winter wheat	950 A	960 A
winter barley	900 A	880 A
Harvest stage		
silage	780 A	970 A
grain	480 A	960 A
Herbicide		
bifenox	950 A	1030 A
untreated check	600 A	860 A
paraquat	540 A	1000 A
paraquat + bromoxynil	520 A	980 A

[a/] Within each variable, means with the same letter are not significantly different, according to the Waller-Duncan k-ratio t test.

Wheat yield

The effects of the preceding small grain, harvest stage, and herbicide on the yield of the succeeding crop of winter wheat were highly interactive.

In general, yields for the succeeding crop of winter wheat did not differ significantly when the preceding small grain was harvested for silage. The wheat yields following spring oats harvested for grain were significantly greater than the wheat yields following winter barley or winter wheat harvested for grain.

Similarly, when the small grains were harvested for silage, none of the herbicide treatments applied to the succeeding crop of winter wheat differed in their effect on wheat yield. When the small grains were harvested for grain, paraquat alone and paraquat plus bromoxynil resulted in significantly greater wheat yields than did bifenox or the untreated check.

Wheat yields as affected by the preceding small grain and the herbicide applied to the winter wheat appear in Table 2.

Table 2. Yields of winter wheat one year after crownvetch seeding, as affected by preceding small grain and herbicide applied to the winter wheat, separated by harvest stage of preceding small grain.

Variable	Weed yield	
	Silage	Grain
Small grain (Averaged over all herbicide treatments)		
	(kg/ha)	(kg/ha)
spring oats	1250 A [a/]	1520 A
winter barley	1240 A	940 B
winter wheat	1170 A	1050 B
Herbicide (Averaged over previous small grain)		
paraquat plus bromoxynil	1190 A	1360 A
paraquat	1330 A	1270 A
bifenox	1120 A	990 B
untreated check	1200 A	870 B

[a/] Means within the same variable followed by the same letter do not differ significantly, according to the Waller-Duncan k-ratio t test.

The primary objective of this study was to find the optimum cropping conditions that allowed the establishment of a crownvetch living mulch. Spring oats can be eliminated as a possible preceding crop since crownvetch yields following spring oats were very low compared to winter barley and winter wheat. Neither the harvest stage of the winter wheat and winter barley nor the herbicide used on the succeeding crop of winter wheat affected crownvetch yield.

The next objective was to determine which treatments gave an acceptable wheat yield. The complexity and nature of the interactions make it impossible to give definitive recommendations, although the results favor winter barley or winter wheat harvested for silage rather than grain. Any herbicide treatment applied to the succeeding crop of winter wheat is acceptable if the preceding small grain is harvested for silage. When harvesting the preceding small grain for grain, paraquat alone or paraquat plus bromoxynil are preferred.

The last objective was to determine which treatments gave acceptable weed control when applied to the succeeding crop of winter wheat. All herbicide treatments, including the untreated check, are acceptable.

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EFFECTS OF VARIATIONS IN DROP MAKEUP ON THE PHYTOTOXICITY OF GLYPHOSATE TO VELVETLEAF

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ABSTRACT

Greenhouse studies were conducted to evaluate how the concentration of active ingredient and surfactant in discrete drops of solution affected the phytotoxicity of glyphosate to velvetleaf (Abutilon theophrasti Medic.). Glyphosate treatments were applied in distilled water to avoid interactions that might occur with divalent cations. Velvetleaf plants were treated with 1-µl drops applied with a microsyringe to a median region of the second leaf of a three and one-half leaf plant. Visual ratings, leaf area, extension, and dry weights were taken 0, 1, 2, 4, 8, and 16 days after treatment. Plants were treated with one, three, or nine drops (1 µl of each) of solution such that the total amounts of active ingredient and surfactant applied to each plant were constant. In one set of experiments, aqueous solutions of technical grade glyphosate (MON 0139-3) were prepared containing 5.0, 1.7, and 0.6 µg ai/µl of glyphosate (41% isopropylamine salt). The surfactant MON-0818 (the surfactant in the commercial glyphosate formulation) was added to each of these three solutions at 0.15, 0.05, and 0.017% (v/v), respectively, to simulate 1, 3, and 9x dilutions of both active ingredient and surfactant. The 5.0 µg ai/µl and 0.15% herbicide and surfactant concentrations, respectively, were that associated with a 0.23 kg/ha formulated glyphosate rate at the 46.75 l/ha (5 GPA) spray volume. In a second set of experiments, the concentrations of technical grade glyphosate used were 7.5, 2.5, and 0.83 µg ai/µl, and the surfactant levels were 0.23, 0.078, and 0.026% (v/v) in each drop. In a third set of experiments, the concentrations of technical grade glyphosate used were 10.0, 3.3, and 1.1 µg ai/µl, and the surfactant levels were 0.31, 0.10, and 0.035% (v/v) in each drop. These three experiments were repeated; however, surfactant concentrations were increased such that levels were 0.5, 0.17, and 0.06% (v/v) in each drop.

Preliminary results indicated that when single, concentrated drops of glyphosate and surfactant were applied to the leaves of velvetleaf plants, there was a decrease in leaf area, extension, and dry weights when compared to the control. Furthermore, if the drop concentration was decreased three- or nine-fold, but the drop number increased three or nine times to maintain the same total amount of active ingredient applied to the plant there was a decrease in phytotoxic response. When surfactant concentration was increased, the loss in efficacy previously exhibited by plants treated with three drops was negated. However, regardless of glyphosate concentration in the droplet, the increased surfactant concentration only slightly negated the loss in efficacy shown by plants treated with nine drops.

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AC 252,214 Induced Growth Cessation in Corn and Sunflower

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ABSTRACT

Growth chamber studies were conducted to investigate the rate and extent of AC 252, 214 induced growth cessation in corn and sunflower. In a preliminary study pre- and postemergence applications of 0.14 kg/ha AC 252, 214 were made to corn and sunflower planted singly in 10 cm styrofoam pots. Postemergence applications were made when corn and sunflower reached 2 to 3-leaf and early first leaf respectively. After treatment shoot and root growth parameters were measured at 2 day intervals until plant death 1 to 2 weeks. Preemergence treatments allowed emergence of both species but no subsequent growth. Postemergent treatments caused growth cessation within 2 days.

In an additional study the direct effects of AC 252, 215 on root tip mitotic activity were assessed. Both corn and sunflower were grown in nutrient solution until the 2 to 3 leaf and early first leaf for corn and sunflower, respectively. Plants were transferred to a solution containing 3.7 x 10^{-3}M AC 252, 214 for one hour. After treatment plants were thoroughly rinsed in water and returned to nutrient solution. Roots were harvested, fixed and stained at 1, 2, 3, 4, 5, 6, 12, 24 and 48 h after the treatment initiation. Using a squash technique the percentage of mitoticly active cells in the root tips was determined. Results indicate that mitotic activity in the root tip decreases dramatically within the first 3 h and remains near zero for the remainder of the study.

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Pendimethalin Phytotoxicity to Velvetleaf as Influenced by Ethoxylated Cationic Surfactants.

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ABSTRACT

Nine ethoxylated cationic surfactants were evaluated in the greenhouse for their ability to enhance the postemergence activity of pendimethalin to velvetleaf (Abutilon theophrasti Medic.). A surfactant containing 15 moles ethylene oxide was the most active of the cationic polyethoxylated amine and diamine surfactants evaluated. Increasing or decreasing the number of moles ethylene oxide in the chemical structure of the surfactants resulted in a significant decrease in activity in comparison to the surfactant containing 15 moles ethylene oxide. Small plot field studies showed that the addition of a surfactant containing 15 moles ethylene oxide to pendimethalin applications significantly increased activity to velvetleaf versus pendimethalin alone at the cotyledon, 3rd, and 5th leaf stages of growth.

INTRODUCTION

Pendimethalin (N-(1-ethylpropyl)-3,4 dimethyl-2,5-dinitrobenzenamine) is a dinitroaniline herbicide that has shown both soil and foliar activity against velvetleaf (1, 2, 4, 5, 6, 7). Researchers have shown that the addition of surfactants to aqueous spray solutions of pendimethalin can increase the postemergence activity of this herbicide (3). The objective of this study was to examine the influence of ethoxylated cationic surfactants on the postemergence activity of pendimethalin applied to velvetleaf.

MATERIALS AND METHODS

Greenhouse Studies

Seven velvetleaf seeds were planted at a 1.25 cm depth in loamy sand soil contained in 12.7 cm plastic pots. This soil was comprised of 90.0% sand, 2.8% silt, and 7.2% clay and had an organic matter content of 4.7%. Prior to planting, the soil was limed to a pH of 6.2 and fertilized to an optimum level. Following emergence, plants were thinned to one plant per pot. The plants were then allowed to grow to the desired stage of growth. Plants were grown under 26.0°C day and 21.0°C night temperatures and natural lighting conditions were supplemented with 1000 watt sodium metal halide lights (16 hour daylength).

Treatments were applied at the cotyledon stage and were replicated six times. Prior to treatment, the soil surface of each pot was covered with vermiculite to intercept any spray not retained on the plant. After the spray had dried on the plants, the vermiculite was removed and discarded.

Pendimethalin treatments were applied at a spray volume of 374 L/ha with a laboratory belt sprayer and were applied at 0.125, 0.25, 0.5, 1.0, or 2.0 kg a.i./ha. The pendimethalin used in all experiments was the commercial 4EC (42.3% a.i.) formulation. Applications included 0.1, 0.2, 0.5, 1.0, or 2.5% (v/v) of each surfactant evaluated. All plants were watered as necessary and herbicidal ratings were taken 3 weeks after treatment.

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Field Studies

Small plot field studies were conducted at the Soils and Crops Research Center, New Jersey Agricultural Experiment Station, Adelphia, NJ. The plots were established on a Holmdel loam soil containing 1.5% organic matter. The field was plowed and disked in the spring and received a broadcast application of 280 kg/ha of 5-10-10 fertilizer which was incorporated by disking. The field then received a 2.24 kg/ha application of alachlor (2-chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide) to control annual grasses. Broadleaved weeds were hand-hoed from each plot.

The experiment was established in a randomized complete block design with three replications. Each plot was 2.2m x 3.0m and contained three rows of velvetleaf at the cotyledon, 3rd, and 5th leaf stages of growth. Treatments were applied at a spray volume of 374 L/ha with a tractor-mounted sprayer at 0.25, 0.5, 1.0, or 2.0 kg a.i./ha. The pendimethalin used was the commerical 4EC (42.3%) formulation. Applications included 0.6 or 1.25% (v/v) of Ethomeen T/25 and all concentrations were prepared in deionized water (pH 5.0). Herbicidal ratings were taken 3 weeks after treatment.

RESULTS AND DISCUSSION

Nine ethoxylated cationic surfactants were evaluated under greenhouse conditions. Of these adjuvants, Ethomeen T/25 surfactant (polyoxyethylene (15) tallow amine) was the most effective in enhancing the postemergence activity of pendimethalin against velvetleaf. Results showed that concentrations of 0.5 to 2.0% (v/v) significantly increased herbicidal activity at all pendimethalin rates. The data also showed that a concentration of 1.0% (v/v) was required to provide commercially acceptable control ($\geq$ 85%) at rates as low as 0.25 kg/ha. Increasing the concentration to 1.25% (v/v) provided complete kill at 1.0 kg/ha, while concentrations greater than 1.25% (v/v) did not significantly increase activity above the 1.25% (v/v) level.

Small plot field evaluations showed that the addition of 1.25% (v/v) Ethomeen T/25 signficantly increased activity at 0.5, 1.0 and 2.0 kg/ha of pendimethalin when applied at a spray volume of 374 L/ha at the cotyledon, 3rd, and 5th leaf stages of growth. Reducing the Ethomeen T/25 concentration to 0.6% (v/v) did not alter the level of activity at 2.0 kg/ha to any growth stage in comparison with the 1.25% (v/v) surfactant concentration. However, applications at 1.0 kg/ha at the 0.6% (v/v) surfactant level were not significantly different from pendimethalin treatments without surfactant.

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POSTEMERGENCE FALL PANICUM CONTROL IN CORN WITH DOWCO 356-TRIAZINE COMBINATIONS[1]

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ABSTRACT

DOWCO 356-*s*-triazine combinations were evaluated for postemergence control of fall panicum *(Panicum dichotomiflorum* Michx.) in corn. When applied at the spike stage or when fall panicum was in the 1-3 leaf stage, DOWCO 356 combined with atrazine and/or cyanazine provided adequate weed control. If the grass was allowed to develop further, control efficacy dropped dramatically. In combination with atrazine at the 1-3 leaf stage of growth of fall panicum, DOWCO 356 applied at 0.43 kg/ha provided reduced control relative to higher rates of DOWCO 356. Increasing the rate of atrazine did not improve performance of DOWCO 356-atrazine combinations. Good weed control was also obtained when atrazine or cyanazine applied preemergence was followed by postemergence DOWCO 356-atrazine combinations.

INTRODUCTION

Differential crop-weed response to herbicide applications is the basis of successful chemical weed control. In many instances, crop tolerance is due to accelerated metabolic detoxification of the herbicidally active chemical. For example, tolerance of corn *(Zea mays* L.) to *s*-triazine herbicides is due to conjugation of triazines with glutathione by glutathione-*S*-transferase, rendering the herbicide inactive. Weed species with low glutathione-*S*-transferase activity cannot metabolize triazine herbicides rapidly enough to detoxify the herbicide before lethal injury occurs. Several *s*-triazine herbicides, such as atrazine (2-chloro-4-ethylamino-6-isopropylamino-*s*-triazine) and cyanazine [2-chloro-4-(2-cyano-isopropylamino)-6-ethylamino-*s*-triazine] are used extensively for weed control in corn due to the tolerance of the crop to rates of these compounds that provide excellent control of numerous species. However, other weed species, particularly grasses, are also tolerant of atrazine and other triazines due to their ability to rapidly metabolize these compounds by conjugation with glutathione. Fall panicum has become a serious pest in corn due to extensive use of triazine herbicide for weed control in this crop. One approach to this problem is to apply additional herbicides preemergence in combination with triazines to control these tolerant species. A second approach to fall panicum control is to reduce the tolerance of this species to triazines, utilizing herbicides that reduce the activity of glutathione-*S*-transferase in the weed species without reducing the tolerance of corn. DOWCO 356 [2-(3,5-dichlorophenyl)-2-(2,2,2-trichloroethyl)oxirane] is one such compound that inhibits this enzyme. The purpose of this experiment was to determine whether

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DOWCO 356 could be used in combination with atrazine and cyanazine for postemergence control of fall panicum at several stages of growth in corn.

MATERIALS AND METHODS

Corn (var. Midstates 747) was planted on May 10, 1984, in a conventionally-tilled Sassafras loam soil (1.5% organic matter) at the Soils and Crops Research Center, New Jersey Agricultural Experiment Station, Adelphia, N.J. Plot size was 3.7 m (12 ft) wide by 5.8 m (19 ft) long, with corn planted in four 0.9 m (36 in) wide rows. Preemergence applications of cyanazine or atrazine were applied to the soil surface on May 11. Postemergence applications as noted below, were timed to stage of growth of corn or fall panicum, as follows: corn: spike stage (fall panicum seedling stage) (May 22); fall panicum: 1-3 leaf stage (corn 3 to 5 leaf stage) (June 7); and fall panicum: 4-6 leaf stage (corn 4 to 6 leaf stage) (June 15).

All herbicide applications were applied with a CO_2-propelled backpack sprayer using 730616 nozzle tips in a 5 nozzle boom delivering a volume of 273 L/ha (40 gpa) at a pressure of 220 kPa (32 psi). The experimental design was a randomized complete block with three replications. Treated plots were visually rated for weed control and crop tolerance on June 27 using a scale of 0 to 10, where 0 = no effect on weed or crop and 10 = complete control. Corn was harvested on September 27, and values were converted to bushels/A. Data for weed control and yield were analyzed using the ANOVA program of the Statistical Analysis System (SAS Institute, Inc., Box 8000, Cory, N.C. 27511).

RESULTS AND DISCUSSION

To evaluate DOWCO 356-triazine combinations for use in postemergence fall panicum control in corn, there are two primary considerations. Treatments should provide adequate control to reduce losses from fall panicum competition without causing injury to corn or by reducing its ability to detoxify triazines. Values for corn and weed stand and vigor and corn grain yield are presented in Table 1. There was no injury to corn, measured as reduction in crop stand and vigor from any of the treatments investigated. DOWCO 356-triazine combinations applied at different stages of corn growth that provided equivalent weed control exhibited no difference in yield, suggesting that application timing does not affect crop injury.

Fall panicum control varied with both treatment and time of application. In general, equivalent rate combinations of DOWCO 356 and triazines were equally effective when applied early postemergence (corn spike stage) or later postemergence (fall panicum 1-3 leaf stage). When these treatments were applied at the 4-6 leaf stage of fall panicum, control was severely reduced. Equivalent rates of atrazine or cyanazine in postemergence combinations with DOWCO 356 were equally effective for fall panicum control. For example, at the 1-3 leaf stage of fall panicum, 1.58 kg/ha atrazine or 1.79 kg/ha cyanazine combined with 0.56 kg/ha DOWCO 356 controlled fall panicum equally well. Additionally, three-way postemergence combinations of 0.56 kg/ha DOWCO 356 and the two triazines also provided good fall panicum control. Application rates of DOWCO 356 were more important than triazine rates in controlling fall panicum. When applied at the 1-3 leaf grass stage of growth, atrazine at 1.68 to 2.24 kg/ha in combination with 0.48 kg/ha DOWCO 356 did not significantly increase weed control. In corn culture, triazines are often applied in combination with a second herbicide

preemergence to improve grass weed control. For example, one recommended herbicide combination in New Jersey is a tank mix of alachlor and atrazine applied preemergence. In the event of treatment failure due to misapplication or adverse environmental conditions, it is desirable to have postemergence treatments available, such as the DOWCO 356-triazine combination. Indeed, the (cultivated) check in this study, 1.68 kg/ha alachlor + 1.34 kg/ha atrazine, provided essentially no fall panicum control, despite the usual effectiveness of this combination. To simulate these rescue situations, preemergence atrazine and cyanazine treatments were followed by applications of 0.56 kg/ha DOWCO 356 in combination with 1.68 kg/ha atrazine at all three spray dates, and evaluated for crop tolerance and weed control. There was no crop injury from the postemergence treatments when following preemergence atrazine or cyanazine. Timing of post-emergence applications following triazines was as important for fall panicum control as was described above for postemergence treatments alone. Treatments applied at the 4-6 leaf stage of grasses provided reduced fall panicum control, compared to treatments applied at the corn spike and 1-3 leaf grass stages of growth.

Corn grain yields exhibited significant differences with treatments applied. All treatments except 0.56 kg/ha DOWCO 356 in combination with 1.68 kg/ha atrazine, and the alachlor-atrazine chemical check, provided significantly greater grain yields than the weedy check. As noted earlier in this experiment, the chemical check did not provide any fall panicum control, but did provide good control of other weeds. To determine the effects of fall panicum control of other treatments on yield, it may be more appropriate to compare all yield values with the chemical check, as the weedy check contained additional weed species. The 0.84 kg/ha rate of DOWCO 356 combined with 1.68 kg/ha atrazine, applied at the 1-3 leaf stage of grasses, was the only combination applied postemergence alone that provided yields greater than the chemical check that was statistically significant. Lower rates of DOWCO 356 applied at any stage of growth investigated, did not provide yields different from the check. 0.56 kg/ha DOWCO 356 in combination with atrazine and cyanazine at 1.12 and 0.9 kg/ha, respectively, applied at the grass 1-3 leaf stage, also provided yield values significantly greater than the check. Of the postemergence treatments alone, only these two treatments applied at the 1-3 leaf stage of grasses improved corn grain yields by reducing fall panicum competition. When preemergence cyanazine was followed by postemergence DOWCO 356-atrazine, greater yields than the chemical check were obtained when the treatment was applied at both the corn spike and fall panicum at 1-3 leaf stages of growth. When the postemergence treatments were applied at the 4-6 leaf stage of grasses, yields were severely reduced, paralleling the effect of spray timing on fall panicum control.

Based on these results, DOWCO 356 applied postemergence in combination with atrazine and cyanazine may provide adequate control of fall panicum in corn. This combination exhibited good crop safety and good fall panicum control if appropriate rates and application timing are used. Fall panicum must be sprayed early, in the 1-3 leaf stage at the latest, for adequate control. Additionally, rates of DOWCO 356 should be greater than 0.48 kg/ha if control of fall panicum is to be obtained.

Additionally, DOWCO 356-atrazine combinations can be applied postemergence for fall panicum control following preemergence atrazine or cyanazine in the event of grass herbicide failure. However, these treatments must be applied early if they are to be successful.

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Table 1. Weed control in corn with postemergence DOWCO 356-triazine combinations.

Treatment	Rate		Weed Control[a]								Yield
			Corn		PANDI[b]		ABUTH[b]		CHEAL[b]		
	lb/A	kg/ha	S	V	S	V	S	V	S	V	BU/A
Spike Stage (May 22)											
DOWCO 356 + atrazine + COC	0.5 + 1.5 PO	0.56 + 1.68 PO	1.3	0.6	7.8	4.3	9.3	8.3	10.0	10.0	118.9
DOWCO 356 + cyanazine	0.5 + 1.6 PO	0.56 + 1.79 PO	1.3	1.1	7.5	5.0	9.5	3.3	9.6	8.3	130.1
DOWCO 356 + atrazine + cyanazine + COC	0.5 + 0.8 + 0.8 PO	0.56 + 0.9 + 0.9 PO	0.5	0.1	8.7	2.5	9.9	8.3	10.0	10.0	133.1
atrazine PE f. by DOWCO 356 + atrazine + COC	1.0 PE (0.5 + 1.5) PO	1.12 PE (0.56 + 1.68) PO	0.8	0.6	8.1	5.0	9.8	8.3	10.0	10.0	124.0
cyanazine PE f. by DOWCO 356 + atrazine + COC	1.0 PE (0.5 + 1.5) PO	1.12 PE (0.56 + 1.68) PO	0.5	0.6	8.3	5.0	10.0	10.0	10.0	10.0	140.8
1-3 Leaf Stage of Grasses (June 7)											
DOWCO 356 + atrazine + COC	(0.38 + 1.5) PO	(0.43 + 1.68) PO	0.5	0.0	4.8	0.0	10.0	10.0	10.0	10.0	131.4
	(0.50 + 1.5) PO	(0.56 + 1.68) PO	0.1	0.3	6.6	0,0	10.0	10.0	10.0	10.0	125.3
	(0.75 + 1.5) PO	(0.84 + 1.68) PO	0.3	0.5	7.3	0.0	10.0	10.0	10.0	10.0	159.6
DOWCO 356 + cyanazine	(0.5 + 1.6) PO	(0.56 + 1.79) PO	0.5	0.5	7.4	0.0	10.0	10.0	10.0	10.0	127.6
DOWCO 356 + atrazine + cyanazine	(0.5 + 0.8 + 0.8) PO	(0.56 + 0.9 + 0.9) PO	0.3	1.3	7.9	0.0	10.0	10.0	10.0	10.0	125.2
	(0.5 + 1.0 + 0.8) PO	(0.56 + 1.12 + 0.9) PO	0.3	0.5	8.2	0.0	10.0	10.0	10.0	10.0	137.6
atrazine PE f. by DOWCO 356 + atrazine	1.0 PE (0.5 + 1.5) PO	1.12 PE (0.56 + 1.65) PO	0.3	0.6	8.3	1.6	10.0	10.0	10.0	10.0	127.1
cyanazine F. by DOWCO 356 + atrazine + COC	1.0 PE (0.5 + 1.5) PO	1.12 PE (0.56 + 1.68) PO	0.5	0.5	8.4	0.0	10.0	10.0	10.0	10.0	158.8
DOWCO 356 + atrazine	(0.38 + 2.0) PO	(0.43 + 2.24)) PO	0.5	0.3	5.8	0.0	10.0	10.0	10.0	10.0	116.2
atrazine + COC	2.0 PO	2.24 PO	0.5	0.0	1.6	10.0	10.0	10.0	10.0	10.0	127.1
4-6 Leaf Stage of Grasses (June 15)											
DOWCO 356 + atrazine	(0.5 + 1.5) PO	(0.56 + 1.68) PO	0.6	0.0	1.6	0.0	10.0	10.0	10.0	10.0	90.2
atrazine (PE) f. by DOWCO 356 + atrazine	1.0 PE (0.5 + 1.5) PO	1.12 PE (0.56 + 1.68)	0.0	0.0	1.3	0.0	10.0	10.0	10.0	10.0	118.7
cyanazine (PE) f. by DOWCO 356 + atrazine + COC	1.0 PE (0.5 + 1.5)	1.12 PE (0.56 + 1.68)	0.0	0.0	3.5	0.0	9.6	6.6	10.0	10.0	123.6
Check - alachlor + atrazine	(1.5 + 1.2)	(1.68 + 1.34	0.0	0.1	0.3	0.0	9.5	6.6	10.0	10.0	101.3
Check - uncultivated	-	-	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	82.8
LSD 0.05			NS	NS	1.8	1.5	0.6	4.0	0.2	1.0	32.1

[a]Weed control ratings (0 = no control, 10 = complete control) on June 27, 1984.
[b]Abbreviations for weed species from Weed Science, Vol. 32, Supplement 2, 1984.
[c]COC - crop oil concentrate, 1 pint per acre
[d]PE = preemergence

HEDGE BINDWEED CONTROL IN FIELD CORN USING DICAMBA AND TRICLOPYR IN 1981

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ABSTRACT

No-till field corn infested with hedge bindweed (Convolvulus sepium L.) and yellow nutsedge (Cyperus esculentus L.) was treated with dicamba at 0.28 kg ai/ha and triclopyr at 0.14, 0.28, and 0.56 kg ai/ha on June 18, 1981. Preplant treatments of cyanazine, alachlor, and paraquat were applied on May 15, 1981 at 2.8, 2.25, and 0.28 kg ai/ha respectively. The corn was planted on the same day.

Both dicamba and triclopyr gave 100% control of hedge bindweed in 1981. Although there was no significant reduction in corn stand, height, or yield from any treatment, triclopyr did cause significant visual injury at all rates tested. If triclopyr is to be used it will have to be at application rates less than 0.14 kg ai/ha for acceptable crop safety.

Table 1. Dry weight yields of hedge bindweed, yellow nutsedge and other weeds, and corn injury, stand, height and yield after treatment with dicamba and triclopry in 1981.

		Weeds (kg/ha)			Corn			
Treatment	Rate kg ai/ha	Hedge Bindweed	Yellow Nutsedge	Other	Inj. %	Stand plants/ha	Ht cm	Yield quintal/ha
Dicamba	0.28	0[c/]b[d/]	146a	309a	10b	46652a	154a	157a
Triclopyr	0.14	0b	22a	506a	60a	43341a	138a	134a
	0.28	0b	22a	304a	64a	44354a	132a	142a
	0.5	0b	85a	231a	74a	40895a	128a	134a
Check (Weedy)	-	2318	0a	489a	28b	40746a	168a	88b

[a/] Injury ratings on 7/19/81 are stunting plus formative effects from the herbicides.

[b/] Other weeds are a mixture of yellow foxtail and redroot pigweed.

[c/] All values are an average of four replications.

[d/] Values followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

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A GROWTH ANALYSIS OF ANNUAL GRASS AND CORN COMPETITION

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ABSTRACT

A field experiment was conducted, at the Massachusetts Experiment Station, to evaluate the effects of three planting dates (May 10, 17, and 24) of corn and four densities of annual grasses (zero, low, medium, and high) on corn yield. The most important grass species were fall panicum [*Panicum dichotomiflorum* Michx.], yellow foxtail [*Setaria lutescence* (L.) Beauv.], and large crabgrass [*Digitaria sanguinalis* (L.) Scop.]. Zero, low, medium, and high densities of annual grasses were established by preemergence application of alachlor at 1.12, 0.56, 0.28, 0.0 kg/ha, respectively. The experiment was a split plot design with planting date as the whole plot and weed density as the subplot with four replications. Height, leaf area, and biomass of weed and corn were determined at three week intervals throughout the summer. Corn was harvested on September 27, 1984 for silage, ear, and grain yields.

Silage, grain, and ear yields of corn were significantly different among weed densities. Regardless of planting date, average yield reductions were 66, 47, and 70% for grain, 29, 41, and 60% for silage, and 35, 47, and 69% for ears, respectively, for low, medium, and high densities. No significant differences in silage, grain, and ear yields were found among planting dates. However, greater grain and silage yields were obtained from the second planting date (May 17) than from either the first (May 10) or third (May 24) planting date. This may have resulted from cold, wet conditions prior to May 17.

Results suggest that yield differences due to weed density levels were greater than those due to time of planting. This implies that the competitive posture of corn, with respect to weed pressure from annual grasses, is weakened as weed density increases. Weed biomass data, relative growth rates, and other growth parameters of weed and crop will also be presented.

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ADAPTATION OF ROPE WICK APPLICATORS FOR USE ON HILLSIDES

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ABSTRACT

The rope wick applicator has been found of use in applying glyphosate to tall growing weeds in soybeans, grapes, apples, cherries, and pears as well as in experimental rescue treatments on such crops as strawberries, cucurbits and alfalfa. Difficulty has been encountered, however, in treating crops on hilly land due to uneven distribution of herbicide solution and excessive dripping from the down hill end of the rope wick applicator. This experiment was designed to test the effect of inserting semi-porous baffles in the rope wick applicator to improve the evenness of distribution of solution when used on various slopes. The effect of baffles on total flow as well as evenness of distribution was measured. Differences were also observed in the two most commonly used types of wick rope and the effect of wick positioning at the 3, 4, and 5 o'clock angles of rotation.

Two single rowed rope wick applicators were constructed using "pistachio" and "peppermint" ropes manufactured by Gulf Rope and Cordage Co. (Box 5516, Mobile, Alabama 36605). Only single rows were used to facilitate measurement of the flow from each wick. The flow over a ten minute interval was measured with both rope types at applicator angles of 0, 5, 10, and 20 degrees. Ten minutes represents the time it would take a tractor moving at 3 miles per hour to travel a row 1/2 mile long. This was chosen as the target time over which an even flow should ideally be maintained. All measurements of performance on a slope were made with the row of rope wicks at the 5 O' clock position and three reps were run with each rope at each angle of applicator tilt. Each rep was begun with the bulk of the herbicide solution in the raised end of the applicator to simulate the field situation when a tractor has just reversed direction on hilly ground. A 33% glyphosate solution was used in all reps. The baffles each consisted of two synthetic kitchen sponges, each approximately 3 1/2"x 6"x 1", rolled up and pushed into the rope wick applicator.

A significant difference in rate of dripping was found in each case with the rope wicks positioned at 3, 4, and 5 o'clock relative to the ground; drip rate with the peppermint rope being 7, 36, and 73 mls., respectively, in a ten minute interval. Pistachio rope was found to wick at approximately 4 times the rate of peppermint rope.

Insertion of one baffle midway along the length of the rope wick applicator improved distribution of flow and did not significantly increase wicking at each of the 5, 10, and 20% inclinations.

Insertion of three baffles further improved distribution of flow at all angles of tilt but significantly increased total flow at the 10 and 20% inclinations. Uncertainty remains as to whether these increased levels of flow would prove detrimental under field conditions.

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WEED CONTROL IN FULL SEASON NO-TILLAGE SOYBEANS

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ABSTRACT

Field experiments were conducted during the years 1982 to 1984 to examine a variety of programs for weed control in full season no-tillage soybeans. The three major programs studied are as follows: a) split applications of standard preemergence herbicides, b) comparisons of fall, winter and spring applications of oryzalin, and c) timing studies involving early preplant applications of cyanazine.

All experiments were conducted at the Poplar Hill Research Farm, Quantico, MD on a Matapeake silt loam soil with a pH of 6.3 and 1.0% organic matter. Studies were arranged as randomized complete block designs with three replications. Individual plots were 25 feet long and 10 feet wide. Soybeans (var. 'Essex' in 1982 and 1983, var. 'Union' in 1984) were planted on 20 inch row spacings with an Allis Chalmers no-tillage planter. Normal fertilizer and insecticide practices were followed. Herbicides were applied in water with a CO_2 pressurized backpack sprayer that delivered 18 gpa at 20 psi utilizing SS-8003 flat fan nozzles. Visual ratings of weed control were made throughout the growing season based on a scale of 0 (no control) to 100 (no weed growth). Yields were obtained with a standard field combine.

During the years 1982 and 1983, split applications of alachlor or metolachlor (½x use rate 2 to 3 weeks preplant, followed by ½x use rate at planting tank-mixed with 1x use rate of paraquat plus linuron) provided better annual grass control than a single application made at planting time (1x use rate of alachlor or metolachlor, tank-mixed with 1x use rate of paraquat plus linuron). In 1984, early season rains appeared to have leached the preplant applications of alachlor and metoalchlor. Thus poor grass control was obtained with the split preemergence program. Best annual grass control in 1984 was achieved with a total at planting application of either alachlor or metolachlor (1x use rate), tank-mixed with paraquat plus linuron (1x use rate). Yields were not different in any year.

Provided 1x use rates of paraquat plus linuron were applied at soybean planting time, oryzalin at 2 lb ai/A fall applied (November) provided good annual grass control the following year. Oryzalin at 1½ lb ai/A applied in the winter (March) also afforded good annual grass control. Preemergence at planting applications of oryzalin generally failed to provide good annual grass control due to insufficient rainfall to activate the herbicide. Yields were not different in the two years this study was conducted (1983, 1984).

In 1983 and 1984 it was demonstrated that cyanazine could be utilized as a preplant treatment in full season no-tillage soybeans at a rate of 1½ lb ai/A. While this application helped in the control of emerged vegetation, data supported the need for additional herbicidal control. A knock-down herbicide such as paraquat usually tank mixed with a 1x use rate of linuron, or metolachlor plus linuron, applied preemergence, was necessary to provide good season long control of annual grasses.

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CONSERVATION TILL SOYBEAN PRODUCTION -- ANSWERS TO WEED CONTROL

Joseph Zawierucha, Harold Watters, William Sciarappa 1/

ABSTRACT

Soybean production under reduced tillage and row width causes growers to encounter new challenges in weed control. Strategies must be modified to deal with remaining crop residues on the soil surface because mechanical control options and incorporation can no longer be employed. Control measures must be changed to rely on new technology to do the job. Moreover, suppression of weeds by the rapid canopy closure of a solid seeded culture offers growers weed control that should be taken advantage of.

In 1984, eighteen trials were conducted by BASF Market Development Reps in the Eastern Region to demonstrate the efficacy of total post weed control in no-till soybean systems. Treatments consisted of sethoxydim, bentazon, and acifluorfen in various combinations and sequentials.

Results suggest the weed control with total post was as good or superior to that of standard grower practices. Across the encountered broadleaf species, total post control averaged 93%, compared to 79% for various grower practices. Similarly, control of various grass species for the total post system was 96%, while grower practices averaged 86%. Yield differences was directly related to the level of weed competition.

These data suggest that total post weed control is a viable, effective option under reduced tillage systems. With preemergent materials, variances in pH, organic matter, soil types, and surface residue quantity are major problems in a no-till culture which can greatly effect season long weed control. However, by the very nature of post-emergent products, these obstacles will not have an impact on performance. Also, by waiting for weeds to emerge, a manager can more accurately diagnose the specific problem he has and choose the proper herbicide combinations for control without applying materials he may not need.

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CONTROL OF GIANT RAGWEED IN CORN AND SOYBEAN

Gary Johnston and Frank Webb[1]

ABSTRACT

Giant Ragweed (Ambrosia trifida L.) is a deep seeded summer annual broadleaf weed that is increasing in its occurrence throughout much of Delaware's crop land. This plant is not only a strong competitor for light and nutrients but because of its large size, also causes considerable problems at harvest time. Giant Ragweed germinates from mid-April through July and normally grows three to five feet above the corn or soybean crop canopy. It is not unusual to find giant ragweed fifteen feet tall in corn fields. The seeds are readily scattered by mechanical harvesters, animals and in soybean seed kept for replanting.

Various chemicals, combinations, timings and rates have been evaluated for use in corn and soybeans over the last three growing seasons, with several treatments providing good control.

Atrazine at 2x rates applied pre-emergence has provided good to excellent control of giant ragweed in corn. Dicamba (0.125 lbs a.i./A), 2,4-D (0.25 lbs a.i./A) or bromoxynil (0.25 lbs a.i./A) applied postemergence on giant ragweed less than 8" tall have all provided excellent control of emerged giant ragweed. However, a second application post-directed is sometimes needed for season-long control in heavily infested fields. Dicamba (0.125 lbs a.i./A) and 2,4-D (0.25 lbs a.i./A) have both done a good job post-directed. Bromoxynil has not been evaluated as a post-directed treatment.

DPX-6025 and AC 252,214 applied pre-emergence in soybeans have provided excellent early season control of giant ragweed. DPX-F6025 has been evaluated two years. The 0.063 lbs a.i./A rate provided season-long control in 1983 while in 1984 control lasted only four to six weeks. The 0.38 lbs a.i./A rate of AC 252,214 is the only rate of this material evaluated thus far. This rate provided excellent season-long control of giant ragweed in 1984.

Postemergence control of giant ragweed in soybeans has been inconsistent. Split applications of bentazon (0.5 lbs a.i./A each application) sprayed 8-10 days apart has provided 97-98% control in 1982 and 1983, but only 70% control in 1984. Split applications of aciflurofen (0.38 lbs a.i./A each applicatoin) plus surfactant (0.25% each application) sprayed 8-10 days apart provided excellent control (95%) in 1982 and 1984 while the same treatment at 0.25 lbs a.i./A provided excellent control (95%) in 1982 and only fair control (80%) in 1983. The 0.38 lbs a.i./A treatment of aciflurofen was not tested in 1983. The combination of bentazon + 2,4-DB (1.0 + 0-.03) provided excellent control of giant ragweed (97%) in 1983 but only 70% control in 1984. PP021 (0.38 lbs a.i./A) plus surfactant (0.5%) provided excellent control (98%) in 1984, the only year it's been tested. The first appliatoin of all the postemergence treatments was made at the second to third trifoliate growth stage of the soybeans and when the giant ragweed was eight inchest tall or less.

Good late season activity on giant ragweed has been attained with alanap + 2,4-DB (1.5 + 0.045) broadcast and glyphosate in a ropewick applicator at a one to one ratio with water.

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HERBICIDE PROGRAMS FOR CONTROL OF TRIAZINE RESISTANT PIGWEED

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Field trials were established in 1981-84 to evaluate herbicide programs for control of triazine resistant pigweed (Amaranthus hybridus L.) in no-till corn. Experiments were established in randomized complete block design with 4 replications in Russell Co., VA in 1981 and 1982 on a silt loam soil of 1.5% organic matter content, and at Blacksburg, VA in 1983 and 1984 on a silt loam soil of 2.4% organic matter content in areas of indigenous infestations. Acetochlor, alachlor, metolachlor, pendimethalin, and dicamba were applied as preemergence and/or postemergence treatments in combination with atrazine or atrazine plus simazine for control of other weeds. Five treatment strategies were evaluated and included application of acetochlor, alachlor, metolachlor, or pendimethalin as preemergence treatments, as preemergence treatments in combination with dicamba as an early postemergence treatment, as early postemergence treatments in combination with dicamba, as split treatments with application at both preemergence and early postemergence timings, and as split treatments in which dicamba was applied in combination with the early postemergence component of the treatment.

All treatments provided greater pigweed control than triazine standard treatments alone. Activity of acetanilide or dinitroaniline treatments varied with the amount of rainfall received for herbicide activation, but 4 year means indicated relative activity as metolachlor > pendimethalin > alachlor. Preemergence treatments alone generally did not give complete pigweed control, and supplemental early postemergence treatment with dicamba was required to eliminate competition from escaped weeds. Application of an acetanilide or dinitroaniline herbicide in combination with dicamba as an early postemergence treatment was of equal or greater effectiveness than preemergence application followed by early postemergence dicamba treatment due to prolonged residual control of late germinating pigweed. Split applications of the acetanilide or dinitroaniline herbicides, alone or in combination with dicamba, were also very effective in pigweed control.

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A Comparison of Girojet CDA and Micron CDA Sprayers for Quackgrass Control

William B. Duke and John Cranmer

ABSTRACT

During the past several years, studies have shown that quackgrass and annual grass control with postemergence herbicides can be improved by low volume applications of selected herbicides such as glyphosate and fluazifop. Field studies were conducted in 1983 to compare the effectiveness of glyphosate on quackgrass following low volume applications made with either a Girojet CDA unit or the more common Micron CDA unit. The newer Girojet unit has been reported to be more efficacious in that its spray pattern is directed downward into the foliage for potential enhanced foliar coverage. Both units provide spray droplets at low gallonages through movement across or through a spinning disc which disperses spray droplets of more uniform nature than conventional nozzles. Glyphosate was applied with each sprayer unit at 1.12 kg/ha when quackgrass was in the 5 to 6-leaf stage. Twice refined, emulsified soybean oil (95% soybean oil; 7% emulsifier) or the cationic surfactant Frigate (SDS Biotech) were used as additional variables with glyphosate to evaluate their effectiveness for improving performance at low herbicide rates. Results showed that quackgrass control with glyphosate was consistently better with Micron CDA units compared to the Girojet units. Additional soybean oil or Frigate provided some improvement in overall control but the increases were not significantly different than results obtained with commercial Round-up (glyphosate + surfactant).

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EFFECT OF CDA AND FLAT-FAN NOZZLES; CARRIER VOLUME AND RATE ON ACTIVITY OF SC-0224 AND GLYPHOSATE

N. L. Hartwig[1/]

ABSTRACT

The herbicidal activity of SC-0224 and glyphosate were compared for control of orchardgrass (*Dactylis glomerata* L.) prior to no-tillage corn (*Zea mays* L.) planting. Each herbicide was applied with a controlled droplet applicator (CDA) and an 800067 flat fan nozzle in water from 2.5 to 20 gal/A at rates of 0.25 to 2.0 lb ai/A. The droplet size from the CDA was about 220 microns and the 800067 about 350 to 375 microns.

There was no significant difference in orchardgrass control between the two herbicides or between the two methods of application at the 10% level of probability. This would tend to indicate that when the droplet size from a flat-fan nozzle approaches that of a CDA, there is no difference in herbicide activity.

Volume of water used as a herbicide carrier also had no significant effect on herbicide activity although corn yields did increase (significance level of 12%) with decreasing carrier volumes.

Herbicide rate was highly significant in its effect on orchardgrass control. In spite of this fact, herbicide rate had no effect on corn stand, height or yield, probably because even the lowest rate of 0.25 lb/A gave over 90% control and the remaining orchardgrass did not significantly reduce corn yields. Total control of orchardgrass was obtained at 1.0 lb/A but there was still a trend for increased corn yields with increasing herbicide rates, probably due to the quicker kill at higher rates.

INTRODUCTION

Control of orchardgrass in no-tillage corn following a hay crop containing orchardgrass has always been a problem. Split treatments including early spring applications of atrazine [2-chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine] followed by paraquat (1,1'-dimethyl-4,4'-bipyridinium ion) tank mixed with residual herbicides at planting time has given good orchardgrass control but paraquat reduces the activity of 2,4-D [(2,4-dichlorophenoxy)acetic acid] or dicamba (3,6-dichloro-o-anisic acid) which may be needed for alfalfa (*Medicago sativa* L.), dandelion (*Taraxacum officinale* Weber) and perennial broadleaf weed control, usually necessitating a third trip over the field for control of these weeds.

When glyphosate [N-(phosphonomethyl)glycine] is used for orchardgrass control, it contributes to the control of other perennial weeds, allows tank mixing of 2,4-D or dicamba without loss of activity, and when tank mixed with residual herbicides usually provides complete weed control in one trip. Recent research indicates that glyphosate activity may be greater when applied with a controlled droplet applicator (CDA) in low carrier volume (1,2). The purpose of this research was to compare SC-0224 (chemistry not disclosed) with glyphosate applied with a CDA vs. an 800067 flat-fan nozzle in various water volumes and at various rates.

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MATERIALS AND METHODS

This trial was conducted in 1983 on a Hagerstown silt loam soil (Typic Hapludult) with about 10% sand, 67% silt, 20% clay, 2.5% organic matter and a pH of 6.0. All herbicide treatments were made on May 12 to an undisturbed stand of 6 to 8 inch orchardgrass five days before corn planting. All treatments were applied with a small plot sprayer mounted on a small tractor to 15 by 25 ft. plots. The CDA applicator was mounted on 40 inch centers, run at 2000 rpm, with a flow rate of 17.25 oz/min at 10 psi. According to a Micromax chart, this should produce a droplet size of about 220 microns. The 800067 flat-fan nozzles were mounted on 20 inch centers and delivered 8.62 oz/min. at 24 psi. At this pressure, the median droplet size should have been about 350 to 375 microns according to a Spraying Systems Co. chart. Once each application system was calibrated, the four different volumes of application were obtained by changing the speed of the sprayer, hence, the pressure, nozzle flow rate and droplet size remained constant over all treatments. The air temperature was 21°C, humidity 32%, and wind 2 to 3 mph on the day of treatment. There was no rainfall for two days after treatment.

The whole trial area was given a blanket treatment of atrazine + simazine [2-chloro-4,6-bis(ethylamino)-s-triazine] at 1.5 + 1.5 lb/A for residual weed control on May 12. This treatment was very effective and the incidence of other weeds was insignificant.

'Pioneer 3591' (105 day) corn was planted with a 6-row John Deere Maximerge no-till planter in 30 inch rows on May 17. Fertilizer was applied in the row at a rate of 100 lb/A of 10-30-10 and 485 lb/A of NH_4NO_3 (165 lb/A of N) was broadcast after planting.

The experiment was a 2 x 2 x 4 x 4 factorial in a randomized block design with three replications. The first replication was ruined by drifting glyphosate used to spray the alleyways and was discarded. Orchardgrass control ratings were determined from the center of the plot and yields were determined by harvesting a random 0.5 m^2 area from the center of each plot on July 28. All corn stand, height, and yield data were an average of three of the four center rows in each plot.

There was adequate moisture for growth during May and June after herbicide application and corn planting but July, August and September were very dry. Corn yields were reduced up to 30% due to drought.

RESULTS AND DISCUSSION

There was no difference between SC-0224 and glyphosate for control of orchardgrass (Tables 1,2). There was a significant difference in corn height between these two herbicides but no significant difference in corn stand or yield. The application technique (CDA vs flat-fan) had no effect on orchardgrass control, corn stand or yields. This would tend to indicate that when droplet size is about equal, there is no difference in herbicide activity. The volume of water in which these herbicides were applied also had no effect on orchardgrass control, corn stand or height and was significant only at the 12% level for corn yield. The rate at which the herbicides were applied had a highly significant effect on the amount of orchardgrass control but no effect on corn stand or height. The herbicide rate was only significant at the 13% level for corn yield. This would indicate that although differences in orchardgrass control were highly significant due to herbicide rate, the overall control was so good at all rates that corn yields were only marginally affected.

Table 1. ANOV (probability) table for orchardgrass control and yield, corn stand, height and yield following application of SC-0224 or glyphosate with CDA or flat-fan nozzles in 2.5 to 20 gal. of water and rates of .25 to 2 lb ai/A.

Treatment	DF[1/]	Orchardgrass Control 5/24 %	Orchardgrass Control 6/16 %	Orchardgrass Yield 7/28 lb/A	Corn Stand Plants/A	Corn Ht. 7/28 cm	Corn Yield 15.5% H_2O bu/A
Rep	1	44.[2/]	100.	73.	31.	47.	70.
Herb	1	16.+	88.	50.	20.+	10.*	45.
Appl	1	83.	78.	74.	48.	38.	46.
Herb*Appl	1	66.	84.	43.	62.	57.	92.
Vol	3	80.	71.	76.	44.	52.	12.+
Herb*Vol	3	32.	27.	11.+	74.	40.	85.
Appl*Vol	3	5.**	84.	71.	90.	34.	27.
Herb*Appl*Vol	3	74.	60.	98.	56.	66.	22.
Rate	3	.1***	.2***	.1***	67.	38.	13.+
Herb*Rate	3	39.	85.	41.	14.+	99.	90.
Appl*Rate	3	42.	49.	2.**	4.**	95.	93.
Herb*Appl*Rate	3	12.+	39.	83.	58.	38.	33.
Vol*Rate	9	12.+	47.	78.	62.	93.	87.
Herb*Vol*Rate	9	55.	79.	42.	18.+	64.	95.
Appl*Vol*Rate	9	69.	89.	83.	19.+	94.	47.
Herb*Appl*Vol*Rate	9	57.	91.	64.	35.	95.	75.

1/ Degrees of freedom associated with each parameter.

2/ Probability (%) of that parameter or interaction not having an effect on the result. Significant at: + < 20%, * < 10%, ** < 5%, *** < 1% level.

Table 2. Orchardgrass control and yield, corn stand, height and yield following application of SC-0224 or glyphosate with CDA or flat-fan nozzles in 2.5 to 20 gal. of water and rates of .25 to 2 lb ai/A.

Treatment	N[1/]	Orchardgrass Control 5/24 %	Orchardgrass Control 6/16 %	Orchardgrass Yield 7/28 lb/A	Corn Stand Plants/A	Corn Ht. 7/28 cm	Corn Yield 15.5% H_2O bu/A
Herbicide							
SC-0224	64	68+[2/]	95	149	24000+	152*	119
glyphosate	64	70+	95	118	24400+	146*	116
Application							
CDA	64	69	95	142	24300	150	119
Flat-Fan (800067)	64	69	95	126	24100	147	116
Volume							
2.5 gal.	32	70	96	108	24600	152	126+
5.0 gal.	32	69	95	111	23900	150	112+
10.0 gal.	32	69	94	168	24400	145	114+
20.0 gal.	32	68	94	147	24100	148	116+

Table 2. cont.

Treatment	N[1/]	Orchardgrass Control 5/24	Orchardgrass Control 6/16	Orchardgrass Yield 7/28	Corn Stand	Corn Ht. 7/28	Corn Yield 15.5% H_2O
		%	%	lb/A	Plants/A	cm	bu/A
Herbicide Rate							
0.25 lb ai/A	32	64***	91***	331***	24100	144	109+
0.50 lb ai/A	32	65***	95***	139***	24100	149	118+
1.00 lb ai/A	32	71***	97***	24***	24600	150	121+
2.00 lb ai/A	32	75***	97***	41***	24100	153	122+

1/ Number of values represented in each mean.

2/ Significant differences present within each sub-group at: + < 20%, * < 10%, ** < 5%, *** < 1% level.

Visual estimates of orchardgrass control on May 24 (12 days after treatment) and June 16 (5 wks. after treatment) are plotted in Figure 1. Orchardgrass yields on July 28, 1983 are plotted in Figure 2.

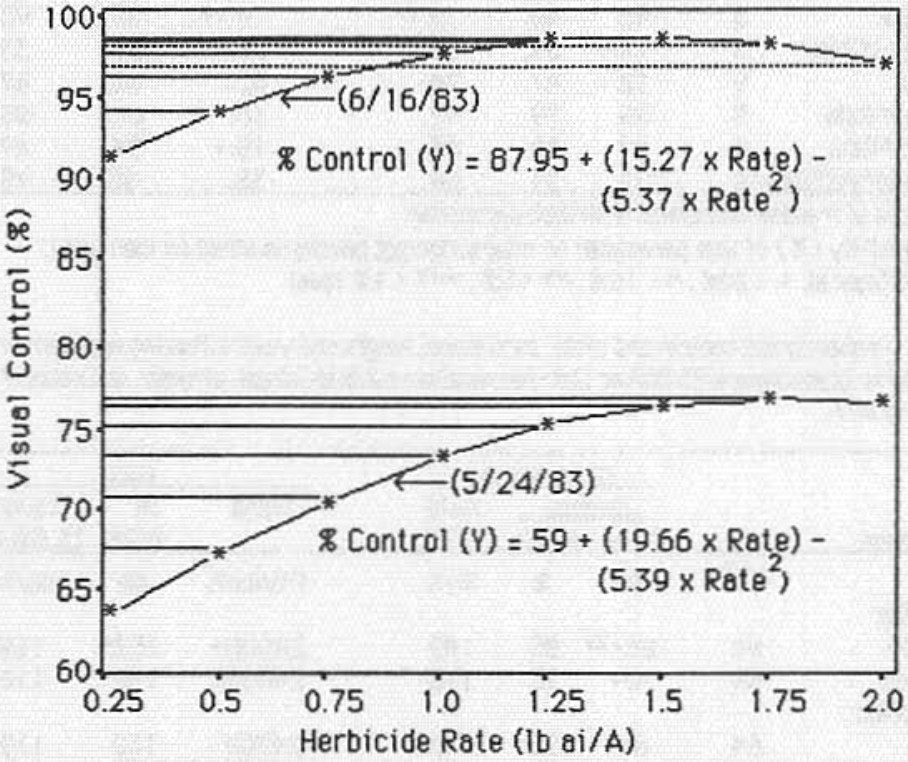

Figure 1. Plot of orchardgrass control based on a quadratic equation generated from actual visual estimates on May 24 and June 16, 1983.

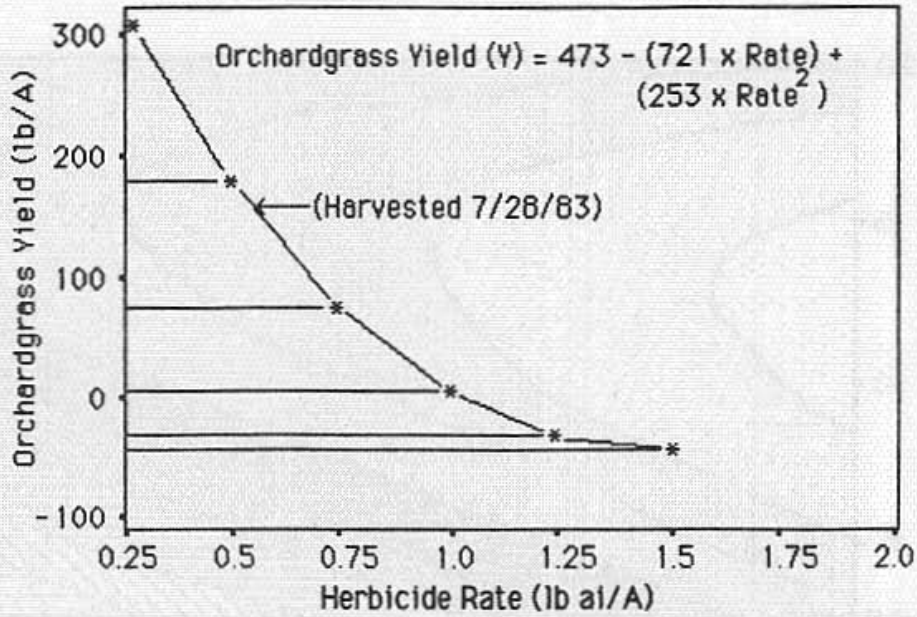

Figure 2. Plot of orchardgrass yield based on a quadratic equation generated from 0.5 m^2 samples harvested on July 28, 1983.

Visual estimates of orchardgrass control and actual yields are averaged over all other parameters except herbicide rate since none of the other parameters had a significant effect. The control reached a peek at 1.25 to 1.5 lb/A of either SC-0224 or glyphosate (Figures 1 and 2). The orchardgrass yield reached zero at a herbicide rate of 1.0 lb/A (Figure 2). Even the lowest herbicide rate of 0.25 lb/A gave over 90% control by June 16 and by July 28 these plots had only about 300 lb/A of orchardgrass dry weight. There was no untreated check in this trial but forage tests would indicate that 4000 lb/A of dry matter are not unusual yields for a first cutting of well fertilized orchardgrass. The corn stand, height or yield did not suffer significantly from orchardgrass competition at even the lowest herbicide rate (Tables 1 and 2).

Corn yields were not significantly affected by any of the parameters at the 10% level but volume of carrier and herbicide rate had a 12 and 13% level of significance respectively. Corn yields are plotted by carrier volume and rate in Figure 3.

The lowest corn yields were obtained at herbicide rates of 0.25 to 0.5 lb/A applied in 10 to 15 gal/A of water. There was a trend towards increased corn yields with increasing herbicide rate and decreasing carrier volume. Although 1 lb/A of herbicide gave total control of orchardgrass (Figure 2), there was still a 10 bu/A increase in corn yields from increasing herbicide rates up to 2 lb/A when applied in 2.5 gal/A of carrier. This would tend to indicate that higher rates of herbicide killed the orchardgrass faster from which the corn benefited.

ACKNOWLEDGEMENTS

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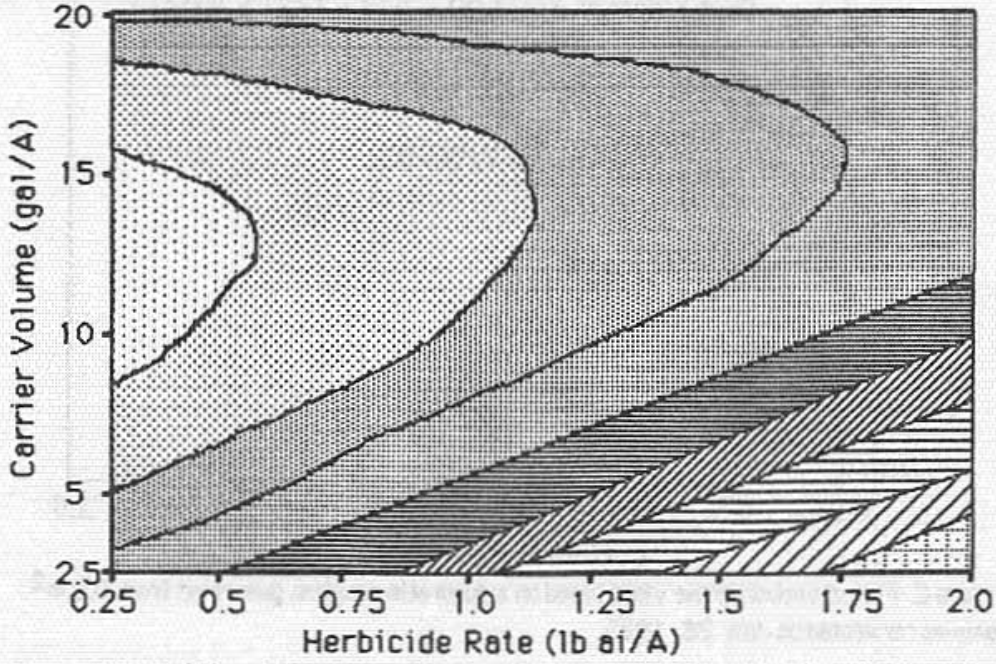

Corn Yield (Y) = 123.58 + (6.2 x Rate) - (2.85 x Vol) + (.11 x Vol^2)

Legend	Corn Yield (Y)	Legend	Corn Yield (Y)
	107.5 - 109.0		121.3 - 124.4
	109.0 - 112.1		124.4 - 127.5
	112.1 - 115.2		127.5 - 130.5
	115.2 - 118.3		130.5 - 133.6
	118.3 - 121.3		

Figure 3. Plot of corn yields by carrier volume and herbicide rate based on a quadratic equation generated from actual corn yields harvested in 1983.

EARLY POSTEMERGENCE WEED CONTROL IN CORN WITH FLUOROCHLORIDONE-TRIAZINE COMBINATIONS[1]

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ABSTRACT

Fluorochloridone, applied alone and in combination with atrazine and cyanazine, was evaluated for weed control efficacy and crop tolerance applied early postemergence in corn. At rates of 0.56 kg/ha and 0.84 kg/ha, fluorochloridone applied alone provided good broad spectrum weed control with commensurate increased yields. Combinations of 0.14 and 0.28 kg/ha fluorochloridone with atrazine improved fall panicum *(Panicum dichotomiflorum* Michx.) control compared to the same rates of fluorochloridone alone. Similar results were obtained from fluorochloridone-cyanazine combinations. All combinations except with 0.07 kg/ha fluorochloridone resulted in yields that were not significantly different from the standard herbicide check of alachlor + atrazine applied preemergence, but greater than the uncultivated check.

INTRODUCTION

Fall panicum, velvetleaf *(Abutilon theophrastis* L.), common lambsquarters (*Chenopodium album* L.) and pigweed *(Amaranthus* spp.) are problem weeds in corn that are generally controlled by preemergence herbicide treatments, of alachlor [2-chloro-2',6'-diethyl-*N*-(methoxymethyl)-acetanilide] in combination with atrazine [2-chloro-4-(ethylamino)-6-(isopropylamino)-*S*-triazine]. Although some postemergence weed control can be effected with these compounds, they are more effective when applied before weed emergence. Effective postemergence broad spectrum herbicide treatments are needed in the event that preemergence treatments fail or cannot be applied in time to adequately control weeds. Fluorochloridone [formerly R-40244, 1-(m-trifluoromethylphenyl)-3-chloro-4-chloromethyl-2-pyrrolidone] was investigated in 1984 to determine whether, alone or in combination with atrazine or cyanazine [2-(4-chloro-6-(ethylamino)-*s*-triazine-2-yl)-2-methylpropionitrile], it can provide broad spectrum postemergence weed control without injury to corn.

MATERIALS AND METHODS

Corn (var. Midstates 747) was planted on May 10, 1984, in a Sassafras loam soil (organic matter 1.5%) at the Soils and Crops Research Center, New Jersey Agricultural Experiment Station, Adelphia, New Jersey. Plot size was 3.6 m (12 ft) wide by 5.4 m (129 ft) long with corn planted in four 0.9 m (36 inch) wide rows. The preemergence herbicide check, alachlor + atrazine at 1.68 and 1.12 kg/ha, respectively, was applied the following day. All other treatments

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[1]New Jersey Agricultural Experiment Station Publication No. J-15274-4-84.

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were applied on May 22, when corn was in the spike stage, common lambsquarters was in the cotyledon to 2-leaf stage, pigweed and velvetleaf were in the cotyledon stage, and fall panicum was in the spike to 1-leaf stage. All herbicides were applied with a CO_2-propelled backpack sprayer, using water as a carrier. Nozzle tips were number 730616 (Spraying Systems, Inc.). Spray volume was 273 L/ha (40 gpa) at a pressure of 220 kPa (32 psi). Observations were made periodically throughout the growing season and detailed weed and crop responses were rated approximately a month later for crop and weed control using a scale from 0 to 10, where 0 reflects no control of crop or weed and 10 reflects complete control.

Corn was harvested on September 27 and grain yield values were converted to bushels/A. Experimental design was a randomized complete block with three replications. Data for weed control were converted to arctan values prior to statistical analysis. All statistical analyses were performed using the ANOVA program of the Statistical Analysis System (SAS Institute, Inc., Box 8000, Cory, N.C. 25711).

RESULTS AND DISCUSSION

Fluorochloridone, alone and in combination with cyanazine or atrazine, caused some bleaching of corn at approximately 10 to 14 days following treatment, and the effect was increasingly severe with increasing rates of fluorochloridone. Corn bleaching was temporary, however, since by June 26 corn no longer showed any symptoms in these plots (Table 1), although corn vigor was slightly reduced at 0.84 kg/ha fluorochloridone. We do not know whether this effect will appear in all seasons, as above normal rainfall may have moved the herbicide into the root zone of corn. Good broad spectrum weed control was obtained from fluorochloridone applied alone at rates of 0.56 and 0.84 kg/ha. Below these rates, control of fall panicum was poor, and control of velvetleaf, common lambsquarters, and pigweed was less than acceptable. Atrazine, at 1.68 kg/ha, provided excellent control of broadleaf weeds, but did not control fall panicum. Cyanazine at 2.24 kg/ha controlled velvetleaf and common lambsquarters, which 0.28 and 0.14 kg/ha fluorochloridone did not control, but did not control pigweed, as expected. Fall panicum control was better from 2.24 kg/ha of cyanazine than for the above rates of fluorochloridone alone. Rates of fluorochloridone between 0.14 and 0.37 kg/ha, in combination with atrazine effected excellent broadleaf weed control. Interestingly, fall panicum control by atrazine in combination with 0.14 or 0.28 kg/ha fluorochloridone was better than the same rates of fluorochloridone alone. This is surprising, since atrazine alone did not provide any control of fall panicum. Increasing rates of fluorochloridone to 0.37 kg/ha in combination with atrazine improved fall panicum control compared to combinations at lower rates, as did increasing atrazine rates. Combinations of fluorochloridone with cyanazine generally provided better weed control than combinations of fluorochloridone with atrazine at similar rates. This was especially evident for fall panicum control; for example, 0.28 kg/ha fluorochloridone in combination with 1.12 kg/ha cycnazine resulted in significantly greater control of this weed than the same rates of fluorochloridone with atrazine. This may reflect higher cyanazine activity when applied alone postemergence to fall panicum.

Yield values reflected treatment efficacy in controlling weeds. Rates of fluorochloridone that did not provide good fall panicum control did not result in yields significantly greater than the uncultivated check. Similarly, 1.68 kg/ha atrazine did not control fall panicum and did not result in yield values significantly different from the uncultivated check. In contrast, cyanazine alone, which did provide some fall panicum control, provided yields greater than the uncultivated check, although not as great as the herbicide check of alachlor + atrazine which provided excellent weed control. Fluorochloridone applied alone, at rates higher than 0.28 kg/ha resulted in yields that were not significantly different from the herbicide check. Combinations of fluorochloridone with atrazine also provided yields that were not statistically different from the chemical check, except at the 0.07 kg/ha rate of fluorochloridone. Similarly, all rates of fluorochloridone except 0.07 kg/ha in combination with cyanazine resulted in yields that were not different from the alahclor + atrazine.

In summary, postemergence fluorochloridone at rates higher than 0.56 kg/ha provided weed control and yields as good as those obtained from preemergence alachlor + atrazine. Lower rates of fluorochloridone were effective when applied in combination with atrazine or cyanazine. Good crop tolerance was exhibited by fluorochloridone applied alone and in combinations with cyanazine and atrazine. These postemergence treatments may provide an alternative to preemergence weed control methods when the latter are not effective or practicable.

Table 1. Weed control in corn with postemergence fluorochloridone alone and in combination with atrazine or cyanazine.

Herbicide	Rate kg/ha	Weed Control[3] Corn V	PANDI[4] S	ABUTH[4] S	CHEAL[4] S	AMARE[4] S	Yield BU/A
Spike to Very Early Post (May 22)[1]							
fluorochloridone (R-40244)	0.07	0.0	0.6	6.6	6.6	6.2	105.7
	0.14	0.0	3.1	6.6	6.6	4.5	118.9
	0.28	0.0	4.3	6.3	3.3	6.0	119.6
	0.56	1.0	8.1	10.0	8.2	9.1	133.1
	0.84	2.0	8.8	10.0	9.6	9.6	135.0
atrazine	1.68	0.0	0.8	10.0	10.0	10.0	107.9
fluorochloridone + atrazine	0.07 + 0.84	0.0	1.8	9.3	10.0	10.0	104.8
	0.14 + 0.84	0.0	5.1	8.6	9.6	9.6	134.0
	0.28 + 0.84	0.0	5.8	10.0	10.0	9.8	140.4
	0.28 + 1.12	0.0	6.5	10.0	10.0	9.9	143.6
	0.37 + 1.12	0.0	7.8	10.0	10.0	10.0	127.8
	0.28 + 2.24	0.0	6.6	10.0	10.0	10.0	132.4
	0.37 + 2.24	1.0	8.5	10.0	10.0	10.0	164.4
cyanazine	2.24	0.0	6.8	10.0	10.0	5.6	129.0
fluorochloridone + cyanazine	0.07 + 1.12	0.0	4.5	10.0	10.0	5.0	104.0
	0.14 + 1.12	0.0	7.7	10.0	10.0	5.5	137.7
	0.28 + 1.12	0.0	8.3	10.0	10.0	8.0	158.1
	0.28 + 1.68	1.0	7.6	9.6	10.0	7.6	147.8
	0.37 + 1.68	1.0	8.6	10.0	10.0	10.0	165.0
	0.28 + 2.24	1.0	8.6	10.0	10.0	8.8	131.5
	0.33 + 2.0	1.0	8.8	10.0	9.9	8.6	136.7
Check - alachlor + atrazine	1.68 + 1.12 PE[2]	0.0	9.2	10.0	10.0	9.3	165.7
Check - uncul.		0.0	0.0	0.0	0.0	0.0	87.2
LSD 0.05	-	1.0	2.0	2.6	2.3	3.1	36.5

[1]Application date.
[2]PE = preemergence
[3]Weed control ratings (0 = no control, 10 = complete control) on June 26, 1984.
[4]Abbreviations: weed species abbreviations from Weed Science, Vol. 32, Supplement 2, 1984. PANDI = *Panicum dichotomiflorum* Michx. ABUTH = *Abutilon theophrasti* L.; CHEAL = *Chenopodium album* L.; AMARE = *Amaranthus retroflexus* L. (also contains *Amaranthus hybridus* L. AMACH).

TRIDIPHANE COMBINATIONS FOR ANNUAL GRASS CONTROL IN CORN

Russell R. Hahn[1/]

ABSTRACT

Postemergence applications of tridiphane in combination with atrazine or cyanazine were compared with standard pre- or postemergence applications of atrazine plus cyanazine for large crabgrass [Digitaria sanguinalis (L.) Scop.], giant foxtail (Setaria faberi Herrm.) or fall panicum (Panicum dichotomiflorum Michx.) control in corn. A randomized complete block design with four replications was used for each of four experiments conducted between 1982 and 1984. Herbicide treatments were applied in water to 10 by 25 ft plots using 8003 flat spray tips mounted on a compressed air plot sprayer calibrated to deliver 30 gpa of spray solution.

The first experiment was established in May 1982 on a Hoosic gravelly loam soil with 2.4% organic matter in Columbia County, New York. Herbicide treatments were evaluated in both reduced tillage (disced) and no-tillage plots. The plot area was heavily infested with fall panicum while only a light infestation of large crabgrass existed. Control ratings and grain yields determined by harvesting an area 5 by 15 ft in the center of each plot are shown in Table 1. There was no significant difference in control ratings between the tillage systems. In addition, there was no difference in fall panicum control between the standard cyanazine plus atrazine treatments or among the tridiphane plus atrazine treatments. The fall panicum ratings for the standard treatments were, however, significantly higher than for the tridiphane combinations. Grain corn yields for all herbicide treatments were significantly higher than that of the control. In addition, yields for the standard cyanazine plus atrazine treatments were significantly higher than for the early postemergence tridiphane combinations, which in turn were higher than for the late postemergence tridiphane combinations.

Giant foxtail control was evaluated on a Hoosic gravelly loam soil with 3.3% organic matter in Columbia County, New York in 1983 and on a Honeoye silt loam with 3.7% organic matter in Seneca County, New York in 1984. In each case, a severe infestation of giant foxtail dominated the plot area. Control ratings are shown in Table 1. In 1983, the preemergence combination of cyanazine plus atrazine provided better giant foxtail control than any of the early postemergence combinations. In addition, the 0.5 lb/A rate of tridiphane plus atrazine did not provide the same level of control as the other early postemergence combinations. Similar results were obtained in 1984 except there was no difference between the pre- and early postemergence applications of the standard cyanazine plus atrazine treatments.

A second experiment to evaluate the potential of tridiphane combinations for fall panicum control was conducted on an Arkport loamy fine sand with 3.4% organic matter in Seneca County in 1983. Late-season control ratings are shown in Table 1. The early postemergence combinations of tridiphane plus cyanazine provided similar fall panicum control as the preemergence standard of cyanazine plus atrazine. The preemergence standard did, however, receive higher control ratings than the postemergence combinations of cyanazine plus atrazine or of tridiphane plus atrazine.

These results indicate that early postemergence combinations of tridiphane plus cyanazine compared favorably with standard pre- or early postemergence combinations of cyanazine plus atrazine for control of giant foxtail and fall panicum in corn. Tridiphane combinations with atrazine were not as effective in controlling these annual grasses as the standard treatments.

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Table 1. Corn yields and control ratings for annual grasses with combinations of tridiphane and triazine herbicides.

Herbicides	Rates (lb/A)	Timing	Control Rating [a] or Yield (bu/A)		
		Reduced Tillage - 1982			
			Crabgrass	Panicum	Corn
Cyanazine + Atrazine	2.0 + 1.0	PRE	6.7	5.5	66
Cyanazine + Atrazine	2.0 + 1.0	EPO	7.0	5.0	61
Tridiphane + Atrazine[b]	0.38 + 1.0	EPO	6.0	3.3	29
Tridiphane + Atrazine[b]	0.5 + 1.0	EPO	7.5	3.7	46
Tridiphane + Atrazine[b]	0.5 + 1.0	LPO	4.3	3.5	17
Tridiphane + Atrazine[b]	0.75 + 1.0	LPO	6.0	3.0	21
Control	---	-	0.0	0.0	10
		No-Tillage - 1982			
			Crabgrass	Panicum	Corn
Cyanazine + Atrazine	2.0 + 1.0	PRE	6.0	6.3	67
Cyanazine + Atrazine	2.0 + 1.0	EPO	7.7	6.5	62
Tridiphane + Atrazine[b]	0.38 + 1.0	EPO	5.7	2.7	37
Tridiphane + Atrazine[b]	0.5 + 1.0	EPO	7.7	3.0	47
Tridiphane + Atrazine[b]	0.5 + 1.0	LPO	4.7	2.5	21
Tridiphane + Atrazine[b]	0.75 + 1.0	LPO	5.5	3.0	27
Control	---	-	0.0	0.0	9
LSD (0.05)			1.6	1.1	12
			1983 Foxtail	1984 Foxtail	1983 Panicum
Cyanazine + Atrazine	2.0 + 1.5	PRE	7.5	8.3	8.5
Cyanazine + Atrazine	2.0 + 1.5	EPO	5.5	7.8	5.5
Tridiphane + Atrazine[b]	0.5 + 1.5	EPO	4.3	6.0	3.0
Tridiphane + Atrazine[b]	0.75 + 1.5	EPO	5.3	7.0	3.0
Tridiphane + Cyanazine	0.5 + 2.0	EPO	6.0	7.8	8.5
Tridiphane + Cyanazine	0.75 + 2.0	EPO	-	7.3	8.3
Control	---	-	0.0	0.0	0.0
LSD (0.05)			0.9	1.0	1.6

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

[b] Treatments included a petroleum oil concentrate-surfactant blend.

EFFECTS OF FOUR TILLAGE SYSTEMS ON HERBICIDE PERFORMANCE IN CORN PRODUCTION

Prasanta C. Bhowmik, Susan Podmayer, and Edwin N. McGlew[1]

ABSTRACT

A field experiment was conducted at the Massachusetts Agricultural Experiment Station in South Deerfield to evaluate the effects of four tillage practices on the efficacy of various herbicide combinations for weed control. Major weed species were large crabgrass [*Digitaria sanguinalis* (L.) scop.], fall panicum (*Panicum dichotomiflorum* Michx.), and horseweed (*Conyza canadensis* L.). The corn 'Agway 584 S' was planted on May 20 on 3 m by 8 m plots. Rows were 75 cm apart with a planting density of 62,800 plants/ha. Preemergence herbicide treatments were applied on May 22. Tillage system A consisted of a mouldboard plow followed by discing. Tillage system B was disced twice, and tillage system C was harrowed by chisel, plow and disc. Tillage D was a no-till system. Within each tillage system, herbicide treatments were replicated four times in a randomized complete block design. Weed control and crop injury ratings were taken on July 4, 1984. Corn was harvested on September 28 for silage, ears, and grain yields.

All herbicide treatments gave excellent (above 90%) annual grass and broadleaf weed control under all tillage systems. There was no significant corn injury noted under tillages A or D. However, injury was observed when cyanazine plus alachlor at 2.24 + 2.8 kg/ha was applied under tillage B (disc-disc). The same treatment, and the combination of cyanazine, dual (atrazine plus metolachlor), 2,4-D LV4, and surfactant at 2.24 + 2.24 + 0.56 kg/ha + 2.34 L/ha, respectively, caused corn injury under tillage system C (chisel-disc).

All herbicide treatments under all four tillage systems produced significantly greater yields of silage, ears, and grain than that of the untreated check. The three treatments found most often to produce the highest yield in all four tillage systems were cyanazine plus atrazine plus 2,4-D LV4, plus surfactant at 2.24 + 2.24 + 0.56 kg/ha plus 2.3 L/ha, atrazine plus cyanazine at 1.12 + 2.24 kg/ha, and atrazine plus alachlor at 1.12 + 2.8 kg/ha.

Comparing the best yields from the four tillage systems, tillage system with mouldboard plow produced more silage (77.2 m tons/ha), ears (18.0 m tons/ha), and grain (13.9 m tons/ha) yields than any of the other systems. The no-till system was next (73.6 m tons/ha silage), followed by the chisel-disc (64.9 m tons/ha) and disc-disc (62.9 m tons/ha) systems. Under the double disc system, yields were 18-19% lower than those of the mouldboard plow disc system.

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THE USE OF DICLOFOP IN FALL SEEDED BARLEY

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ABSTRACT

Diclofop, a herbicide used to control various grassy weeds, is labeled for preemergence and postemergence use in wheat. Preliminary tests, however, have shown that applications to barley can result in crop injury and yield loss. Field experiments were conducted to determine if it is possible to minimize or eliminate these negative effects by proper timing of diclofop application in barley and to determine if response is affected by barley variety.

Research was conducted during the 1983 - 1984 winter small grain growing season at the Poplar Hill Research Farm in Quantico, MD. Three varieties of barley ('Barsoy', 'Henry', and 'Surrey') were planted in conventionally tilled soil on October 19 at the rate of 2.0 bu/A using a John Deere grain drill. Three rates of diclofop (0.75, 1.0, and 1.5 lb ai/A) were then applied at five times (preemergence, December 14, January 27, February 22, and April 6). Treatments were arranged in a randomized complete block design with three replications. Individual plots were 25' long and 10' wide. Normal fertilizer practices were followed. The soil was a Matapeake silt loam (pH 6.1, OM 1%). Herbicides were applied with a CO_2 pressurized backpack sprayer that delivered 18 gpa at 20 psi utilizing SS-8003 flat fan nozzles. Visual rating of crop injury and lodging were based on a scale of 0 (no injury or no lodging) to 100 (total dessication or total lodging). Yields were taken with a standard field combine.

Crop injury, if any, usually took the form of stunting, although in severe cases the stand was also thinned. Stunting remained visible throughout the growing season with only slight outgrowth observed.

Preemergence applications resulted in moderated to severe crop injury and slight lodging with all three varieties. Corresponding yield losses resulted, especially with the higher rates.

December applications caused only slight injury (except moderate injury to 'Henry' and 'Surrey' from the highest rate), no lodging, and no loss of grain yield. January applications resulted in less or equal injury but did cause significant lodging with the 1.5 lb ai/A rate. Again, however, there was no loss of grain yield.

February and April applications did not injure 'Surrey' and only slight injury was observed with 'Barsoy' and 'Henry'. However, crop lodging became a severe problem with 'Henry' and 'Surrey' and to a moderate extent with 'Barsoy'. Interestingly, up to 70% lodging could be tolerated without any loss in yield.

Based on these findings, December and January are the safest times to apply diclofop to barley, resulting in only minimal injury and lodging, and no yield loss. Preemergence applications result in severe injury and yield loss while February and April applications cause severe lodging problems, especially with 'Henry' and 'Surrey'.

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BROADLEAF WEED CONTROL IN WHEAT AND BARLEY WITH FALL APPLICATION OF POST EMERGENCE HERBICIDES

T.E. Vrabel and P.C. Bagley1/

ABSTRACT

In studies conducted in Maryland and southern Pennsylvania fall applied herbicide combinations were evaluated for the control of common chickweed [Stellaria media (L.) Vill.], henbit (Lamium amplexicaule L.), wild mustard (Sinapis arvensis L.) and Virginia pepperweed (Lepidium virginicum L.) in wheat and barley. When treated at the 2 - 4 leaf stage these species were controlled by combinations of bromoxynil at 0.43 kg/ha with MCPA at 0.43 kg/ha, dinoseb at 0.84 kg/ha or dicamba at 0.07 kg/ha. These treatments were superior in weed control and crop safety to spring application of 2,4-D at 1.12 kg/ha or the combination of 2,4-D at 0.56 kg/ha and dicamba at 0.37 kg/ha. Common chickweed and henbit 8 cm tall was controlled only by the bromoxynil plus dinoseb treatment.

Dinoseb caused significant injury to barley foliage and reduced tiller populations by up to 15%. Elimination of primary tillers and increased severity of winter injury were the major causes of the observed stand reductions. Foliar burn from dinoseb was also observed in wheat but no long term adverse effects occurred. Bromoxynil, MCPA, and fall applied dicamba did not cause injury to wheat or barley.

The results of these experiments show that fall treatment of small grains when weeds are in the seedling stage with bromoxynil in combination with MCPA or dicamba can provide safe and effective broadleaf weed control. With larger weeds control can be obtained by the addition of dinoseb to the tank mix but appreciable injury to barley may occur.

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CORN CHAMOMILE CONTROL IN WINTER WHEAT - AN UPDATE

Russell R. Hahn[1/]

ABSTRACT

Fall- or spring-applied postemergence herbicide treatments were evaluated for corn chamomile (Anthemis arvensis L.) control in winter wheat. A randomized complete block design with four replications was used for the two experiments conducted between 1982 and 1984. Herbicide treatments were applied in water to 6 by 20 ft (1982-83) or 10 by 25 ft (1983-84) plots using 8003 flat spray tips mounted on a compressed air plot sprayer calibrated to deliver 30 gpa of spray solution.

The first experiment was established in September 1982 on a Hudson and Collamer silt loam soil with 3.3% organic matter in Tompkins County, New York. Houser wheat was planted on September 14. Fall- and spring-applied postemergence treatments were made on October 18, 1982 and May 6, 1983, respectively. None of these postemergence herbicide treatments caused significant wheat injury. Corn chamomile control ratings made on July 9, 1983 are shown in Table 1. The only fall-applied treatment that did not provide acceptable corn chamomile control was the 2.0 lb/A rate of bifenox. All other fall-applied treatments received significantly higher control ratings than this treatment. Fall applications of bromoxynil, dicamba, metribuzin, and the dicamba combinations with bromoxynil or metribuzin all provided significantly better corn chamomile control than their spring counterparts. Only chlorsulfuron and DPX-6376 provided acceptable control when applications were made in the spring.

A second experiment was established in September 1983 on a Hilton silt loam soil with 3.1% organic matter in Niagara County, New York. Purcell wheat was planted on September 25, 1983. Fall- and spring-applied postemergence herbicide treatments were made on October 21, 1983 and April 27, 1984, respectively. Once again, none of these postemergence herbicide treatments caused significant wheat injury. Only the fall application of dicamba and the spring application of fluorochloridone failed to provide acceptable corn chamomile control. Control ratings for the other herbicide treatments were significantly higher than the ratings for these unacceptable treatments.

The standard treatment of bromoxynil in the fall continues to perform well against corn chamomile in winter wheat. In addition, fall applications of metribuzin, either fall or spring applications of chlorsulfuron or DPX-6376, and spring applications of DPX-6316 proved effective against this species.

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Table 1. Corn chamomile control ratings with fall- or spring-applied postemergence herbicide treatments in winter wheat.

Herbicides	Rates (lb/A)	Corn Chamomile Control Ratings[a]	
	Tompkins County - 1983	FPO[b]	SPO[b]
Bifenox	2.000	2.8	2.3
Bromoxynil	0.375	9.5	-
Bromoxynil	0.500	8.8	5.5
Chlorsulfuron	0.016	-	7.5
Chlorsulfuron	0.031	-	9.0
Chlorsulfuron	0.063	9.8	10.0
DPX-6376	0.016	-	10.0
DPX-6376	0.031	-	10.0
DPX-6376	0.063	10.0	10.0
Dicamba	0.125	7.8	2.0
Metribuzin	0.375	9.8	5.8
Dicamba + Bromoxynil	0.125 + 0.375	8.8	3.0
Dicamba + Metribuzin	0.125 + 0.375	9.5	5.8
Control	---	0.0	0.0
LSD (0.05)		1.3	1.3
	Niagara County - 1984	FPO[b]	SPO[b]
Bromoxynil	0.375	8.0	-
Bromoxynil	0.500	9.3	-
Chlorsulfuron	0.016	8.8	10.0
Chlorsulfuron	0.023	10.0	-
DPX-6316	0.016	-	9.5
DPX-6316	0.031	-	9.3
DPX-6316	0.063	-	10.0
DPX-6376	0.016	10.0	-
DPX-6376	0.023	10.0	-
Dicamba	0.125	5.3	-
Metribuzin	0.375	9.3	-
Fluorochloridone	0.375	-	2.0
Control	---	0.0	0.0
LSD (0.05)		1.8	1.8

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

[b] FPO and SPO = fall- or spring-applied postemergence applications.

ANTAGONISM OF CGA-82725 WITH 2,4-D IN SMALL GRAINS[1]

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ABSTRACT

The effects of spring treatments of CGA-82725 and 2,4-D alone and in combination on barley *(Hordeum vulgare* L. cv. 'Barsoy') and wheat *(Triticum aestivum* L. cv. 'Hart') were evaluated in 1983 and 1984 at the Soils and Crops Research Center, New Jersey Agricultural Experiment Station, Adelphia, New Jersey in the absence of weed competition. In both years CGA-82725 applied alone at rates of 0.28 (low) and 0.56 (high) kg/ha significantly reduced barley yields. Wheat yields were significantly reduced in 1983 at the high rate and at both rates in 1984. Increasing the rate of CGA-82725 from low to high resulted in significantly decreased yield. When either rate of CGA-82725 was applied in combination with 2,4-D at rates of either 0.28 (low) or 0.56 (high) kg/ha, barley and wheat yields were not significantly different from the check, indicating an antagonistic effect of 2,4-D on CGA-82725.

In 1984 2,4-D at the low and high rates was followed three days later with CGA-82725 at either the low or high rate. Wheat yields were significantly reduced by the low rate of 2,4-D followed by the high rate of CGA-82725 but were significantly higher than the same rate of CGA-82725 applied alone. Barley yields were significantly reduced with the low rate of 2,4-D followed by CGA-82725 at either the low or high rate, and at the high rate of 2,4-D followed by the high rate of CGA-82725. These data suggest that applications of 2,4-D followed three days later by CGA-82725 in ratios of 1:1 and 1:2 lessen the antagonistic effect of 2,4-D on CGA-82725.

Tillers per meter row and bushel weight were measured in 1983 and 1984 in both crops. No significant differences were found. CGA-82725 applied alone decreased barley height. The high rate of CGA-82725 produced significantly lower height than the low rate. Tank mix combinations of CGA-82725 + 2,4-D at all rates studied did not affect crop heights. 2,4-D followed three days later by CGA-82725 resulted in decreased heights at all but the high rate of 2,4-D followed by the low rate of CGA-82725.

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[1]New Jersey Agricultural Experiment Station Publication No. J-15274-5-84.

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CROWNVETCH AND NO-TILLAGE CROP PRODUCTION FOR SOIL EROSION CONTROL

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ABSTRACT

The use of crownvetch as a living mulch for agronomic crop production has been researched for ten years at Penn State University. The results of this research and the program for its use is available by the above title from the The Pennsylvania State University Cooperative Extension Service.

Crownvetch can be established following small grains or by seeding into a corn crop. Once established, a rotation of no-tillage forages, corn or small grains is possible without losing the crownvetch. Some of the original crownvetch seedings made ten years ago are still in excellent condition after having various rotations including the above crops planted into these seedings in the meantime.

Crownvetch has to be suppressed to prevent excessive competition in all crops except forages in a corn, small grain, forage rotation. Fortunately, most herbicides used for weed control in corn and small grains are excellent for providing the right amount of suppression without losing the crownvetch. Competition from suppressed crownvetch has normally not reduced crop yields more then five to ten percent and in some years corn yields have actually been greater when grown in crownvetch compared to corn stalk residues without the living mulch.

The major benefit of a crownvetch living mulch is the almost total elimination of soil erosion. Water runoff loss, soil loss and associated herbicide loss was reduced 95 to 99% for no-tillage corn in crownvetch as compared to conventional tillage corn on a 14% slope during a five month growing season where 44.7 cm of runoff inducing rainfall was received. Additional benefits may include improved soil tilth, nitrogen when allowed to regrow at some point in the rotation, and competitive weed control.

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ALLELOPATHIC EFFECTS OF VANILLIN AND ITS GLUCOSIDE ON GERMINATING LEGUME SEEDS

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ABSTRACT

We are currently investigating the chemical components in quackgrass (Agropyron repens (L.) Beauv.) responsible for allelopathy against legume crops. Cinnamic acids and derivatives have been identified as inhibitors of seed germination and growth. Vanillic acid has been found in soils under quackgrass and vanillin glucoside has been reported as a constituent of quackgrass. We tested vanillin and its β-glucoside separately against seeds or seedlings of alfalfa, Empire and Viking birdsfoot trefoil, red clover and red kidney bean. Concentrations of chemical ranged from 0 to 100 ppm w/v. Two levels of oxygen were used, Normal O_2 (atmospheric) and low O_2 (10% O_2, 90% N_2).

There were no significant effects on germination of any of the species due to chemical rate or O_2 level. Neither vanillin nor its glucoside had measurable effect on root or shoot growth of kidney bean at normal O_2 level. Measurements could not be made of chemical effect on kidney bean growth under low O_2 due to decay of the germinated seeds.

Alfalfa root growth was inhibited by vanillin at both normal and low O_2. Alfalfa shoot growth was not inhibited by vanillin glucoside at either normal or low O_2. Vanillin glucoside inhibited root growth at low but not normal O_2.

Red clover shoot and root growth was inhibited by vanillin but not by vanillin glucoside at normal O_2. At low O_2 both root and shoot growth were inhibited by vanillin glucoside but only root growth was inhibited by vanillin.

Empire birdsfoot trefoil root growth was inhibited by both vanillin and vanillin glucoside at normal O_2. Shoot growth was not affected by either chemical at normal O_2. At low O_2 both root and shoot growth was inhibited by vanillin but not vanillin glucoside.

Viking birdsfoot trefoil root growth was inhibited by vanillin but not by vanillin glucoside at normal O_2. Under normal O_2, shoot growth was not affected by either chemical. At low O_2 levels shoot and root growth were inhibited by both chemicals.

The results reported here may help explain species and variety differences in legume seeding success under variable soil moisture conditions.

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WEED-SNAP BEAN COMPETITION FOR LIGHT

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ABSTRACT

A field experiment was conducted to determine what portion of snap bean yield reduction by weed competition was due to shading. A shaded treatment allowed the weeds to grow undisturbed after the beans were planted, an unshaded treatment kept the weeds tied back from the center bean plant row, and a clean cultivated control was kept weed free all season. The mean fresh weights of the snap beans of the shaded, unshaded and control plots were all significantly different from each other. Compared to the cultivated control, the shaded and unshaded treatments showed a 93.3% and 48.8% reduction respectively. The 48.8% reduction in bean yields can be attributed to competition from the weeds for moisture and nutrients or other factors other than shade. The remaining 44.5% reduction in bean yields in the shaded treatment is due to light competition from the weeds.

INTRODUCTION

The objective of this field experiment was to determine what portion of snap bean yield reduction by weed competition was due to shading.

MATERIALS AND METHODS

The field experiment was conducted during the 1982 growing season at the University of Connecticut Plant Science Field Laboratory in Storrs. The soil type was a Woodbridge fine sandy loam (coarse loamy, mixed, mesic, Aquic Dystrochrept.) with six to seven percent organic matter. A 1.83M X 1.83M plot size was used. A 10-10-10 fertilizer was broadcast at the rate of 1120 kg/ha and disked in on May 14, 1982. On July 1 bush snap beans (*Phaseolus vulgaris* L.) cv. 'Provider' were planted. Also on July 1, 56 kg N/ha was broadcast because of excessive precipitation (Table 1) after the initial fertilizer applications. Each plot contained three rows and was hand seeded at a 2.5 cm depth. The soil pH was 6.3.

Table 1. 1982 rain fall data

Month	1982 prec. (cm)	30 yr. avg prec. (cm)	Percent of avg (%)
June	32.5	8.8	368
July	5.4	9.9	54
August	8.3	12.5	66
Sept.	7.9	10.4	76

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The first treatment was a shade treatment where weeds were allowed to grow undisturbed after the beans were planted. The second treatment was an unshaded treatment where the weeds were kept tied back from the center bean row leaving at least 122 cm opening in the weed canopy at all times. Weeds were tied back using cord and stakes which were adjusted as the weeds grew in order to maintain the opening in the weed cover. Weeds in these plots continued to grow vigorously and appeared to be unaffected by being tied back. The third treatment was a clean cultivated control which was kept weed free all season by periodic hoeing. Treatments were arranged in a randomized complete block with three replications. The tree major weeds present were crabgrass (Digitaris sanguinalis (L.) Scop.); redroot pigweed (Amaranthus retroflexus L.), and common lambsquarters (Chenopodium album L.). At harvest the lambsquarters and pigweed greatly towered over the bean plants which were difficult to find in the dense weed growth.

On September 10 the beans were harvested from all plots and fresh weights of the snap beans recorded.

RESULTS AND DISCUSSION

The mean weights of the snap beans from the shaded, unshaded and control plots were all significantly different from each other (Fig. 1). The shaded and the unshaded treatments showed a 93.3% and 48.8% reduction in yield respectively as compared to the cultivated control. The 48.8% reduction in bean yields can be attributed to competition from the weeds for moisture and nutrients and to other factors other than light. The remaining 44.5% reduction in bean yields in the shaded treatmetnt is due to light competition form the weeds. Competition for light by the weeds accounted for roughly half of the snap bean yield reduction when the weeds were allowed to grow undisturbed.

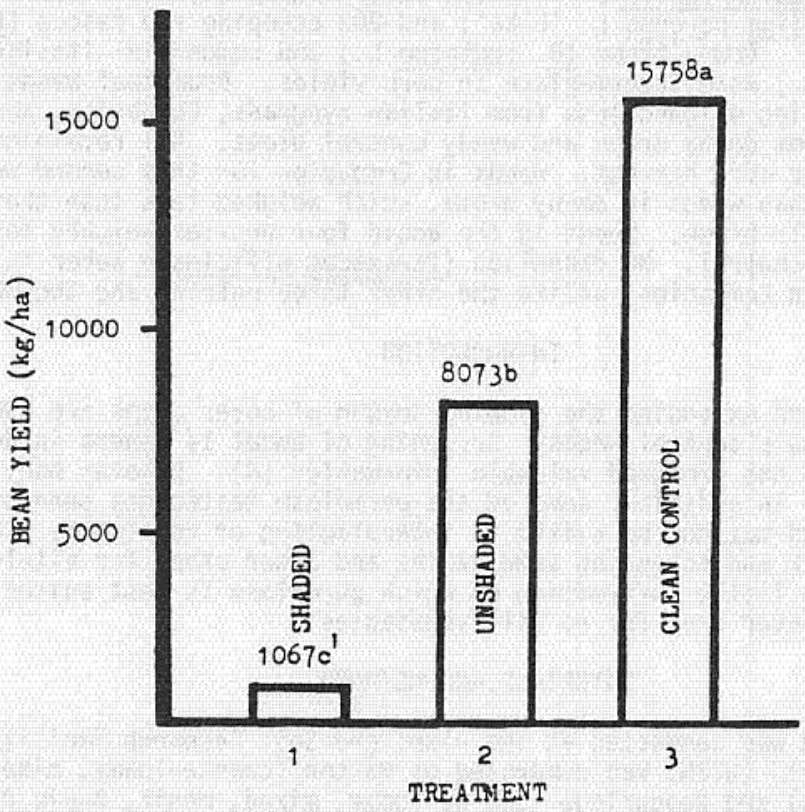

Fig. 1. Weed-crop light competition in snap beans.

1/ Means followed by the same letters are not significantly different at the 5% level using Duncan's Multiple Range Test.

SCREENING LIVING MULCHES AND COVER CROPS FOR WEED SUPPRESSION IN NO TILL SWEET CORN

Ralph E. DeGregorio and Richard A. Ashley[1/]

ABSTRACT

Fifty-seven entries were screened for use as living mulches or no till cover crops. Results from four of the more promising entries are reported here. No till sweet corn (Zea mays L. var. rugosa 'Harmony') ear and stover yields were highest in field brome (Bromus arvensis L.) and lowest in Companion, a mixture of 80% perennial ryegrass (Lolium perenne L. 'Elka') and 20% creeping red fescue (Festuca rubra L. 'Ensylva'). Downy brome (B. tectorum L.) and commercial Italian ryegrass (L. multiflorum Lam.) were intermediate in corn yields. Broadleaf weeds harvested 43 days after planting weighed less from Italian ryegrass, Companion, and field brome plots than from downy brome and weedy control plots. All remaining weeds were harvested after corn harvest. Weeds in Companion for this second weed harvest weighed less than weeds in downy brome, which weighed less than those in Italian ryegrass or field brome. Weeds in the above four entries weighed less than those in the weedy control. No dandelion (Taraxacum officinale Weber in Wiggers) plants were found in Companion, unlike the other three entries and the weedy control.

INTRODUCTION

Living mulch and extending the growing season of cover crops are two concepts with potential to help control weeds. Screening of about 14 genera in New York for use as living mulch has produced valuable information (8). However many taxa have not been screened. In addition, some of the germplasm tested has been bred for forage or grain use and may not be suited to interplanting of vegetables. Except for the work in New York and screening some grains and other crops for allelopathy, there appears to be little information on which germplasm is best suited for use as a living mulch or cover crop for no till vegetables.

MATERIALS AND METHODS

The experiment was conducted at the Plant and Soil Research Facility, Mansfield, CT. The field (W23N) was comprised of Paxton (coarse-loamy, mixed, mesic, Typic Dystrochrepts) and Woodbridge (coarse-loamy, mixed, mesic, Aquic Dystrochrepts) fine sandy loams with a slope of 0 to 8%. Compact glacial till in these soils begins at approximately 60 cm below the soil surface, is slowly permeable to water, and severely restricts root growth. The acre furrow slice of bare soil in late spring 1984 was high in K, medium in P, and had a pH of 6.6, according to the modified Morgan test. Rye (Secale cereale L.) grain and straw were removed prior to beginning this experiment. Before rye the field was primarily large crabgrass (Digitaria sanguinalis (L.) Scop.) in 1982, and was used for sweet corn herbicide studies and experiments with other vegetables from 1968-1981. Weeds were abundant in and around this field.

After rye was removed and the soil tilled, rocks on the surface were removed by hand and 100 kg/ha of P_2O_5 as 0-46-0 was broadcast with a tractor-drawn spreader. The soil was then disked, planked, and firmed with a corrugated roller.

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Seeds of downy brome, field brome, and Companion were sown by hand on 4 Sept. 1983. Both bromes were sown at the highest recommended rate for field brome (45 kg/ha). Companion was also sown at the highest recommended rate (22 kg/ha). Seeds of downy and field brome were harvested in 1983 and 1979, respectively and were obtained from the Soil Conservation Service, Missouri. Companion seed was obtained from International Seeds, Inc., Halsey, OR.

Each entry was sown onto an area 1.8 by 3 m and was surrounded by a 0.6 m alley on all sides. After sowing the plots were again firmed. Treatments were replicated three times in a completely randomized design.

On 11 Apr. 1984 Italian ryegrass was sown in the same manner (except for firming) as the 4 Sept. 1983 seeding (54 kg/ha). Prior to sowing, visible weeds were pulled from Italian ryegrass plots. Italian ryegrass was spring sown because it does not overwinter well at this location.

On 10 to 11 June and 7 July 1984 plots were mowed with a sickle bar or rotary mower leaving as little stubble as practical. Corn was planted with a John Deere 7000 Conservation Planter (4 row) on 25 to 26 June. The planter banded 40-100-0 kg/ha of N-P_2O_5-K_2O 14 cm to the side of the seed as dry diammonium phosphate. Three rows of corn 75 cm apart were planted per plot with the center row harvested for yields. Corn rows ran approximately northeast to southwest. On 27 June one of the Italian ryegrass plots was replanted with corn due to improper adjustment of the planter. On 10 July all brome plots were replanted with corn due to seed damage, apparently by insects. A rotary push lawn mower was used to mow as close to harvest rows as practical on 11 July and again on 26 July. Ammonium nitrate at 100 kg/ha nitrogen (N) was broadcast on 17 to 20 July as 374 L/ha of aqueous solution containing 0.25 and 0.13% (v/v) of X-77 spreader and Nufilm-17 sticker, respectively. N was applied with a hand-held, compressed air sprayer at 270 kPa. Corn in the harvest row was thinned on 29 July as close as possible to 20-25 cm between plants, except in the weedy control. Broadleaf weeds were pulled from the entire 1.8 by 3 m area of all plots on 8 Aug. and weighed. Guard rows were thinned to approximately 20-25 cm on 17 to 18 August. On 19 August N was sidedressed approximately 20 cm from corn at the rate of 45 kg/ha as NH_4NO_3 with a Planet Jr.

Ears and stover were harvested and weighed from Italian ryegrass plots on 7 and 13 September respectively. A 2 m length of row was harvested from the center of the 3 m harvest row. The other three entries were harvested in the same manner on 27 September. From 29 September to 15 October all weeds from an area 2 by 0.75 m, centered on the length of the harvest row, were pulled, dried, and weighed. Roots were washed in detergent and water to remove soil when necessary for the second harvest. Analysis of variance was conducted and, if F was significant, means were compared using LSD.

RESULTS AND DISCUSSION

Of the three entries sown on 4 September field brome provided the most ground cover from fall to spring. Italian ryegrass, sown on 12 April, established very quickly and provided a uniform cover intermediate in height between Companion, which is a mixture of turf grasses, and the bromes, which are about the height of small grains.

Growth of Companion appeared to be limited by N (3). Ground cover by Companion increased noticeably after each of the first two N applications to corn. Of note, weeds did not occupy bare spots in Companion plots.

On 10 May downy brome in all plots exhibited less than 10% of the plants heading while volunteer rye was still in the boot stage. On 24 May downy brome panicles were lax while volunteer rye was just heading. At this time volunteer rye was taller than downy brome, which was taller than field brome. The latter was also much greener than downy brome on this date. Downy brome matures about a month before field brome in Missouri (2).

Downy brome did not regrow after the first mowing. Field brome regrew to some extent while Italian ryegrass and Companion regrew completely. Mowing resulted in plots of bromes being completely covered with a dead brome mulch, with downy brome appearing to be the thicker. Such a mulch, even though not incorporated, may have produced an unfavorable C/N ratio or soil temperature, acted as a barrier to N applications, and favored lambsquarters germination.

On 8 August 1984 fresh weights of broadleaf weeds in Italian ryegrass, Companion, or field brome were significantly less than the weedy control or downy brome (Table 1). The dominant broadleaves throughout the experiment were common lambsquarters (Chenopodium album L.) and Amaranthus spp. while the dominant grass weeds were large crabgrass and fall panicum (Panicum dichotomiflorum Michx.). Italian ryegrass was remarkably low in broadleaf fresh weight. However, during the fall, winter, and spring it was noted that the center of the field (which was to be planted to Italian ryegrass) had fewer weeds than the edges of the field. In addition, all visible weeds were pulled from Italian ryegrass plots on 12 April so that all entries would be sown on a clean seedbed. Thus Italian ryegrass may have been favored in two ways with respect to weeds.

Table 1. The effect of living mulch or cover crop on weed and corn weights.

Entry	Broadleaves 8 Aug. 1984 (Fresh wt)	Weeds[1] 29 Sept. to 15 Oct. 1984 (Dry wt)	Sweet Corn Unhusked ears (Fresh wt)	Sweet Corn Stover (Fresh wt)
	g/plot			
Companion	400a[2]	110a	1300a	1000a
Italian ryegrass	100a	1300b	5800b	5800b
Downy brome	5200b	610a	5700b	7900c
Field brome	900a	1330b	9100c	12000d
Weedy control	4300b	2640c	—	—

[1]Broadleaves and grasses other than the entry.

[2]Means followed by the same letter within a column are not significantly different at the 5% level according to the LSD test.

Also remarkable was the very high broadleaf fresh weight in downy brome on 8 August. The four weeks without either downy brome or corn present to compete with weeds may have been critical. Research in Michigan indicated that, "Time of killing cover crops...influenced weed density and biomass, with greatest reductions occurring in later killed treatments" (1). In another experiment in Michigan weed populations in no-till were reduced by 77% if glyphosate application was delayed two weeks (6). In summary, weed control could be obtained for 30 to 60 days after dessication of certain grass cover crops in Michigan (5). North Carolina also reported no-till and rye mulch "...temporarily...." reduced densities of the same broadleaves (7).

Weeds present after corn harvest were also harvested for yields. Companion or downy brome plots contained less weed biomass than either Italian ryegrass or field brome plots (Table 1). Weedy control plots contained more weed biomass than any of the four entries after corn harvest. Weed control by Companion was excellent. The only plots reported in this paper without dandelion were those of Companion. 'Elka' was reported to reduce dandelion by 95% and annual weeds by nearly 100% in a Washington orchard study (4). When both weed harvests are considered, bromes controlled grass weeds better than broadleaves, while Italian ryegrass controlled broadleaves better than grasses.

Corn ear fresh weight was greater in field brome than in Italian ryegrass or downy brome (Table 1). Ear weight from either of the latter two entries was greater than from Companion. Thus, even though downy brome contained more broadleaf weeds than Italian ryegrass on August 8 (over 50 times more), there was no significant difference in ear fresh weight. Possibly season-long interference from grasses (weeds and Italian ryegrass) was as detrimental to corn ear weight as early season interference from broadleaves. Also, the 8 August broadleaf harvest was from entire plots so that weeds harvested from near the perimeter of each plot may actually have exerted little effect on the center harvest row.

Stover may be a better indicator than ears of the potential of a row crop under conditions such as these. Stover yield declined in the following order: field brome > downy brome > Italian ryegrass > Companion (Table 1). Differences among all four entries were significant. As with ear weight, only more so, stover in downy brome was not depressed due to high broadleaf weight -- compared to Italian ryegrass. During harvest it was noted that corn plants in field brome tillered more than in other plots. Tillering is usually an indication of high fertility. It was also noted at harvest that corn in field brome tended to lodge less than in other plots; again this suggests higher fertility as well as less insect damage.

Rainfall was above average from February through July 1984. In a dry year dead mulch probably would outyield live mulch by even more than reported here. In early November 1984 downy brome was growing. Apparently this species had matured seed prior to being mowed and the seed tended to remain dormant during the summer. Field brome, on the other hand, had not re-established itself to the same extent. Companion on the same date exhibited complete cover and Italian ryegrass was intermediate between Companion and downy brome.

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INFLUENCE OF DOWCO-453 AND SC-1084 ON GERMINATION AND GROWTH[1/]

Robert M. Devlin[2/], Irena I. Zbiec, and Stanislaw J. Karczmarczyk[3/]

ABSTRACT

The germination of wheat and radish was significantly delayed by DOWCO-453 and SC-1084. Inhibition of wheat seed germination occurred in seeds treated with 1 mM DOWCO-453 or 1000 ppm SC-1084. Inhibition of radish seed germination (slight but significant) occurred at 100 µM DOWCO-453 or 100 ppm SC-1084. Wheat shoot length, fresh weight, and dry weight were reduced by 1 µM DOWCO-453 and by 2 ppm SC-1084. Neither herbicide influenced root length. Both herbicides affected enzyme activity in the germinating wheat seed in a similar manner, stimulation or no effect at the lower concentrations and inhibition at the higher concentrations tested.

INTRODUCTION

DOWCO-453 {methyl-2-[4-((3-chloro-5-(trifluoromethyl)-2-pyridinyl)oxy)phenoxy] propanoate} and SC-1084 (chemistry not known) are selective postemergence herbicides for the control of annual and perennial grasses. Both herbicides, when used at suggested rates, show no activity against broadleaf plants and sedges.

In the present paper the influence of DOWCO-453 and SC-1084 on the growth of wheat (*Triticum aestivum* L. 'Mericopa') and the germination of wheat and radish (*Raphanus sativus* L. 'White Icicle') was studied. The effect of these herbicides on the activity of acid phosphatase, alkaline phosphatase, invertase, α-amylase, peroxidase, and phenylalanine ammonia-lyase (PAL) was also studied.

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MATERIALS AND METHODS

Seeds of wheat and radish were imbibed for 6 h in solutions of DOWCO-453 and SC-1084. For germination tests some of the imbibed seeds were transferred to 9-cm petri dishes containing 3 pads of filter paper. Each dish contained 50 seeds and 5 ml of distilled water. Constant conditions were maintained by allowing the seeds to germinate in the dark at 25±1°C in an incubator. Germination was recorded every day for 7 days.

The remaining imbibed wheat seeds were sown in 8-cm styrofoam pots (15 seeds per pot) containing moist vermiculite and grown in a growth chamber under constant conditions of light (178 $\mu Em^{-2}s^{-1}$ 16 h light and 8 h dark) and temperature (22±2°C). After shoot emergence 40 ml of 1/2 strength Hoagland solution was applied daily to each pot. After 14 days the seedlings were removed from the pots and the roots thoroughly washed. The 10 largest seedlings (determined by shoot length) from each pot were selected and their shoot length, root length, fresh weight, and dry weight determined. All experiments were replicated 4 times.

Testing the effect of DOWCO-453 and SC-1084 on enzyme activity in wheat was done according to the methods of Devlin et al. (1). A phosphatase unit (U) of activity is the amount of enzyme contained in one kg of fresh tissue which liberates one mM of p-nitrophenol. A U of peroxidase activity is expressed as the increase in optical density of the reaction mixture per one minute per 100 g fresh tissue. A U of PAL activity is the amount of enzyme in 100 mg fresh tissue that yields one µM of trans-cinnamic acid per minute.

RESULTS AND DISCUSSION

Wheat seed germination was delayed by all concentrations of DOWCO-453 tested. Compared to the control, there was 13% less germination recorded two days after planting in seeds treated with the lowest concentration (0.01 µM) of DOWCO-453 tested (Table 1). Under the same circumstances, 33% less germination occurred in seeds treated with 100 µM and no germination was observed in those treated with 1 mM DOWCO-453. From days four through seven after planting, significant reduction of germination was only observed in wheat seeds treated with 1 mM DOWCO-453 (Table 1).

The percent germination of untreated radish seeds one day after planting was 36. Radish seeds treated with 100 and 1000 µM DOWCO-453 had germination rates that were 19 and 31%, respectively, lower than the control one day after planting (Table 2). In fact, these rates caused significant reduction in germination throughout the six day test period (Table 2).

Table 1. Effect of DOWCO-453 on the germination of wheat seeds.

DOWCO-453 (µM)	% Germination-Days After Planting					
	2	3	4	5	6	7
0	62.0	83.5	90.5	93.0	94.5	95.0
10^{-2}	48.5	76.5	85.0	91.5	94.0	94.5
10^{-1}	50.0	79.5	89.5	95.0	96.0	96.5
10^{0}	45.5	76.0	91.0	94.5	95.5	96.5
10^{1}	46.0	71.0	89.0	91.0	92.0	94.5
10^{2}	28.5	63.5	85.0	91.0	93.5	95.0
10^{3}	0.0	9.0	25.5	30.5	33.0	43.0
LSD 5%	8.1	7.9	7.4	5.6	6.0	6.0
1%	11.0	10.7	9.9	7.5	8.2	8.0

Table 2. Effect of DOWCO-453 on the germination of radish seeds.

DOWCO-453 (µM)	% Germination-Days After Planting					
	1	2	3	4	5	6
0	36.0	93.5	96.5	97.0	97.0	97.5
10^{-2}	40.0	88.0	92.0	92.5	92.5	94.5
10^{-1}	38.5	85.0	92.5	94.5	94.5	95.5
10^{0}	37.0	87.5	90.5	91.5	93.0	94.0
10^{1}	36.0	87.0	92.5	92.5	94.0	94.0
10^{2}	20.5	80.5	84.0	85.5	88.0	88.5
10^{3}	9.0	52.0	58.5	59.5	63.0	67.5
LSD 5%	7.4	7.7	8.8	9.1	7.4	7.7
1%	10.0	10.3	11.8	12.2	9.5	10.4

Table 3. Effect of SC-1084 on germination of wheat seeds.

SC-1084 (ppm)	% Germination-Days After Planting					
	2	3	4	5	6	7
0	74.5	85.0	91.5	93.5	94.5	94.5
10^{-1}	80.5	92.5	95.5	97.0	97.0	97.0
10^{0}	71.0	87.0	92.5	95.5	96.0	96.0
10^{1}	41.5	88.5	94.5	96.0	96.5	96.5
10^{2}	9.5	68.5	84.5	88.0	91.0	91.5
10^{3}	0.0	0.0	5.0	11.5	16.5	22.0
LSD 5%	11.4	16.0	8.3	6.9	6.5	6.2
1%	15.5	21.7	11.3	7.3	8.9	8.4

When examined two days after planting there was 33 and 65% less germination in wheat seeds treated with 10 and 100 ppm SC-1084, respectively, and no germination in those treated with 1000 ppm (Table 3). Three days after planting germination was delayed in only those seeds treated with 100 and 1000 ppm. When examined on days four through six, significant reduction was only observed in wheat seeds treated with 1000 ppm SC-1084 (Table 3).

All concentrations of SC-1084 tested delayed germination of radish seeds one day after planting. However, by the second day significant reduction of germination was only observed in those seeds treated with 100 and 1000 ppm SC-1084 (Table 4). This trend was observed throughout the six day test period (Table 4).

Shoot length of wheat was slightly inhibited by 0.1 µM and reduced 54% by 1 µM DOWCO-453. In addition, 1 µM also caused significant reductions of shoot fresh weight and dry weight (Table 5). Wheat root length and dry weight were not affected

Table 4. Effect of SC-1084 on germination of radish seeds.

SC-1084 (ppm)	% Germination-Days After Planting					
	1	2	3	4	5	6
0	43.8	92.5	93.5	95.0	97.5	97.5
10^{-1}	34.0	93.5	95.0	96.0	96.5	97.5
10^{0}	35.5	90.5	92.5	93.0	93.5	93.5
10^{1}	32.0	88.5	90.0	92.0	92.0	93.0
10^{2}	20.0	81.5	82.0	85.0	86.0	88.0
10^{3}	1.5	36.5	44.5	51.0	53.5	55.0
LSD 5%	6.4	7.1	6.6	5.8	5.5	6.5
1%	8.7	9.7	9.0	7.9	7.4	8.8

Table 5. Effect of DOWCO-453 on the growth of wheat.

DOW-453 (µM)	Shoot Length (cm)	Root Length (cm)	Shoot Fresh Wgt (g/10pl)	Shoot Dry Wgt (mg/10pl)	Root Fresh Wgt (g/10pl)	Root Dry Wgt (mg/10pl)
0	25.5	13.9	3.38	314	1.45	125
10^{-2}	23.4	15.5	3.17	305	1.38	126
10^{-1}	22.6	14.6	3.24	311	1.34	117
10^{0}	11.6	12.0	1.44	154	0.96	107
LSD 5%	2.2	2.1	0.49	47	0.15	36
1%	3.0	2.9	0.68	65	0.21	50

by DOWCO-453, but root fresh weight was reduced 34% (Table 5).

Shoot length, fresh weight, and dry weight were all significantly reduced by 2 ppm SC-1084 (Table 6). In contrast to its inhibitory effect on shoot length, SC-1084 did not influence root length even at the much higher rate of 5 ppm (Table 6). However, root fresh weight and dry weight were both reduced by 2 ppm SC-1084 (Table 6).

Table 6. Effect of SC-1084 on the growth of wheat.

SC-1084 (ppm)	Shoot Length (cm)	Root Length (cm)	Shoot Fresh Wgt (g/10pl)	Shoot Dry Wgt (mg/10pl)	Root Fresh Wgt (g/10pl)	Root Dry Wgt (mg/10pl)
0	22.4	10.4	2.95	323	1.20	124
0.1	22.3	9.6	2.91	332	1.13	118
1.0	22.6	9.6	2.90	334	1.13	120
1.5	23.9	11.2	3.00	329	1.28	114
2.0	14.8	10.5	1.92	185	0.76	81
5.0	1.7	12.6	0.22	18	0.77	88
LSD 5%	4.3	1.5	0.44	40	0.18	15
1%	5.8	2.0	0.60	54	0.24	20

It is interesting to note that at the concentrations tested both DOWCO-453 and SC-1084 had no influence on root length. However, both compounds reduced the fresh weight of roots. This suggests that both herbicides may retard water uptake and/or water retention by wheat plants.

Both DOWCO-453 and SC-1084 stimulated PAL activity in the germinating wheat seed. Peak activity for DOWCO-453 occurred at 0.1 µM (Table 7) and for SC-1084 at 0.1 ppm (Table 8). Peroxidase activity was inhibited by both herbicides, 1 mM DOWCO-453 causing a 61% inhibition (Table 7) and 1000 ppm SC-1084 causing an 89% inhibition (Table 8). Both herbicides had a similar influence on alkaline phosphatase activity but differed slightly in their effect on acid phosphatase in the germinating wheat seed. For example, all concentrations of DOWCO-453 tested inhibited acid phosphatase activity (Table 7). However, the lower concentrations of SC-1084 (0.01, 0.1, and 1 ppm) slightly stimulated activity (Table 8).

As with PAL, peroxidase, and alkaline phosphatase, both grass herbicides similarly influenced the activity of the hydrolytic enzymes invertase and α-amylase. Very low concentrations of DOWCO-453 and SC-1084 stimulated activity while higher concentrations strongly inhibited hydrolytic enzyme activity (Tables 7 and 8).

Table 7. Effect of DOWCO-453 on enzyme activity in germinating wheat seeds. Acid-P and alkaline-P stand for acid phosphatase and alkaline phosphatase, respectively. Glu stands for glucose.

DOW-453 (µM)	PAL (U/100mg)	Peroxidase (U/100g)	Acid-P (U/kg)	Alkaline-P (U/kg)	Invertase (mM glu/100g)	α-Amylase (mM glu/100g)
0	1.45	51	265	3.8	328	28
10^{-2}	1.71	51	201	3.7	604	27
10^{-1}	1.85	50	212	3.7	578	28
10^{0}	1.62	49	187	3.6	254	3
10^{1}	1.57	45	190	3.3	81	3
10^{2}	1.40	37	176	2.7	68	2
10^{3}	0.53	20	146	2.3	37	0

Table 8. Effect of SC-1084 on enzyme activity in germinating wheat seeds. Acid-P and alkaline-P stand for acid phosphatase and alkaline phosphatase, respectively. Glu stands for glucose.

SC-1084 (ppm)	PAL (U/100mg)	Peroxidase (U/100g)	Acid-P (U/kg)	Alkaline-P (U/kg)	Invertase (mM glu/100g)	α-Amylase (mM glu/100g)
0	1.19	62.8	185	3.1	284	51
10^{-2}	1.86	62.5	194	3.2	378	50
10^{-1}	2.35	60.3	202	3.3	370	51
10^{0}	1.66	56.8	205	3.0	362	50
10^{1}	1.39	55.4	151	2.9	197	48
10^{2}	1.36	27.8	114	2.7	79	45
10^{3}	0.55	6.5	81	2.3	39	32

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Antagonistic Interactions Between Auxins and Fluazifop-butyl

Elizabeth Hirsh and Scott Glenn 1/

ABSTRACT

Interactions between auxin-like chemicals and fluazifop-butyl on growth of 4-leaf corn (Zea mays 'Pioneer 3022') and 47- cm high johnsongrass (Sorghum halepense) were evaluated in greenhouse studies. Fluazifop-butyl was applied at 0, 0.14, and 0.28 kg ai/ha (+ 1% crop oil) alone or in a tank mixture with 1.12 kg ai/ha of 2,4-D or dicamba. Fluazifop-butyl at 0.14 and 0.28 kg/ha alone killed corn and caused 85 and 95% injury to johnsongrass, respectively, three weeks after application. Injury to corn and johnsongrass three weeks after application of 0.14 kg/ha fluazifop-butyl was reduced 20 and 45%, respectively, when 1.12 kg/ha 2,4-D was tank mixed with fluazifop-butyl. Tank mixtures of 1.12 kg/ha dicamba with 0.14 kg/ha fluazifop-butyl decreased corn and johnsongrass injury 20% and 35%, respectively, compared to fluazifop-butyl applied alone. Antagonism from 2,4-D and dicamba on fluazifop-butyl activity decreased at the five and six week rating. Corn coleoptile elongation was stimulated by 10^{-6} M 2,4-D or dicamba 16 and 11%, respectively, compared to controls. Fluazifop-butyl at 10^{-4} and 10^{-5} M antagonized this auxin-like stimulation, whereas 10^{-4} and 10^{-5} M fluazifop-butyl had no effect on coleoptile elongation. Data indicate 2,4-D and dicamba reduce the herbicidal activity of fluazifop-butyl and fluazifop-butyl interfers with the auxin-like activity of 2,4-D and IAA.

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Absorption, Translocation, and Distribution of ^{14}C-2,4-D in Common Milkweed

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ABSTRACT

The foliar absorption of ^{14}C-2,4-D [(2,4-dichlorophenoxy)acetic acid] was investigated in common milkweed (Asclepias syriaca L.) seedlings grown in controlled environment. Absorption of 2,4-D into the leaves was maintained up to 120 h. after application. About 45.1% of the applied radioactivity was absorbed within the first 6 h., although an insignificant amount of the tracer was translocated at this time period. Translocation of ^{14}C-2,4-D occurred in symplast and was basipetal. Substantial loss of 2,4-D (53.2%) occurred indicating a rapid metabolism and its subsequent loss from the plant. This information on absorption and translocation of ^{14}C-2,4-D can be used in directing the use of other translocated or phenoxy herbicides in controlling common milkweed.

INTRODUCTION

Common milkweed is a perennial weed native of North America which is becoming widely distributed in many farming areas in Canada and U.S.A. The widespread use of effective preemergence herbicides for annual weeds in field crops has removed the competition both for crops and the common milkweed. Thus, it allows them to grow more vigorously and favours their establishment. Once the weed has become established, it is difficult to control with herbicides. The difficulty of achieving effective control of this weed with herbicides is due largely to its deep and extensive root system with numerous adventitious buds. This species reproduced vegetatively by adventitious root buds and also by seeds (4). Common milkweed has not been controlled with 2,4-D as evident from the growth room studies (3) and field studies (5,10). Successful control of perennial weeds with phenoxy or other translocated herbicides is dependent on the extent of foliar penetration, which is dependent on the stage of growth (1), the time of application (5), and the subsequent translocation of the material into the root system.

Studies on foliar absorption and translocation of 2,4-D have been reported by Leonard and Weaver (12) in shoots of Tokay grape, Chancellor (7) on perennial broadleaved weeds, Coble et al. (8) in honeyvine milkweed (Ampelamus albidus), and by Carson and Bandeen (6) on Canada thistle [Cirsium arvense (L.) Scop.]. The objective of this study was to examine the nature and extent of absorption and translocation of ^{14}C-2,4-D in common milkweed seedlings.

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MATERIALS AND METHODS

Translocation of ^{14}C-carboxy-labelled-2,4-D (specific activity 28.4 mCi/mmol) in common milkweed seedlings was studied using autoradiography and radio assay methods. Seedlings were grown in quartz sand in paper cups and watered with half strength Hoagland's solution (11) every two days in a controlled growth cabinet having 30C during 16 h. photoperiod and 25C during dark period. The relative humidity was maintained at 60% during the day and 70% during the night. For uniformity, seedlings with the same number of leaves were selected. Treatments were applied on 45-day-old seedlings and were replicated 3 times.

Plants to be assayed or radioautographed following foliar application were treated with a 10 ul droplet of ^{14}C-2,4-D in ethanol:water (1/1, v/v) (3.876 ug/ul for radio assay and 0.775 ug/ul for autoradiography) in a lanolin ring. The droplet was applied on the mid-rib of the third fully expanded leaf from the top of the plant. Plants were harvested 0, 2, 6, 12, 18, 24, 120 and 240 h. after application. During harvest, the lanolin ring was removed, leaf washed 3 times with 20 ml of ethanol:water (1/1, v/v), and washings radioassayed using a gas flow planchet counter. Radioactivity in leaf washings was measured with a gas flow (helium and butane) type planchet counter. A 0.5 ml aliquot of each sample was placed on a planchet and dried under an infra-red lamp. All samples received similar drying conditions in order to avoid any variation due to volatilization.

The plants were divided into the following components: (1) treated leaf, (2) leaf opposite to treated one, (3) leaves above treatment, (4) leaves below treatment, (5) stem above treatment, (6) stem below treatment, (7) main root, and (8) lateral roots.

All plant components were dried in a freeze-drier for 72 h., weighed and ground. Samples of 15.0 mg each were placed in scintillating counting vials with 20 ml of scintillating fluid. They were mixed thoroughly and kept in the dark overnight before counting. Toluene scintillating solution was prepared by mixing 50 mg of POPOP [1,4-bis-2(5-phenyl oxazoyl)-benzene], 4.0 g of PPO (2,4-diphenyl-oxazole) and 40.0 g of Cab-o-sil in a liter of toluene. External standards for various tissue types and background were used for calculating the efficiency of counting in each sample.

Radioactivity in leaf washings was regarded as the amount of activity not absorbed by the plant and the treated leaf counts were regarded as the amount of activity not translocated or exported from the treated leaf.

The plants used for autoradiography were prepared by first removing the lanolin ring from the treated leaf. Then the plants were forzen in a freezer and placed in a freeze-drier (Virtis, 10-145MR-BA model) for 48 h. The plants were humidified (after freeze-dring and before mounting), mounted on paper and exposed to x-ray film (Kodak NS-54T) for two weeks as outlined by Crafts and Yamaguchi (9).

RESULTS AND DISCUSSION

At zero hour, there was no movement of the radioactive material but after 12 h., a slight movement of the tracer from the treated leaf was evident. Autoradiographs for the 0, 12, and 120 h. are not presented. However, a considerable amount of radioactivity was found in the lower stem and the root system after 120 h. The tracer accumulation was even greater after 240 h. in regions of the root system and the lower stem (Figure 1). This accumulation of ^{14}C-2,4-D in the lower stem and the root system indicates a source-to-sink pattern of translocation in the assimilate stream. The autoradiographs indicated that most of the ^{14}C-2,4-D bypassed the mature leaves. Similar results have been reported by Crafts and Yamaguchi (9) who found that the movement of ^{14}C-2,4-D from the third leaf of field bindweed (Convolvulus arvensis L.) was mainly into the upper roots and the stems.

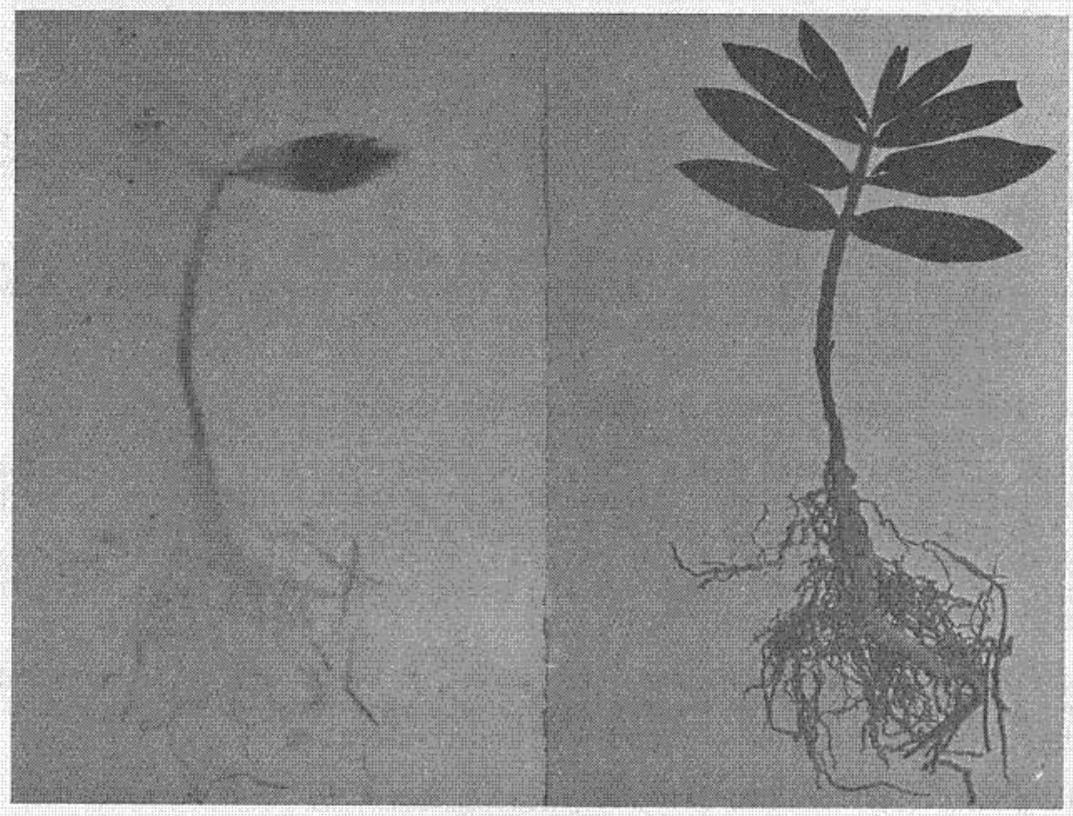

Figure 1. Translocation of ^{14}C-2,4-D in common milkweed seedling. Right: plant mount; left: autoradiograph. Treatment time: 240 h.

The results of radioactivity determination on leaf washings, the treated leaf, whole plant, and the export from the treated leaf are presented in Table 1. The amount of radioactivity in the leaf washings was highest at 0 h. and then started to decline with time, reaching its lowest value by the end of 240 h. period. However, the highest recovery of total radioactivity applied was found to be 63.9% 6 h. after application (Table 1). The greatest change is percentage recovery occurred between 12 and 18 h. after application. The loss in total recovery could be due to volatilization during washing or plating. The loss in radioactivity from leaf washing would not affect the interpretation of the data on absorption and translocation, since the amount of radioactivity absorbed was calculated on the basis of the total radioactivity applied on leaf surface. It is evident from the data that after 240 h., 53.2% of the applied radioactivity was lost in the plant. This loss could be due to the fact that ^{14}C-carboxy-labelled-2,4-D was metabolized in the plant. No attempt was made to follow the metabolism of 2,4-D in the plant. These results are in agreement with the findings of Wyrill and Burnside (14) who found that 60% of the 2,4-D in common milkweed roots was metabolized.

The absorption of ^{14}C-2,4-D into leaves was low at 0 h. but it increased with time (Table 1). The maximum total absorption was found to be 53.9% of the applied radioactivity which had occurred by the 120 h. period. The applied tracer had penetrated into the leaf within 2 h. of application and that penetration continued for at least 120 h. During the first 6 h. period, only a very small amount (0.9%) of the labelled material was exported from the treated leaf, although 45.1% of the applied ^{14}C-material was absorbed (Table 1). After that period, the total radioactivity in the rest of the plant started to increase and continued steadily up to 120 h. The total radioactivity in the rest of the plant attained a maximum value of 46.8% at 240 h. At this time, 28.3% of the applied ^{14}C-material was found in the treated leaf and only a trace amount was detected in leaf washings.

From the distribution of radioactivity in different plant parts (Table 2), it is evident that ^{14}C-2,4-D was accumulated more in the lower stem and the root system compared to any other part at any time period. Since phloem transported herbicides are thought to move by mass flow (2), it is possible that 2,4-D is soluble in the smyplast and is translocated throughout the plant system. This was confirmed by autoradiographs in the present study. Radioactivity started to increase in all plant parts as the time progessed from the treatment application. At any time interval, maximum radioactivity was found in the lower stem followed by the primary root. After a 24 h. period, more radioactive material was accumulated in the lateral roots than in the upper stem. The accumulation of the tracer in the roots and the lower stems was the greatest between 120 and 240 h. after application. These results agree well with the findings of Carson and Bandeen (6) who found that more ^{14}C from 2,4-D was accumulated in the roots than was translocated acropetally at all growth stages of Canada thistle. In the present study, little accumulation (0.17%) of the tracer occurred in the leaf located opposite to the treated leaf at 240 h. after application. The results suggest that 2,4-D is strictly distributed via the phloem and in the direction of assimilate movement. Consequently, there was more basipetal movement (accumulation) than acropetal in common milkweed seedlings. This agrees with the results of Leonard *et al*. (13) who reported that 2,4-D is strictly systematically distributed via the phloem in grape (*Vitis vinifera* L.).

Table 1. Distribution of radioactivity in leaf washing, treated leaf, whole plant, and exported from the treated leaf from 45-day-old common milkweed seedling treated with 3.876 ug/ul of ^{14}C-2,4-D.

	Radioactivity as a percentage of total ^{14}C applied[a]			
Time (h.)	Leaf washing	Treated leaf	Whole plant	Exported from the treated leaf
0	59.9a[b]	Tc	Tb	0c
2	57.8a	2.1c	2.2b	Tc
6	18.9b	44.7a	45.1a	0.9c
12	12.6c	46.0a	47.9a	4.1c
18	1.9d	48.7a	50.9a	4.4c
24	0.8d	48.2a	50.7a	4.9c
120	Td	40.5ab	53.9a	24.9b
240	Td	28.3b	46.8a	39.6a

[a]Values within a column followed by the same letter are not significantly different at the 0.05 level according to Duncan's multiple range test.

[b]T = less than 0.5%.

Table 2. Distributon of ^{14}C-2,4-D material in different plant parts of common milkweed seedling at various time intervals.

	Radioactivity[a] (cpm X 10^2)						
Time (h.)	Opposite leaf	Upper leaves	Lower leaves	Upper stem	Lower stem	Primary root	Lateral roots
0	0d	0d	0c	0b	0d	0b	0b
2	0d	0d	Tc	Tb	Td	Tb	0b
6	Td[b]	1.91cd	0.98bc	3.78b	31.85cd	3.36b	1.28b
12	0.51cd	2.03cd	1.85bc	4.81b	178.21cd	24.91b	4.77b
18	0.96cd	5.60cd	2.59bc	7.80b	192.50c	30.93b	6.06b
24	3.52bc	8.26c	3.82bc	8.12b	201.36c	41.31b	13.28b
120	4.65b	17.13b	9.52b	25.78b	726.00b	552.27a	152.50b
240	9.04a	27.44a	24.53a	73.07a	998.64a	558.68a	364.40a

[a]Values within a column followed by the same letter are not significatnly different at the 0.05 level according to Duncan's multiple range test.

[b]T = less than 0.5%.

An extensive absorption of ^{14}C-2,4-D occurred within 6 h. of application. The translocation pattern of 2,4-D would therefore by related to assimilat movement, indicating a similarity to the source and sink pattern of translocation in the assimilate stream. The substantial loss of ^{14}C-2,4-D in the plant suggested a rapid metabolism.

The ^{14}C-2,4-D study leads to a new direction in the fact that translocated herbicides could be used in directing a control program for this species. Applied herbicides would be transported into the extensive root system along with the assimilate movement. Thus, the herbicide would be more available to the root buds and would therefore be more effective in its control. The results of the present investigation suggest that the control of common milkweed may be more successful by promoting more efficient translocated herbicides. It also suggests that a better understanding of the factors which regulate the absorption and translocation of herbicides in common milkweed may lead to more effective control of this species.

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CANADA THISTLE CONTROL WITH COMBINATIONS OF GROWTH REGULATORS AND GLYPHOSATE OR TRICLOPYR

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ABSTRACT

Canada thistle [Circium arvense (L.) Scop.] is difficult to control when insufficient herbicide is translocated throughout its extensive root system. We hypothesized that increasing sink activity by root sprout induction with ethephon or chlorflurenol would enhance herbicide basipetal translocation. In this study we investigated the effect of 2 plant growth regulators (PGRs), ethephon and chlorflurenol, on thistle control with triclopyr or glyphosate.

In a field experiment triclopyr (.45 or 4.5 kg/ha) or glyphosate (4.5 kg/ha) was applied alone, tank mixed with ethephon (144 ppm) or chlorflurenol (27 ppm), or applied sequentially 1 week after PGRs. Thistle height, % of area covered, density (no./m^2), and frequency (no. plots with thistle/total no. plots) were evaluated before, 3 weeks after treatment (July), and 11 weeks after treatment (September).

Triclopyr control increased with time whereas glyphosate control decreased. Three weeks after glyphosate treatment the thistle area covered and density decreased nearly 80% to 8% and 6 plants/m^2. By September however, density had increased to 28 plants/m^2 and area covered to 27% which were similar to control (28 plants/m^2 and 21%). In contrast, 4.5 kg/ha triclopyr slowly killed thistle and by September thistle area covered (9%) and density (7 plants/m^2) were significantly less than control. Four and one-half kg/ha triclopyr provided the greatest thistle reduction but did not significantly differ from .45 kg/ha triclopyr (14 plants/m^2 covering 14% of the area). Suppression of height growth followed the same trend as density, from shortest to tallest: 4.5 kg/ha triclopyr (5 cm), .45 kg/ha triclopyr (12 cm), 4.5 kg/ha glyphosate (13 cm).

Neither sequentially applied nor tank mixed PGRs consistently improved thistle control in the field. Chlorflurenol did not influence herbicidal control. Ethephon enhanced reduction of frequency (from 80% down to 60%) by 4.5 kg/ha triclopyr and of density (from 28 to 17 plants/m^2), and area covered (from 27% to 16%) by 4.5 kg/ha glyphosate. First year results indicated that low doses of triclopyr effectively controlled thistle. Evaluations will be made again in spring 1985.

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TIMING GLYPHOSATE APPLICATIONS RELATIVE TO GROWTH STAGE OF YELLOW NUTSEDGE

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ABSTRACT

Generally, the best time to apply herbicides to control perennial plants is just before bloom stage. Now there is evidence that this general rule is not applicable to the use of postemergence herbicides on yellow nutsedge (*Cyperus esculentus* L.).

Historically, herbicides from several chemical families have provided poor control of yellow nutsedge. Reasons given include poor translocation to sites of action, failure to inhibit sprouting of tubers, and failure to inhibit tuber formation. Current research indicates that glyphosate inhibits tuber formation when applied no later than the tuber initiation stage. This herbicide is not very effective in the control of those rhizomes in which the tuberization process is visably underway, although it is very effective in killing rhizomes and blocking tuber formation in rhizomes without tubers. Combinations of glyphosate with oxyfluorfen provide more rapid top kill and synergistically improve control of tuber formation.

Our studies also indicate that this greater effectiveness with the two herbicides is due to greater absorption and translocation of each of the herbicides applied at the tuber initiation stage.

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THE PLANT COMMUNITIES ON FOUR LANDFILL SITES, NEW YORK CITY, NEW YORK

Richard Stalter 1/

ABSTRACT

The plant communities at four landfill sites, New York City, New York, were examined from April to June 1984. The vegetation at each site was sampled by the quadrat method to determine species composition and dominance. Phragmites communis and Artemisia vulgaris were the dominant species at all sites. Additional members of the Gramineae, Caryophyllaceae and Cruciferae were dominant or common at each of the four study sites. Fire is the most important factor in maintaining the Phragmites dominated portions of the landfill sites. Other factors of importance include: time of disturbance; proximity to seed sources; variations in topography; differences in soil texture; presence of a permanent or seasonally high water table; drought; the activity of small mammals; allelopathy; local soil disturbance; and local mowing. In the absence of defined maintenance procedures, the future composition of the vegetation at each landfill cannot be predicted with certainty.

INTRODUCTION

The plant communities at four landfill sites in New York City, New York, were examined from April to June 1984 to determine species composition and dominance. The four landfill sites include one active site, the barge-fed Fresh Kills Site on Staten Island (Site 4); one "inactive site"; the Pennsylvania Avenue Truckfill (Site 2); and two recently closed landfills, the Idlewild Truckfill (Site 1); and Marine Park Truckfill (Site 3). The location and construction of each of the four landfills have been described by the author in an earlier paper.[4]

The objectives of the present study are: (1) to describe the plant communities on four landfill sites during the spring of 1984; (2) to record the phenology (date of flowering) abundance class and dominance of species found at each of the four landfills; (3) to offer suggestions dealing with the establishment, perpetuation and future composition of the plant communities at each study site.

MATERIALS AND METHODS

Thirty (one meter^2) quadrats were established at each of the four landfill sites, and abundance classes for each species were recorded. Sampling was initiated on March 27, 1984 and was terminated on June 20, 1984. Phenology and abundance classes were recorded for common species at each of the four landfills from April to June. Abundance classes for each species at each

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study site are presented in Tables 1 and 2.

RESULTS AND DISCUSSION

IDLEWILD TRUCKFILL

Phragmites communis is the dominant taxon of the Idlewild Truckfill covering more than 60 percent of this site, while Artemisia vulgaris is dominant species in the upper drier roadside border of this site. Other species are unimportant (Tables 1 & 2). Artemisia produces new growth in late March from rhizomes while Phragmites produced new growth this season in early April.

MARINE PARK

Phragmites communis covering approximately 50 percent of this study site, is the dominant species at the Marine Park Truckfill. Artemisia vulgaris is abundant on the drier portions of this landfill. Other members of the Gramineae and Compositae are common here. The Marine Park Truckfill contains the greatest wealth of species.

By late April, Stellaria media is in flower and fruit. During early May, Draba verna, Poa annua and Bromus japonicus are at or near anthesis and make up a conspicuous portion of the flora of this site (Table 1).

In late May, taxa such as Veronica officinalis, Dactylis glomerata, Juncus tenuis, Bromus inermis, Agropyron repens, Phlaris arundinacea and Poa pratensis are in flower. Agrostis hyemalis, which favors disturbed ground near the sidewalk, flowers slightly later than the aforementioned species. During June, additional grasses flower including Poa elatior, Poa compressa, Agrostis alba, and Festuca rubra (Table 2). Annual flowering composites such as Ambrosia artemissiifolia and Heterotheca subaxillaris are well represented by seedlings. Heterotheca is especially common in the sandy,xeric, disturbed portions of this site.

THE PENNSYLVANIA AVENUE TRUCKFILL

Artemisia vulgaris is the dominant plant at this site covering most of the outer berm. Phragmites communis forms a pure stand in the southwest portion of the Pennsylvania Avenue Truckfill. Patches of Arabidopsis thaliana, Veronica officinalis, and Bromus japonicus accompany Phragmites and Artemisia at this site during the spring. Ambrosia artemisiifolia is common locally, especially on the disturbed road that traverses the northeastern portion of the berm (Tables 1 & 2).

FRESH KILLS LANDFILL

The Fresh Kills Landfill is the largest most active landfill site in New York City. On stable portions of this landfill,

Phragmites communis and Artemisia vulgaris again are the dominant taxa. Severe erosion is common on the recently constructed berms and hinders colonization by plants. Stellaria media is the earliest flowering plant of this area. It flowers in April and continues flowering through May as it does at the other landfill sites (Table 1). During May, Silene noctiflora, Capsella bursa-pastoris and Veronica officinalis are common at this site. Hordeum jubatum is conspicuous when in anthesis and fruit during June.

Generally, the dominant taxa observed last June are dominant at each study site this year. Phragmites communis and Artemisia vulgaris are dominant at each landfill. Phragmites favors wet sites while Artemisia vulgaris prefers dry more disturbed sites.

Few woody species have been successful invading each study site. The presence of Phragmites communis at each study site will probably preclude successful invasion by shrubs and trees since the Phragmites dominated portions of the landfills are often subjected to fires of high intensity. Fire at landfill sites is common.[4] Observations by the author in 1983 and 1984 indicate that fires of high intensity are severe enough to kill shrub species such as Myrica pennsylvanica and trees e.g. Populus spp., Prunus serotina, Morus alba, and Betula populifolia. However shrubby species such as Myrica and Rubus may produce new growth from root sprouts if fires are not severe; if fires are of low intensity, Myrica may set forth stem sprouts.

With the absence of predictable maintenance procedures, and the presence of severe fires, prediction of the precise assemblage of vegetation and plant communities in the future is difficult. Grasses will probably be dominant at the Pennsylvania Ave. and Fresh Kill Landfills if these sites are seeded and maintained by mowing in the future. Areas dominanted by thick stands of Phragmites might be dominated by Phragmites in the future especially if fires of high intensity oontinue to ravage these areas.

The steep sides of the berms at the Fresh Kills and Pennsylvania Avenue landfills are too steep to be maintained by mowing. Where thick grasses eventually dominate, succession to shrubs and eventually to trees might be slow, since thick sod-producing grasses have been reported to impede the invasion of shrubs and trees.[2] The presence of small rodents and rabbits might place additional stress on invading shrubs and trees, especially when the numbers of these animals are high and winters severe[4]. Small rodents such as Microtus pennsylvanicus will eat seeds of shrubs and trees; meadow voles and rabbits might also girdle the stems of plants when there is no other food available during severe winters of abundant snow and subfreezing temperature.

Drought is another factor that may impede the establishment and growth of trees and shrubs. Severe summer drought will place

more water stress on shrubs and trees than grasses since grasses become dormant during periods of severe drought. Moreover, the sandy soil might exacerbate drought conditions favoring annuals and perennial forbs and grasses.[3]

Additional factors affecting plant succession on these four landfills include time of disturbance; proximity to seed sources; allelopathy; presence of a permanent or seasonally high water table; type of fill material used at each site; and local disturbances by motor vehicles. The possible role of the aforementioned factors on plant succession at the four New York City landfills has been treated by the author in more detail in an earlier paper.[4]

With a multiplicity of factors responsible for the present assemblage of vegetation, and the uncertainty of how these landfills might be maintained in the future, succession in a directional sense is uncertain. Personal observations of plant communities at Floyd Bennett Field, and Fort Tilden, New York represent areas similar to the landfill sites and may provide clues to successional trends. On higher drier areas that are protected from burning, shrubs such as *Myrica pennsylvanica*, *Prunus maritima*, and *Rhus toxicodendron* might become established as they have at nearby Fort Tilden and Floyd Bennett Field. *Prunus serotina* and *Amelanchier canadensis* might follow frutescent species. *Populus spp.* and *Ailanthus altissima* might be locally dominant. However, succession culminating in an oak dominated hardwood forest might never occur on the four landfills or might take far longer than succession on fallow farmland in nearby rural New Jersey or Long Island, New York.[1,4]

Table 1. Species composition and dominance as determined by abundance class for species on four landfill sites, New York City, New York. See introduction section for site location. Data were collected in April and early May, 1984.

Species	April Study Sites				Early May Study Sites			
	1	2	3	4	1	2	3	4
Artemisia vulgaris	5	5	4	3	5	5	5	3
Phragmites communis	5	5	5	4	5	5	5	4
Draba verna		5				5		
Stellaria media		3				5		
Hieracium spp		2				2		
Poa annua		3				3		
Bromus japonicus		5				5		
Capsella bursa-pastoris		3				3		
Arabidopsis thaliana						3		

Table 2. Species composition and dominance as determined by abundance class for species on four landfill sites, New York City, New York. See introduction section for site location. Data were collected in late May and June, 1984.

Species	Late May Study Sites				June Study Sites			
	1	2	3	4	1	2	3	4
Artemisia vulgaris	5	5	4	3	5	5	4	4
Phragmites communis	5	5	5	4	5	5	5	4
Poa annua		3				3		
Bromus japonicus		5				2		
Veronica officinalis		5				3		
Silene noctiflora				2				1
Achillea millifolium				1				2
Dactylis glomerata		1				1		
Juncus tenuis		2				2		
Bromus inermis		2				3		
Agropyron repens		3				2		
Ammophila breviligulata		3				3		
Heterotheca subaxillaris		5				5		
Phlaris arundinacea		2				3		
Poa pratensis		5				5		
Agrostis hyemalis		3				3		
Festuca elatior		3				5		
Ambrosia artemisiifolia			5				5	
Hordeum jubatum								3
Helianthus annuus			1	2			2	2
Melilotus alba		1	1	2		2	1	2
Poa compressa		2				4		
Festuca rubra		3				5		
Polygonum spp.			1	1			3	4
Erigeron canadensis							1	3
Lactuca scariola								3

Abundance Class

1 rare or from 1 to 20 percent
2 occasional or from 20 to 40 percent
3 frequent of from 40 to 60 percent
4 common or from 60 to 80 percent
5 abundant or from 80 to 100 percent

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EFFECT OF SETHOXYDIM ON PIGMENT SYNTHESIS AND ENZYME ACTIVITY IN PLANTS[1]

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ABSTRACT

Sethoxydim inhibited chlorophyll and carotenoid synthesis in etiolated corn (Zea mays L. 'Merit') leaf sections exposed to 5, 10, and 20 h light. Chlorophyll content was reduced 91% in leaf sections treated with 10 µM sethoxydim and exposed to 5 h light. Under the same conditions there was a 36% reduction in carotenoid content. The influence of sethoxydim on the activity of acid phosphatase, alkaline phosphatase, invertase, α-amylase, peroxidase, and phenylalanine ammonia-lyase (PAL) in wheat (Triticum vulgare L. 'Mericopa') was also studied.

INTRODUCTION

Sethoxydim {2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one} is a relatively new herbicide that has shown effective postemergence control of both annual and perennial grasses in broadleaf crops (8,9,10). It is readily absorbed by the foliage and translocated in the phloem to metabolic sinks (2,11). Although the mode of action of sethoxydim is still unknown there are indications that the herbicide adversely affects cell division and inhibits chlorophyll synthesis (1,11).

The objectives of the present study were (a) to determine if sethoxydim can influence chlorophyll and carotenoid synthesis in corn and (b) to observe what effect the herbicide has on several enzyme systems in wheat.

MATERIALS AND METHODS

Pigment synthesis. Corn seeds were soaked for 6 h in distilled water. The imbibed seeds were sown in 8-cm styrofoam pots (15 seeds

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per pot) containing moist vermiculite and grown in complete darkness in a growth chamber for 8 days at 25°C. The bottoms of the pots were punctured several times to allow for good drainage. Under green safelight the coleoptiles of the etiolated corn seedlings were removed and the primary leaf cut into 1 cm sections. The leaf sections were floated on different solutions of sethoxydim (formulation containing 20% active ingredient and 80% inert ingredients) in petri dishes. The pH of all solutions was adjusted to 6.8 ± 0.2. The petri dishes were then placed in the growth chamber in complete darkness at 25°C. After 8 h in the dark the leaf sections were exposed to white light (178 $\mu E\ m^{-2} s^{-1}$) for 5, 10, and 20 h in the growth chamber. After each time period leaf sections were analyzed for chlorophyll and carotenoid content according to the methods of Devlin et al. (4). All experiments were replicated 4 times.

Plant preparation for enzyme studies. Wheat seeds were imbibed for 6 h in distilled water or in different solutions of sethoxydim. Some of the untreated imbibed seeds were sown in 8-cm styrofoam pots containing moist vermiculite and transferred to a growth chamber where they were allowed to grow under controlled conditions of light (178 $uE\ m^{-2} s^{-1}$, 16 h light, 8 h dark) and temperature (25°C). After shoot emergence, 40 ml of half-strength Hoagland solution was applied daily to each pot. After 14 days of growth the plants were sprayed with different concentrations of sethoxydim, 3 ml per pot. The plants were examined for enzyme activity 3 days after application of sethoxydim.

The remaining imbibed seeds (treated and untreated) were placed in 14-cm petri dishes containing 3 pads of filter paper (Whatman No. 1) and 10 ml of water. One of the pads of filter paper was used to cover the seeds. After 4 days of incubation at 25°C the germinating seeds were examined for enzyme activity.

Mature plants and germinating seeds were tested for enzyme activity according to the methods of Devlin et al. (5).

RESULTS AND DISCUSSION

Sethoxydim inhibited chlorophyll and carotenoid synthesis in etiolated corn leaf sections exposed to light. After 5 h light a 24% reduction in chlorophyll content was observed in sections treated with 0.01 µM sethoxydim (Table 1). This inhibitory effect increased with increase in the concentration of sethoxydim. For example, at the highest concentration of herbicide (100 µM), a 91% reduction in chlorophyll was noted (Table 1).

A less notable, but still highly significant, reduction in chlorophyll content was observed in leaf sections exposed to a

longer period of light (Table 1). After a 10 h light period chlorophyll content was not significantly affected in leaf sections treated with 0.01 µM sethoxydim. However, under the same light period, 0.1 µM sethoxydim caused almost a 15% reduction, and leaf sections treated with 100 µM contained 82% less chlorophyll than the control (Table 1).

Table 1. Effect of sethoxydim on the synthesis of chlorophyll (Chl) and carotenoid (Car) pigments in etiolated corn leaf sections exposed to light. Data for chlorophyll and carotenoids are in µg per g of fresh tissue.

Sethoxydim (µM)	5 h light		10 h light		20 h light	
	Chl	Car	Chl	Car	Chl	Car
0	92	91	149	104	243	143
10^{-2}	70	83	143	107	233	136
10^{-1}	67	83	127	102	237	130
10^{0}	61	81	129	101	224	127
10^{1}	50	79	99	94	191	126
10^{2}	8	58	26	55	53	66
LSD 5%	11	13	13	12	19	15
1%	16	18	18	16	26	20

When sethoxydim-treated etiolated leaf sections were exposed to 20 h light, reduction in chlorophyll content was still observed. However, significant decreases were only observed in leaf sections treated with 1, 10, and 100 µM sethoxydim. The decreases observed were 8, 21, and 78%, respectively (Table 1).

With the exception of the highest concentration used (100 µM), sethoxydim did not cause a significant reduction in the carotenoid content of the leaf sections. However, in leaf sections treated with 100 µM sethoxydim and then esposed to 5, 10, and 20 h of light there were reductions of 36, 47, and 54%, respectively (Table 1).

Reduction of chlorophyll content by sethoxydim in etiolated corn leaves has recently been reported by Asare-Boamah and Fletcher (1). They treated etiolated leaves with sethoxydim for 24 h in the dark and then exposed the leaves to light for 48 h before analyzing for chlorophyll content. In the present study etiolated leaf sections were treated for only 8 h in the dark before being exposed to light for 5, 10, and 20 h. With this method the progress of chlorophyll accumulation in the light can be followed in the treated leaf sections. In Table 1 it can be seen that chlorophyll synthesis is inhibited but not completely prevented by sethoxydim.

Of interest also, Gealy and Slife (6) found that sethoxydim inhibited apparent photosynthesis in corn but attributed this effect

Table 2. Effect of sethoxydim on enzyme activity in germinating wheat seeds. Phosphatase and glucose are abbreviated as Phos and Glu, respectively. Unit of Activity = U.

Sethoxydim (μM)	Acid Phos (U/100g)	Alkaline Phos (U/100g)	Invertase (mM Glu/100g)	α-Amylase (mM Glu/100g)	Peroxidase (U/100g)	PAL (mU/g)
0	26.4	0.09	281	53	57.8	7.2
10^{-2}	25.8	0.07	335	54	57.9	7.8
10^{-1}	25.6	0.06	319	52	58.3	7.3
10^{0}	25.6	0.07	280	50	58.8	7.0
10^{1}	21.2	0.06	95	44	58.7	6.8
10^{2}	19.8	0.02	87	40	54.0	6.1
10^{3}	11.1	0	32	27	34.4	5.2
10^{4}	7.4	0	14	18	14.1	3.4

Table 3. Effect of sethoxydim on enzyme activity in wheat plants. Phosphatase and glucose are abbreviated Phos and Glu, respectively. Units of activity = U.

Sethoxydim (μM)	Acid Phos (U/100g)	Alkaline Phos (U/100g)	Invertase (mM Glu/100g)	α-Amylase (mM Glu/100g)	Peroxidase (U/100g)	PAL (mU/g)
0	11.0	0.28	331	27	32.0	3.0
10^{-2}	11.6	0.25	357	30	31.8	3.2
10^{-1}	11.4	0.24	395	31	32.1	1.8
10^{0}	11.0	0.26	392	28	32.5	1.3
10^{1}	15.5	0.35	402	29	32.3	1.4
10^{2}	14.4	0.36	403	27	35.8	2.4
10^{3}	15.0	0.36	417	27	40.5	2.9
10^{4}	16.8	0.28	552	30	49.3	3.3

to the herbicide's adverse influence on corn leaf growth. They did not analyze for chlorophyll content and it is possible that the inhibitory influence of sethoxydim on chlorophyll production was at least partially responsible for the slowdown in apparent photosynthesis.

Concentrations of sethoxydim up to 1 µM had no effect on acid phosphatase activity in the germinating wheat seed (Table 2). Higher concentrations inhibited activity. In contrast, higher concentrations of sethoxydim (10 to 10,000 µM) stimulated acid phosphatase activity in the mature wheat plant (Table 3). Sethoxydim did not affect alkaline phosphatase activity in the germinating seed or mature wheat plant (Table 2, 3).

The hydrolytic enzymes, invertase and α-amylase, were inhibited in germinating wheat seeds by all concentrations of sethoxydim above 1 µM (Table 2). In contrast, sethoxydim stimulated invertase activity and had no effect on α-amylase in the mature wheat plant (Table 3).

Sethoxydim had an inhibitory effect on peroxidase activity in germinating seeds (Table 2). However, the higher concentrations of sethoxydim used (100 to 10,000 µM) were found to stimulate peroxidase activity in mature wheat plants (Table 3).

PAL activity in germinating wheat seeds was inhibited by the higher concentrations (10 to 10,000 µM) of sethoxydim tested (Table 2). Sethoxydim was primarily inhibitory to PAL activity in mature wheat, but at 10,000 µM stimulated activity (Table 3).

The enzyme PAL catalyzes the elimination of NH_3 from L-phenylalanine to yield trans-cinnamic acid. The removal of ammonia from L-tyrosine to yield p-coumaric acid can also occur in the presence of this enzyme (3). Both trans-cinnamic acid and p-coumaric acid are plant growth inhibitors. Thus PAL activity diverts two amino acids away from protein synthesis and into the production of growth inhibitors. This secondary metabolism eventually leads to the production of metabolites such as flavinoids, lignin, tannins, and alkaloids (7).

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EFFECT OF RATE OF GLYPHOSATE WITH AND WITHOUT FRIGATE SURFACTANT ON WEED CONTROL IN ORBIT SPRING OATS

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ABSTRACT

Four rates, 0.25, 0.5, 1.0, and 2.0 lbs ai/a, of glyphosate herbicide, with and without frigate surfactant, were applied to untilled ground prior to a spring oat (*Avena sativa* L. 'orbit') crop. Spray volumes were 10, 20, and 40 gals./a. A vigorous infestation of quackgrass (*Agropyron repens* L.) was present at the time of applications. At each rate and spray volume, glyphosate plus frigate surfactant (0.5% v/v) was more effective than glyphosate alone for controlling quackgrass eight days after application.

INTRODUCTION

This trial was conducted to determine if the non-selective herbicide, glyphosate [*N*-(phosphonomethyl)glycine] would be more effective on perennial quackgrass when tank-mixed with frigate (tallow fatty acid amine ethoxylate) (SDS Biotech Corp.). Several herbicide rates were applied in three spray volumes. Following visual evaluation of weed control, a spring oat crop was planted on the plots to determine the effect on grain yield and quality. Other treatments included R40244 (confidential chemistry), frigate alone, and a check.

MATERIALS AND METHODS

The experimental design was a randomized complete block with four replications. Plot size was nine by thirty feet; and the soil was a Caribou gravelly silt loam. Quackgrass was approximately six inches high and vigorous when herbicides were applied with a compressed-air back-pack sprayer at 40 psi. Spray volumes are listed in Table 1. Six flat fan nozzles (#8003) were attached to the spray boom. Weed control ratings were assigned after eight days. On the eleventh day, a seedbed was prepared and orbit oats were sowed with a commercial grain drill. Mustard species (*Brassica* sp.) only were assigned control ratings at mid-season. Oat yield and quality were determined at fall harvest from 1/1000 acre sub-plots.

RESULTS AND DISCUSSION

June 12 weed control ratings indicate that for similar rates of glyphosate, frigate improved control of quackgrass and broadleaved weeds. Improved weed control also corresponded with increasing glyphosate rates from 0.25 lbs. ai/a. Changing spray volumes between 10, 20, and 40 gals./a did not influence glyphosate efficacy. Mid-season mustard weeds were not affected by the pre-tillage glyphosate treatments. Frigate-only plots were similar in weed populations to check plots.

After eight days, 0.5 lb. ai/a of R40244 was not very effective against quackgrass, but completely controlled broadleaved weeds. Mid-season control of mustard species was close to satisfactory. The addition of frigate did not improve R40244 efficacy.

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No phytotoxic symptoms developed in the oat crop and plots were sampled October 16, 1984. Although there were no significant differences, mean moisture readings ranged from 16.0 to 19.2 percent. Yields were good, but a snowfall of October 5 created sampling problems due to severe lodging. Thus, the mean bushel per acre yields listed in Table 1 are somewhat inconsistent. To generalize, glyphosate plus frigate plots outyielded glyphosate-only plots in five comparisons; yielded similarly in two comparisons; and yielded less in one comparison. Yield increases were statistically significant at 0.25 lb. ai in 40 gals./a and 2.0 lbs. ai in 20 gals./a.

In summary, frigate surfactant improved glyphosate efficacy and may have increased oat yield. Whether this warrants reduced rates of glyphosate is not apparent.

Table 1. Weed control and oat yield following preplant applications of various rates of glyphosate with and without frigate surfactant. Maine - 1984.

Treatments[a] Lbs. ai/a		Surfactant 0.5% v/v	Water Gal./A.	Weed Control Ratings[b] Quackgrass 6-12	Broadleaved 6-12	Mustard sp. 7-30	Oat Yield[c] Bu./A.
0.5	Glyphosate		10	6.8	7.3	4.5	65abc
0.5	Glyphosate	Frigate	10	7.5	8.0	4.5	53c
0.25	Glyphosate		20	4.8	5.8	4.0	64abc
0.25	Glyphosate	Frigate	20	5.5	6.5	4.5	70ab
0.5	Glyphosate		20	7.0	7.5	4.2	66abc
0.5	Glyphosate	Frigate	20	8.2	8.5	4.2	65abc
1.0	Glyphosate		20	8.5	8.0	4.0	54bc
1.0	Glyphosate	Frigate	20	9.0	9.0	4.2	67abc
2.0	Glyphosate		20	9.0	8.0	4.5	53c
2.0	Glyphosate	Frigate	20	9.0	9.0	3.8	70ab
0.25	Glyphosate		40	5.2	6.2	4.5	55bc
0.25	Glyphosate	Frigate	40	5.8	6.0	5.0	74a
0.5	Glyphosate		40	6.8	7.0	4.0	56bc
0.5	Glyphosate	Frigate	40	7.8	8.0	4.2	65abc
1.0	Glyphosate		40	8.8	8.0	3.8	57abc
1.0	Glyphosate	Frigate	40	8.8	9.0	4.0	56bc
0.5	R40244		20	5.0	9.0	6.2	64abc
0.5	R40244	Frigate	20	5.0	9.0	6.2	67abc
	(Water)	Frigate	20	4.2	4.2	4.5	51c
Check				3.8	4.5	4.5	59abc

[a]Herbicides applied to untilled ground June 4, 1984. Temp. - 56F., sunny; moist soil; 3-5 mph s. wind.

[b]Rating code: 9 = no weeds; 1 = weeds cause crop abandonment; <7 = unacceptable weed control

Average check plot population per square foot on June 14: *Agropyron repens* - 9.8; *Brassica* sp. - 8.0; Other broadleaved weeds - 7.0.

[c]Following tillage on June 15, oats were planted and fertilized; harvested - October 16, 1984.

TRIAZINE RESISTANT WEED SURVEY IN MARYLAND

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ABSTRACT

In the United States over 30 species of weeds have developed resistance to the triazine herbicides. In Maryland resistance was first noted in the mid-1970's with pigweed (Amaranthus hybridus L.) in the Piedmont region. Since that time resistant pigweed has spread over thousands of acres and a resistant form of lambsquarters (Chenopodium album L.) has also been detected.

In the fall of 1983 a project was initiated with the help of funds from the APHIS-PPQ Plant Pest Survey and Detection Program to survey the state of Maryland for the spread of triazine resistant weeds. From September to October 654 randomly chosen fields were sampled throughout the state. In each field 10 sites were selected and at each site a 10 row ft. area was used to rate the density of various weeds. Seed heads of potentially resistant species were collected from 20 plants throughout the field.

All pigweed seed heads were examined to determine whether they were A. hybridus or A. retroflexus (L). Of the more than 2000 seed heads identified, over 98% were A. hybridus. After identification seed heads were threshed and seeds were exposed to 50° C for four days to enhance germination. Using a 0.1 ml volumetric measure, approximately 150 seeds from the composite sample of 20 heads were planted in the greenhouse in 12 X 18 cm plastic trays filled with commercial potting soil. When seedlings reached the first true leaf stage, plants were sprayed with a 4 lb a.i./A solution of atrazine. Applications were made with a belt sprayer delivering 40 gpa at 40 psi. No additional surfactant was used since it appeared to cause some foliar burning on the resistant plants. After 1-2 weeks visual observations were made to determine the susceptability or resistance of plants from each field.

Pigweed was completely resistant to atrazine in 198 of the 654 fields sampled. An additional 29 fields contained mixed populations of both resistant and susceptable strains. Completely resistant populations were found in 18 of Maryland's 23 counties and low level mixed populations were found in several of the remaining counties. Resistant lambsquarters populations were found in less than 10 locations, all of which were in the Piedmont region where resistant pigweed first became a problem.

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USE OF PENETRATION ENHANCERS IN AGRICULTURE

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ABSTRACT

Penetration enhancers are designed to aid in the movement of a chemical (normally a drug or pesticide) to the target tissue (i.e. particular cells). One class of compounds, the caprolactams, has shown little toxicity in animal tests and one particular compound, "Azone", has been cleared for use in the control of cutaneous functions in animals. Azone was tested for effects on herbicide application to plants. Glyphosate was chosen as the test herbicide because movement is required before it can be effective in the plant. The initial results are summarized below.

TABLE I[2/]

	Bean	Cucumber	Marijuana
Glyphosate 1/8 lb/acre + 1% Tween 80	10	10	10
Glyphosate 1/8 lb/acre + 1% Tween + 1% Azone	9	7	10
Glyphosate 1/16 lb/acre + 1% Tween 80	8	9	5
Glyphosate 1/16 + 1% Tween + 1% Azone	2	0	10

[2/] Ten is maximum phytotoxicity, zero is no effect. All seedlings were one month old when sprayed. Data were collected two weeks after spraying.

The results in Table I were obtained on three separate occasions. Differences in response were also observed between four bean varieties and six other crop and weed species. The major difficulty was that several weed species were protected by Azone application even in the presence of a variety of other glyphosate enhancers which were effective when used alone. The reason for the differing responses is the phytotoxicity of the pure compound which can be correlated with the amount of wax in the cuticle of the leaf. It is thought that in protected plants a thicker cuticle prevents movement of the enhancer and the herbicide. However, since the compound is so toxic to isolated cells and protoplasts, the possibility of increased penetration and subsequent death of the cells which serves to prevent transport of the herbicide cannot be ruled out.

In order to test the theory of cell death, a number of other caprolactams of differing carbon chain length were tested to see if chain length was correlated to penetration. The penetration of actual leaves showed little differences. However, some compounds were less toxic to protoplasts and cells than Azone indicating some correlation with chain length.

The effectiveness of a penetration enhancer depends upon the use and chemical nature of the pesticide or drug. Because of this specificity, it is expected that they will only be useful in very specialized situations where conditions can be manipulated to get the maximum benefit from such a compound.

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WILD PROSO MILLET IN NEW YORK STATE

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ABSTRACT

A weedy strain of proso millet (Panicum miliaceum L.) was first identified in New York State by the author in August of 1981. The somewhat limited infestation was found in a soybean field on the north side of McCullough Road near its junction with Kings Corners Road in the Town of Varick, Seneca County. Although the known infestation is very limited, the potential for spread is of concern to New York agriculture. Like the proso millet that has become a serious weed problem in Minnesota, Wisconsin and in Ontario, Canada, the proso millet found in New York State has dark brown or black seed that shatter as it matures.

Proso millet is a summer annual grass that is closely related to fall panicum (Panicum dichotomiflorum Michx.) and witchgrass (Panicum capillare L.). Proso millet seedlings develop rapidly into somewhat branched, upright plants that may grow to a height of 5 feet. The stems develop an abundance of hairs at right angles to the stems. The leaf blades, which are somewhat hairy on both surfaces and along the edges, may be up to 1 foot in length. The leaf sheaths are densely hairy and have overlapping margins. The ligule is a line of dense hairs and there are no auricles. Proso millet produces a panicle which varies from compact to open. The egg-shaped seed are about 1/8 inch long with a hard, shiny seed coat.

Proso millet seedlings look somewhat like volunteer corn; however, the abundance of hairs on the leaf blades and sheaths is apparent during the seedling stage and serves as a distinguishing characteristic. At maturity, the panicle resembles that of fall panicum; however, fall panicum has relatively smooth stems and leaves, a spreading growth habit and smaller seeds. Witchgrass is hairy with an upright growth habit like proso millet but does not grow as tall or as vigorously. In addition, witchgrass panicles are more delicate with seed that are less than half the size of proso millet seed. Positive identification of proso millet can be made by carefully pulling the plants from the soil and observing the large seed coat which remains attached to the roots, even at maturity.

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ANESTHETIC RELEASE OF SEED DORMANCY IN AMARANTHUS RETROFLEXUS SEEDS

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ABSTRACT

Previous research has shown that some substances having anesthetic properties in animals strikingly relieve dormancy in seeds of several weed species. We have found a similar activity in redroot pigweed (*Amaranthus retroflexus* L.) seeds. The order of activity of the compounds examined was ethanol > methanol > isopropanol > acetone > acetaldehyde. N-propanol was inactive. Seeds of redroot pigweed differed from other seeds in two major respects. First, only brief exposures to ethanol were required to give marked stimulation. Exposures of 15 minutes to 0.1 M ethanol increased germination by about 30% over suitable controls, while 1 hour treatment gave a 70% increase (maximum). The second observation was that redroot pigweed seeds responded only slightly to ethanol or red irradiation alone but germinated completely when both were provided. Phytochrome involvement is indicated because the promotion of germination by red light following exposure to ethanol was reversible with far-red light. Ethanol may function either to enhance phytochrome activity directly or to stimulate a process prerequisite to phytochrome activity. Based on previous observations with the behavior of these compounds in other seeds, it seems more plausible that ethanol enhanced the ability of active phytochrome to function.

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GLYPHOSATE AND SC 0224 ENHANCEMENT WITH ADDITIVES ON BERMUDAGRASS

C. E. Beste[1/]

ABSTRACT

Bermudagrass (Cynodon dactylon (L.)Pers.) control during early spring with 0.25 lb ai/A SC 0224 or glyphosate in 7.4 GPA spray volume was 80 to 65% and 70 to 40%, respectively. Mid-summer application of glyphosate or SC 0224 at 0.25 lb ai/A in 7.4 or 30 GPA spray volume provided 70 to 40% control with both herbicides. Bermudagrass completely recovered by the end of the season from this low rate of glyphosate. Bermudagrass flowering suppression was greater with SC 0224 than glyphosate. Spray volumes of 7.4 or 30 GPA did not appear to affect bermudagrass control with either glyphosate or SC 0224, however, at 30 GPA, the additive Emphasizer™ appeared to enhance SC 0224 but not glyphosate. Non-ionic surfactant at 2 qt/100 gal improved bermudagrass control in mid-summer but not in early spring. Emphasizer™ appeared to reduce the effectiveness of glyphosate more than SC 0224. Bermudagrass control was 95 and 98% with Frigate™ additive at 2 qt/100 gal. with glyphosate and SC 0224, respectively, at 7.4 gal/A spray volume in early spring but in mid-summer, improved control with Frigate occurred with 30 gal/A spray volume and not at 7.4 gal/A. Frigate™ was the only additive that enhanced glyphosate and SC 0224 activity at 0.25 lb ai/A adequately to provide full season suppression of bermudagrass and the spring treatment provide 90% bermudagrass control.

INTRODUCTION

Bermudagrass (Cynodon dactylon (L.)Pers.) control could be more effective and less expensive if additives improved the efficacy of glyphosate (N-(phosphonomethyl) glycine)or SC 0224 (trimethylsulfonium carboxymethylaminomethylphosphonate).

MATERIALS AND METHODS

The experiments were conducted on established bermudagrass sod at the University of Maryland, Vegetable Research Farm, Salisbury. Glyphosate and SC 0224 were applied at 0.25 lb ai/A in 7.4 or 30 GPA spray volumes with flat fan nozzles at 32 psi nozzle pressure. On May 19, 1984 glyphosate and SC 0224 were applied in 7.4 GPA spray volume to bermudagrass with 4 to 6 inch length stems on a lawn that had been mowed twice at a 3 inch height during the spring. The plot size on May 19 was 6 ft. 8 in. by 30 ft. and unreplicated. A second study on the bermudagrass lawn was treated on July 9, 1984 with glyphosate and SC 0224 in spray volumes of 7.4 or 30 GPA and a plot size of 6 ft. 8 in. by 10 ft. with three replications. A third study was established in a bermudagrass pasture which regrew to an 8 inch height and sprayed on July 9 with glyphosate or SC 0224 at 0.25 lb ai/A in 7.4 or 30 GPA spray volume with three replications. The spray additives evaluated were non-ionic surfactant (X-77™) at 2 qts/100 gal. rate, non-surfactant wetting agent (Emphasizer™) at 1 pt/10 gal. rate and surfactant (Frigate™) at 2 qt/100 gal.

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The experimental design for studies two and three was a randomized complete block design with three replications and the plot size was 6 ft. 8 in. by 10 ft.

Ratings for bermudagrass growth and inflorescence formation were obtained. The number of inflorescence per sq. ft. were obtained for study one and reported as completely open inflorescence or as an inflorescence emerging from the leaf sheath. Inflorescence numbers were determined in two locations of one sq. ft. each per plot.

RESULTS AND DISCUSSION

Bermudagrass control during early spring with 0.25 lb ai/A SC 0224 or glyphosate in 7.4 GPA spray volume was 80 to 65% and 70 to 40%, respectively. Mid-summer application of glyphosate or SC 0224 at 0.25 lb ai/A in 7.4 or 30 GPA spray volume provided 70 to 40% control with both herbicides. Bermudagrass completely recovered by the end of the season from this low rate of glyphosate. Bermudagrass flowering suppression was greater with SC 0224 than glyphosate. Spray volumes of 7.4 or 30 GPA did not appear to affect bermudagrass control with either glyphosate or SC 0224, however, at 30 GPA, the additive Emphasizer™ appeared to enhance SC 0224 but not glyphosate. Non-ionic surfactant at 2 qt/100 gal. improved bermudagrass control in mid-summer but not in early spring. Bermudagrass control was 95 and 98% with Frigate™ additive at 2 qt/100 gal. with glyphosate and SC 0224, respectively, at 7.4 gal/A spray volume in early spring but in mid-summer, improved control with Frigate™ occurred with 30 gal/A spray volume and not at 7.4 gal/A. Frigate™ was the only additive that enhanced glyphosate and SC 0224 activity at 0.25 lb ai/A adequately to provide full season suppression of bermudagrass and the spring treatment provide 90% bermudagrass control (Table 1 and 2).

A non-ionic wetting agent appears to be beneficial under stress conditions of summer for bermudagrass control. Frigate™ appears to increase the activity of glyphosate and SC 0224 by a 2 to 20 times factor since glyphosate is registered for bermudagrass control at 5.0 lb ai/A. Emphasizer™ appeared to reduce the effectiveness of glyphosate more than SC 0224 at this low rate of 0.25 lb ai/A.

Table 1. Bermudagrass control with glyphosate and SC-0224 and several additives.

Treatment (May 19, 3 PM)		BERMUDAGRASS					
		Growth (% of Control		Inflorescence[3/] (% Suppression)	Inflorescence[4/] (Number per Sq. Ft. - July 2)		
Herbicidal/	Additive[2/]	June 5	June 11	July 2	Open	Closed	Total
1. Control	---	100	100	0	96	20	116
2. glyphosate (4S)	none	30	45	80	34	28	62
3. glyphosate	X-77™	30	50	75	90	18	108
4. glyphosate	Emphasizer™	35	70	65	111	52	163
5. glyphosate	Frigate™	4	6	96	16	28	44
6. SC 0224 (4S)	none	15	25	92	17	8	25
7. SC 0224	X-77™	15	25	90	17	4	21
8. SC 0224	Emphasizer™	15	30	85	19	37	56
9. SC 0224	Frigate™	8	2	98	11	12	23

1/ Herbicides applied at 0.25 lb ai/A in 7.4 GPA spray volume when bermudagrass had 4 to 6 inches of new growth.
2/ X-77™ non-ionic surfactant (2 qt/100 gal.), Emphasizer™ non-surfactant additive 1 pt/10 gal., Frigate™ surfactant 2 qt/100 gal.
3/ Visual rating.
4/ Average of the number per sq. ft. for two areas in each plot on July 2.

Table 2. Additives for glyphosate and SC-0224 at 7.4 and 30 GPA spray volumes for bermudagrass control.

Treatment (Applied July 9, 1984)			Bermudagrass Lawn					Bermudagrass Pasture				
			% Chlorosis	(% of Control) Plant Growth			Inflorescence Formation 3/	% Chlorosis		(% of Control) Plant Growth		Inflorescence Formation 3/
Herbicide 1/	Additive 2/	GPA	7/14	7/21	8/6	9/5	8/6	7/14	7/21	8/6	9/5	8/6
1. Control-untreated	---	---	0	100	100	100	100	0	0	97	100	100
2. glyphosate (4S)	None	30	8	50	55	87	87	7	23	57	83	63
3. glyphosate	Surf.	30	15	38	22	73	37	3	28	47	40	47
4. glyphosate	Emp.	30	5	48	57	70	43	20	39	60	73	53
5. glyphosate	Frig.	30	15	35	8	47	27	18	43	30	50	33
6. SC-0224 (4S)	None	30	13	48	48	73	67	13	35	33	40	47
7. SC-0224	Surf.	30	5	58	20	80	17	12	32	60	80	20
8. SC-0224	Emp.	30	23	28	27	60	67	3	28	63	68	48
9. SC-0224	Frig.	30	20	30	12	53	20	18	50	30	57	27
10. glyphosate	None	7.4	13	28	35	57	83	23	40	50	50	57
11. glyphosate	Surf.	7.4	13	35	27	67	27	18	53	33	50	47
12. glyphosate	Emp.	7.4	8	55	50	70	53	2	20	77	70	60
13. glyphosate	Frig.	7.4	13	35	22	57	27	12	43	40	60	33
14. SC-0224	None	7.4	15	43	25	83	25	5	35	32	67	57
15. SC-0224	Surf.	7.4	17	25	5	43	5	35	62	25	33	20
16. SC-0224	Emp.	7.4	7	57	45	87	47	8	32	47	67	43
17. SC-0224	Frig.	7.4	12	42	25	80	27	18	48	42	63	30

1/ Application rate for glyphosate and SC-0224 was 0.25 lb ai/A. (3 replications)
2/ Surf. = non-ionic surfactant (X-77™ brand) 2 qt/100 gal, Emp. = Emphasizer™ non-surfactant additive 1 pt/10 gal, Frig. = Frigate™ surfactant at 2 qt/100 gal.
3/ Rated as % of control.

VEGETABLE SUSCEPTIBILITY TO DPX-Y6202

M.A. Ruizzo and S.F. Gorski[1/]

ABSTRACT

It is well documented that many of the postemergence grass herbicides have exhibited considerable selectivity to grass species while broadleaf species express good tolerance. Development of a herbicides use is largely dependent on its degree of selectivity. Therefore, an objective of this research was to determine the extent of selectivity of postemergence grass herbicides on vegetable crops.

A preliminary field screening (1983) with postemergence grass herbicides on vegetable crops was conducted to evaluate crop selectivity. Onion, celery, lettuce, and cabbage expressed good tolerance to the herbicides tested but spinach (var. 'Melody') and cucumber (var. 'Calypso') demonstrated varying susceptibility. Injury to spinach appeared as a chlorotic leaf speckling 7 days following treatment while cucumber expressed growth inhibiting effects such as chlorosis/necrosis of treated leaf tissue followed by a progressive collapse of the foliage.

DPX-Y6202 and cucumber (var. 'Calypso') were selected for further investigation in a 1984 field study. In addition to DPX-Y6202, two adjuvants, nonionic surfactant and crop oil concentrate, were examined to determine their possible effects on herbicide activity. The type of adjuvant utilized was not significant but the rate of adjuvant affected both crop yield and visual phytotoxicity. The growth inhibiting effects classified in the 1984 study agreed with those of the 1983 trial.

Greenhouse experiments were conducted at The Ohio State University in 1984 to investigate adjuvants possible function in cucumber susceptibility to DPX-Y6202. Again, adjuvant type (nonionic surfactant and crop oil concentrate) was not significant in its effect on cucumber (fresh weight basis) but the interaction of DPX-Y6202 rate by adjuvant rate significantly reduced cucumber fresh weight with rate of herbicide accounting for a large percentage of the effect.

Results indicate that cucumber (var. 'Calypso') is susceptible to DPX-Y6202 at expected use rates.

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AVOIDANCE OF HERBICIDE INJURY BY PLACEMENT BETWEEN ROWS OF POLYETHYLENE MULCH

John R. Teasdale[1]

ABSTRACT

Several herbicides which normally are toxic to cantaloupe did not reduce cantaloupe yield when applied to soil between rows of black polyethylene mulch including metolachlor, alachlor, oryzalin, linuron, acifluorfen, metribuzin, and paraquat. However, oxyfluorfen and atrazine caused severe injury and yield reduction in some instances. Herbicide injury appeared to result from movement of herbicide to plants by rainfall runoff and/or volatilization rather than by root uptake from the treated area.

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COST AND EFFECTIVENESS OF HAND WEEDING AND CULTIVATION COMPARED TO LABELED AND EXPERIMENTAL HERBICIDE PROGRAMS

B.A. Majek[1]

ABSTRACT

Herbicides, mechanical cultivation, and hand weeding by hoeing and pulling are weed control methods that are frequently employed by vegetable growers. These crops represent a wide range of plant species, varying in growth habit, length of growing season, and time of growing season. These and other factors affect the competitive ability of the different crops. The cost and effectiveness of the weed control techniques evaluated also varied. Allowing weeds to grow untreated caused significant yield reductions in all the crops evaluated. Lettuce, onions, and parsley were most sensitive to weed competition. Yields were reduced to zero when weeds were allowed to grow untreated with these crops. Cultivation controls weeds between the crop rows, but does not control weeds in the row. Only snap bean and sweet corn yields were not significantly reduced by the competition provided by weeds growing in the row. The effects of weeds in the row on harvest efficiency and crop quality were not considered in this study, but can be important. Cultivated only treatments were deleted from the spinach and parsley studies since harvest procedures require weed-free stands between and in the rows of these crops. The cost of labor for hand weeding was 10 to 100 times higher than the cost of an effective herbicide program that resulted in similar yields for every crop evaluated except lettuce. No herbicide program alone provided effective weed control in lettuce. Hand weeding costs were the highest for crops such as onions that require a long growing season, close row spacing, and compete poorly with weeds and for crops that must be weed free at the end of the growing season, such as parsley to facilitate harvest. A labeled and recommended herbicide program provided effective weed control that resulted in yields that were not significantly different from the hand-weeded treatments in snap beans, tomatoes, spinach and sweet corn. Standard herbicide programs did not provide adequate weed control in cabbage, onions, and parsley. Yield results from experimental herbicide programs that did provide effective weed control were included for these crops. The competitive weeds in these studies were fall panicum, large crabgrass, smooth pigweed, and common lambsquarters. A species shift in the weed population could alter the effectiveness of any of the weed control programs used.

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Table 1. Vegetable crops weed control costs and effectiveness

Treatment	Appl.	Rate Lb ai/A	Hand weeding (manhr/A) 1983	Hand weeding (manhr/A) 1984	Cultivations (no.) 1983	Cultivations (no.) 1984	Yield[1] 1983	Yield[1] 1984	Cost[2] 1983	Cost[2] 1984
Beans, snap										
Hand weeded & cultivated			122	222	2	2	2.3	3.6	509	909
Cultivated			0	0	2	2	1.8	3.3	20	20
Untreated			0	0	0	0	0.8	1.2	0	0
Metolachlor	Pre	1.50	0	0	0	0	2.2	2.7	19	19
$LSD_{0.5}$							0.7	0.8		
Cabbage (transplanted)										
Hand weeded & cultivated			169	110	2	2	15.6	14.4	697	461
Cultivated			0	0	2	2	8.2	14.6	20	20
Untreated			0	0	0	0	3.0	8.3	0	0
DCPA	Post trans	7.50	0	0	0	0	12.6	10.0	52	52
Oxyfluorfen &	Post trans	0.50	0	0	0	0	16.6	12.1	45	45
Sethoxydim +	Post	0.20								
Oil conc.		1.0%								
$LSD_{0.5}$							4.0	4.1		
Lettuce (seeded)										
Hand weeded & cultivated			424	224	3	2	15.6	42.0	1726	916
Cultivated			0	0	3	2	1.1	17.0	30	20
Untreated			0	0	0	0	0.0	8.0	0	0
Pronamide	Pre	2.00	0	0	0	0	1.9	23.0	44	44
$LSD_{0.5}$							3.3	9.3		
Onion (seeded)										
Hand weeded & cultivated			-	1067	-	4	-	8.3	-	4308
Cultivated			-	0	-	4	-	0.1	-	40
Untreated			-	0	-	0	-	0.0	-	0
DCPA	Pre	6.00	-	0	-	0	-	0.1	-	41
Propachlor &	Pre	5.00								
Oxyfluorfen &	Post 1	0.05								
Oxyfluorfen &	Post 2	0.05								
Sethoxydim +	Post 3	0.20	-	0	-	0	-	8.0	-	61
Oil conc. &		1.0%								
Oxyfluorfen &	Post 4	0.05								
Oxyfluorfen	Post 5	0.05								
$LSD_{0.5}$								1.9		
Parsley										
Hand weeded & cultivated			976	-	3	-	155	-	3934	-
Untreated			0	-	0	-	4	-	0	-
DCPA	Pre	6.00	0	-	0	-	33	-	41	-
DCPA +	Pre	6.00	0	-	0	-	220	-	49	-
Linuron		0.75								
$LSD_{0.5}$							72			
Spinach										
Hand weeded & cultivated			-	209	-	1	-	7.2	-	846
Untreated			-	0	-	0	-	7.3	-	0
Cycloate	PPI	3.00	-	0	-	0	-	8.8	-	37
$LSD_{0.5}$								1.8		
Sweet corn										
Hand weeded & cultivated			-	316	-	2	-	222	-	1284
Cultivated			-	0	-	2	-	182	-	20
Untreated			-	0	-	0	-	29	-	0
Alachlor	Pre	1.50	-	0	-	0	-	207	-	17
$LSD_{0.5}$								56		
Tomato										
Hand weeded & cultivated			182	259	2	2	29.1	23.8	748	1056
Cultivated			0	0	2	2	23.5	12.1	20	20
Untreated			0	0	0	0	16.0	8.4	0	0
Trifluralin +	PPI	0.75	0	0	0	0	26.2	23.0	32	32
Metribuzin		0.25								
$LSD_{0.5}$							8.4	5.3		

1 Yield: Ton/A - snap beans, cabbage, seeded onions, spinach and tomato; lb/box (24 heads/box) - lettuce; box/A (60 bunches/box and 190 g/bunch) - parsley; crates/A - sweet corn.

2 Hand labor costs $4/hour; cultivation costs $10/A; herbicide costs 1983 suggested retail prices of a major supplier plus $10/A for each application and $20/A for incorporation.

LETTUCE VARIETAL RESPONSE TO THIOBENCARB IN NUTRIENT SOLUTION

S. Reiners and S.F. Gorski[1/]

ABSTRACT

A rapid and sensitive bioassay technique was developed to determine lettuce tolerance to thiobencarb. Varietal tolerance to the herbicide had been established in the field in the summer of 1983. Five lettuce varieties, Bibb, Dark Green Boston, Great Lakes 366, Slobolt and Valmaine were selected. Seeds were placed in styrofoam cups with cheesecloth bases and floated on a modified nutrient solution containing thiobencarb at rates of 0, 0.5, 1.0 and 1.5 ppm. Solutions were changed every four days. All lettuce varieties were grown in a growth chamber at 18°C, 80% RH with 14 hour days for a period of 16 days. At the end of this time, plants were removed and top fresh weight determined. Regression analysis was performed on all the data.

The bioassay allowed for screening of many lettuce varieties easily and within a short period of time. Differences in variety tolerance were observed, most notably between Dark Green Boston and Great Lakes 366, a head lettuce. Dark Green Boston exhibited a significant cubic response (r^2=0.99) with top fresh weight dropping off sharply at low rates of thiobencarb (0.1-0.5 ppm) before leveling off and then falling again at rates greater than 1.0 ppm. Great Lakes 366 exhibited a linear (r^2=0.98) decline over the entire range of thiobencarb rates, a decline that was not as great as that observed with Dark Green Boston. This indicates a significant difference in lettuce variety tolerance to thiobencarb. Differences in response was greatest between 0.2 and 0.6 ppm thiobencarb indicating this as the optimum concentration for determining tolerant and susceptible varieties.

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EFFECTIVENESS AND POST HARVEST RESIDUES OF THREE LETTUCE HERBICIDES

J. Rabin and B.A. Majek[1]

ABSTRACT

Fall lettuce producers require safe effective herbicides that do not interfere with the establishment of subsequent small grain cover crops. Effective herbicides have been avoided by growers to reduce the risk of cover crop injury. Benefin was applied preplant incorporated and bensulide and pronamide were applied preemergence to iceberg lettuce seeded for a fall crop. None of the herbicides injured the lettuce. Common purslane (**Portulaca oleracea** L.) was most effectively controlled by pronamide. Bensulide provided fair control and the weed control obtained with benefin was poor (Table 1). Soil samples were taken from the plots after lettuce harvest, 10 weeks after herbicide application. Greenhouse bioassays were conducted with wheat and rye. Wheat and rye shoot growth, root growth, and tiller number were reduced by bensulide. Only the root growth of wheat and rye was reduced by pronamide (Table 2). A standard curve for rye tolerance to the three herbicides in the greenhouse indicated that rye was most sensitive to pronamide and least sensitive to bensulide (Table 3). Pronamide rates as low as 0.25 lb a.i./A completely controlled rye, while 5 lb a.i./A bensulide only slightly injured rye. The standard curve indicates that pronamide would be more likely than bensulide to injure a cover crop. However, the field soil bioassay indicated that pronamide had dissipated within the period of time necessary to mature a fall lettuce crop in New Jersey (Table 2). No injury was observed on a subsequent cover crop sown in the field in late October (Table 1).

Table 1. Weed control in fall lettuce and the effect of herbicide residues on subsequent winter cover crop.

Treatment	Rate Lb ai/A	6/3/83 % Crop Inj.	6/3/83 % Control Copu	9/26/83 Yield (lb/box)	6/8/84 Wheat fresh wt (kg/M^2)
Hand weeded		0	100	42.8	1.3
Untreated		0	0	23.0	1.5
Preplant Incorporated					
Benefin	1.1	0	22	32.2	1.6
Preplant Incorporated & Preemergence					
Benefin & Bensulide	5.5 5.0	0	75	40.2	1.4
Benefin & Pronamide	1.1 2.0	0	100	44.0	1.6

(table continued)

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Table 1. Weed control in fall lettuce (continued)

Treatment	Rate Lb ai/A	6/3/83 % Crop Inj.	6/3/83 % Control Copu	9/26/83 Yield (lb/box)	6/8/84 Wheat fresh wt (kg/M^2)
Preemergence					
Bensulide	5.0	0	50	44.1	1.4
Pronamide	2.0	0	95	45.9	1.4
Bensulide + Pronamide	5.0 2.0	0	100	46.2	1.2
$LSD_{0.5}$		-	18	7.6	NS

Table 2. Greenhouse bioassay for residue in the field 10 weeks after herbicide application

Treatment	Appl.	Rate Lb ai/A	Wheat Oven dry wt (g) Shoots	Wheat Oven dry wt (g) Roots	Wheat Tiller No.	Rye Oven dry wt (g) Shoots	Rye Oven dry wt (g) Roots	Rye Tiller No.
Hand Weeded			2.6	3.0	6.7	2.5	2.2	4.2
Untreated			1.9	2.0	5.7	1.9	1.4	3.9
Benefin	PPI	1.1	2.0	2.4	5.0	1.4	1.2	2.9
Bensulide	Pre	5.0	1.3	1.0	3.2	1.1	0.6	2.5
Pronamide	Pre	2.0	2.2	1.6	6.4	1.9	1.2	3.8
$LSD_{0.5}$			1.0	1.0	2.6	0.9	0.9	1.0

Table 3. Greenhouse rye standard curve for herbicide residues

Treatment	Rate Lb ai/A	Oven dry wt (g) Shoot	Oven dry wt (g) Root	Tiller No.
Untreated		2.3	1.7	11
Benefin	1.10	0.2	0.0	1
Benefin	0.55	0.3	0.2	2
Benefin	0.28	1.1	0.8	6
Benefin	0.14	1.2	0.9	7
Bensulide	5.00	1.8	1.5	12
Bensulide	2.50	2.5	1.6	9
Bensulide	1.25	2.3	1.6	12
Bensulide	0.62	2.2	1.6	9
Pronamide	2.00	0.0	0.0	0
Pronamide	1.00	0.0	0.0	0
Pronamide	0.50	0.0	0.0	0
Pronamide	0.25	0.0	0.0	0
$LSD_{0.5}$		0.4	0.4	2.9

WEED CONTROL IN PARSLEY AND FENNEL

R.W. VanVranken and B.A. Majek[1]

ABSTRACT

Chemical weed control in parsley and fennel is important due to excessive costs of hand pulling weeds. DCPA is the only labeled herbicide for parsley. No herbicides are labeled for use in fennel. Parsley and fennel were treated preemergence and postemergence with several herbicides to determine crop tolerance and weed control effectiveness. DCPA and linuron applied preemergence to parsley and fennel were safe at two times the normal rate. Preemergence applications of chloroxuron injured fennel. Linuron applied postemergence severely injured fennel, but parsley was marginally tolerant. Delaying postemergence linuron applications to parsley until the crop developed three true leaves increased the margin of safety. The injury observed was slight temporary chlorosis which appeared 7 to 10 days after application. Recovery was complete within 21 days of application. The weed species evaluated for control were fall panicum (**Panicum dichotomiflorum** Michx.), barnyardgrass [**Echinochloa crus-galli** (L.), Beauv.], ladysthumb (**Polygonum persicaria** L.), common lambsquarter (**Chenopodium album** L.) and common ragweed (**Ambrosia artemisiifolia** L.) in parsley and common purslane (**Portulaca oleracea** L.), hairy galinsoga [**Galinsoga ciliata** (Raf.) Blake], and goosegrass [**Eleusine indica** (L.) Gaertn.] in fennel. DCPA effectively controlled annual grasses but did not control many broadleaf weeds. Linuron controlled broadleaf weeds, but did not control annual grasses except when applied at high rates. A tank mix of DCPA and linuron applied preemergence has the potential to provide safe, effective broad spectrum weed control in parsley and fennel. Postemergence application of linuron may be considered in parsley providing slight temporary injury is acceptable. Fennel should not be treated with linuron postemergence.

Table 1. Weed control in parsley at the Rutgers Research & Development Center-Bridgeton, N.J.

Treatment	Rate Lb ai/A	7/7/83 Crop Inj.	Weed Control Fapa	Bygr	Lath	Colq	Corw	7/25/83 Yield (Boxes/A)[1]
Hand weeded		0	100	100	100	100	100	155
Untreated		0	0	0	0	0	0	4
Preemergence								
DCPA	6.00	0	82	75	0	75	0	33
DCPA + Linuron	6.00 0.75	0	92	100	100	100	95	220
DCPA + Linuron	6.00 1.50	0	98	100	100	100	100	204

(table continued)

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Table 1. Weed control in parsley (continued)

Treatment	Rate Lb ai/A	7/7/83 Crop Inj.	Weed Control Fapa	Bygr	Lath	Colq	Corw	7/25/83 Yield (Boxes/A)[1]
Preemergence & Early Postemergence (1 leaf)								
DCPA & Linuron	6.00 0.75	25	82	75	100	100	92	131
DCPA & Linuron	6.00 1.50	60	85	78	100	100	100	69
DCPA & Linuron	6.00 3.00	92	100	93	100	100	100	3
Preemergence & Late Postemergence (3 leaf)								
DCPA & Linuron	6.00 0.75	8	82	80	85	98	72	145
DCPA & Linuron	6.00 1.50	30	80	75	80	100	82	115
DCPA & Linuron	6.00 3.00	42	85	85	100	100	100	108
$LSD_{0.5}$		4	2	3	4	2	5	72

1 Yield calculations based on 189.2 grams per bunch and 60 bunches per box.

Table 2. Weed control in fennel at South River Farm, Buena Vista, N.J.

Treatment	Rate Lb ai/A	8/8/84 Crop Inj.	Weed Control Copu	Haga	Gogr	10/26/84 Yield (Boxes/A)[1]
Hand Weeded		0.0	100.0	100	100.0	892
Untreated		0.0	0.0	0	0.0	0
Preemergence						
DCPA	7.5	7.5	85.0	33	90.0	0
DCPA	15.0	0.0	100.0	43	100.0	345
Linuron	0.5	7.5	87.5	100	22.5	1042
Linuron	1.0	7.5	87.5	100	77.5	969
Linuron	2.0	67.5	100.0	100	97.5	1018
Chloroxuron	1.0	37.5	42.5	50	2.5	0
Chloroxuron	2.0	32.5	50.0	70	5.0	0
Chloroxuron	4.0	37.5	42.5	56	2.5	21
Postemergence						
Linuron	0.5	92.5	100.0	100	35.0	101
Linuron	1.0	95.0	100.0	100	57.5	213
Linuron	2.0	97.5	100.0	100	100.0	14
Chloroxuron	1.0	60.0	72.5	83	0.0	0
Chloroxuron	2.0	55.0	90.0	100	0.0	0
Chloroxuron	4.0	47.5	80.0	100	20.0	0
$LSD_{0.5}$		15.0	23.6	24.2	19.7	296

1 Yield calculations based on 24 plants per box and 1.5 lb/plant.

DELAYED APPLICATION OF METOLACHLOR FOR PEPPER, TOMATO, AND CUCUMBER

John R. Teasdale[1/]

ABSTRACT

Peppers (Capsicum annuum L. 'Keystone Resistant Giant No. 3') were consistently tolerant of metolachlor (2-chloro-N-[2-thyl-6-methylphenyl]-N-[2-methoxy-1-methylethyl] acetamide) when applied 2 or 4 weeks after transplanting. Tomato (Lycopersicon esculentum Mill. 'Pik-Red') exhibited occasional injury to metolachlor applied 2 or 4 weeks after transplanting although yield was not affected. Metolachlor application immediately after transplanting tended to reduce vigor and occasionally reduced yield of pepper and tomato. Preplant incorporated application of metolachlor significantly reduced vigor and yield of pepper and tomato. Cucumbers (Cucumis sativus L. 'Poinsett 76-S') were injured by all applications of metolachlor although injury was reduced as application was delayed.

INTRODUCTION

Metolachlor has been used traditionally as a preplant incorporated or preemergence herbicide for weed control for many agronomic crops. Metolachlor would be a desirable herbicide for use with vegetable crops because it controls many weeds which are difficult to control including Galinsoga species, nightshade (Solanum) species, and yellow nutsedge (Cyperus esculentus L.). However, metolachlor has not been registered for use with most vegetable crops because of questionable crop safety. Jordan and Harvey (3, 4) demonstrated that when application was delayed to early postemergence, peas (Pisum sativum L.) were more tolerant of many acetanilide herbicides including metolachlor. Good nightshade and yellow nutsedge control without crop injury was obtained for tomatoes when metolachlor was applied postemergence-directed and incorporated (2, 5). Metolachlor has little foliar activity and has been used safely as a broadcast postemergence application with a number of crops (1, 6, 7). The purpose of this research was to determine whether delayed applications of metolachlor would be safer to pepper, tomato, and cucumber than preplant incorporated or preemergence applications.

MATERIAL AND METHODS

Experiments were conducted at Beltsville, MD on an Elkton silt loam with 1.4% organic matter in 1983 and a Codorus silt loam with 1.5% organic matter in 1984. 'Keystone Resistant Giant No. 3' peppers and 'Pik-Red' tomatoes were transplanted and 'Poinsett 76-S' cucumbers were seeded with a single row of each crop in a plot. Plots were 6.1 m in length and were arranged in a randomized complete block design with four replications. Metolachlor was applied broadcast at various timings (see Table 1 for details) using a compressed air pressurized bicycle sprayer delivering 243 L/ha at 138 kPa. The preplant application was incorporated 8 cm with a rotavator. All plots were kept weed-free for the duration of the season by cultivation and handweeding. Crop vigor ratings were made 2 weeks after the last metolachlor application and each crop was harvested over a period of 1 to 2 months.

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Rainfall increases the activity of acetanilide herbicides by moving herbicides deeper into the root zone (3, 4). In this experiment, when natural rainfall did not follow an application, irrigation was provided so that at least 3 cm of moisture followed every application (one exception was the POST-2 application in 1983 which received only 0.5 cm of rainfall). Therefore, there was adequate soil penetration of metolachlor to ensure optimal herbicide activity.

RESULTS AND DISCUSSION

Peppers were consistently tolerant of metolachlor when applied at 2 and 4 weeks after transplanting (Table 1). The only visual injury observed from these applications were a few necrotic specks on leaves. Metolachlor applied immediately after transplanting caused some vigor and yield reduction in 1983 and preplant incorporated applications significantly reduced crop vigor in both years.

Tomato yield was not reduced in either year from metolachlor applications at 2 and 4 weeks after transplanting (Table 1). However, some injury was observed from these treatments in 1984 including leaf burn and rolling and curling of younger leaves. Application immediately after transplanting tended to cause some vigor and yield reduction of tomatoes but this effect was usually not statistically significant. Preplant incorporated treatments consistently injured tomatoes.

Cucumber yield was comparable to the control only when metolachlor was applied 4 weeks after seeding in 1983 (Table 1). All metolachlor treatments significantly reduced cucumber vigor and yield in 1984. Injury symptoms from postemergence applications included leaf burn and cupping of new leaves.

All crops were injured by preplant incorporated application of metolachlor indicating that, when metolachlor is uniformly distributed in the root zone, these crops are susceptible. The selective use of metolachlor, therefore, depends on physically localizing metolachlor in a zone above the root system. The increased tolerance of all crops to metolachlor when application was delayed was probably the result of more time for root development below the zone of metolachlor activity.

These results demonstrate that metolachlor can be applied safely when applied 2 to 4 weeks after transplanting peppers and tomatoes. Peppers were consistently tolerant while some initial injury was observed with tomato. Metolachlor would best be applied at layby so that activity could extend late in the season and provide full-season control of problem weeds such as galinsoga, nightshade, and nutsedge.

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Table 1. Response of pepper, tomato, and cucumber to broadcast applications of metolachlor at various timings in weed-free field experiments.

Crop	Metolachlor Rate (kg/ha)	Metolachlor Timing[a]	Vigor reduction[b] 1983 (%)	Vigor reduction[b] 1984 (%)	Yield[b] 1983 (1000 kg/ha)	Yield[b] 1984 (1000 kg/ha)
Pepper	0	-	0	0	20.2	24.9
	2.24	PPI	14*	23*	14.9*	22.5
		POST-0	11*	3	17.6	26.7
		POST-2	0	1	20.1	28.0
		POST-4	0	0	20.2	26.1
	4.48	PPI	24*	35*	10.2*	18.6*
		POST-0	18*	8	13.4*	25.7
		POST-2	0	0	19.4	29.0
		POST-4	0	1	20.2	26.0
LSD (P = 0.05)			10	8	4.3	5.6
Tomato	0	-	0	0	31.8	62.6
	2.24	PPI	16*	21*	21.6*	52.6
		POST-0	8	8	25.1	61.8
		POST-2	0	1	30.7	63.0
		POST-4	0	8	33.0	60.9
	4.48	PPI	28*	31*	18.4*	41.9*
		POST-0	8	16*	21.5*	56.5
		POST-2	3	6	28.8	70.2
		POST-4	0	20*	27.8	58.4
LSD (P = 0.05)			10	8	7.7	13.1
Cucumber	0	-	0	0	65.0	82.7
	2.24	PPI	38*	66*	38.5	50.8*
		PRE	55*	63*	40.3	48.0*
		POST-2	9	56*	47.5	54.6*
		POST-4	4	24*	64.9	60.3*
	4.48	PPI	85*	90*	4.4*	28.0*
		PRE	75*	89*	8.8*	26.5*
		POST-2	20	58*	39.9	45.5*
		POST-4	5	23*	61.8	50.5*
LSD (P = 0.05)			23	13	27.3	14.5

[a]PPI = preplant incorporated, PRE = immediately after seeding cucumber, POST-0 = immediately after transplanting pepper or tomato, POST-2 and POST-4 = 2 and 4 weeks after transplanting or seeding.

[b]Values followed by an "*" are significantly different from the control according to the LSD (P = 0.05) test.

WEED CONTROL IN TRANSPLANTED CRUCIFERS[1/]

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ABSTRACT

Fourteen herbicide treatments were evaluated on transplanted broccoli, cabbage and cauliflower at the Long Island Horticultural Research Laboratory at Riverhead, New York in 1984. Crops were transplanted on August 2, but a portion of the cabbage had to be replanted on August 13. Preplant incorporated treatments of napropamide and trifluralin were applied on August 1 and incorporated twice with spike tooth harrow. Early post-emergence applications of alachlor and metolachlor were made on August 7, (August 20 on replanted cabbage). Postemergence applications of fluazifop-butyl and sethoxydim were applied on August 30 with follow-up applications of the PP005 formulation of fluazifop-butyl made on September 18.

Plot size for chemical treatments was an area 4 rows (3.5 m) by 7.6 m. An extra row of broccoli was planted, but not used for phytotoxicity data. The weed control ratings were analyzed as a randomized complete block with four replications.

Barnyardgrass (*Echinochloa crus-galli* (L.) Beauv.) pressure was light. All treatments reduced the grass problem. The effectiveness of preplant incorporated DCPA applied alone at 6.72 kg/ha diminished with time. Complete to near complete control of barnyardgrass was achieved when DCPA was followed by one application of 0.28 or 0.56 kg/ha of the original formulation of fluazifop-butyl or 0.56 kg/ha of sethoxydim, or two applications of 0.28 or 0.56 kg/ha each of the PP005 formulation of fluazifop-butyl; combinations of trifluralin at 0.84 kg/ha with oxyfluorfen at 0.56 or 1.12 kg/ha; and single applications of alachlor or metolachlor at 1.68 kg/ha.

All treatments reduced purslane (*Portulaca oleracea* L.) pressure. Those that resulted in a high degree of control were alachlor at 1.68 kg/ha applied early post-plant, and trifluralin at 0.84 kg/ha followed by preplant applications of oxyfluorfen at 0.28, 0.56, and 1.12 kg/ha. In addition to the above treatments, metolachlor at 1.68 kg/ha and DCPA at 6.72 kg/ha applied alone gave commercial control of smartweed (*Polygonum pensylvanicum* L.).

Phytotoxicity was observed in all crops from postemergence applications of fluazifop-butyl and sethoxydim at 0.56 kg/ha. The PP005 formulation of fluazifop-butyl caused slightly more injury than the original formulation. The August 30 application of PP005 caused more injury than the application made on September 18th. Broccoli and cauliflower appeared more susceptible to the injury than cabbage. The damage appeared as necrotic spots on leaves which came in contact with the spray. Affected leaves did not reduce market appearance or quality. Yield or time of harvest did not appear to be affected. Some lower leaf speckling was observed in one replication of the 1.12 kg/ha oxyfluorfen treatment. This was not observed in other crops or in other replications.

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Table 1. The effect of fourteen herbicide treatments on weed control in transplanted crucifers, Riverhead, N.Y., 1984[a/]

Treatment[b/]			Weed control ratings[c/]					
			Barnyardgrass		Purslane		Smartweed	
Chemical	kg/ha /appl.	Timing	8/28	9/26	8/28	9/26	8/28	9/26
No herbicide			6.8	7.0	3.8	4.8	7.0	6.0
trifluralin	1.12	PPI	8.3	8.5	6.3	6.3	7.3	6.3
trifluralin	0.84	PPI						
followed by:								
napropramide	1.12	PPI	8.3	8.5	6.0	6.5	6.8	6.5
oxyfluorfen	0.28	Pre	8.3	8.5	8.8	8.8	8.0	7.5
oxyfluorfen	0.56	Pre	9.0	9.0	8.8	8.8	8.0	7.5
oxyfluorfen	1.12	Pre	8.8	9.0	8.8	9.0	8.5	8.8
metolachlor	1.68	E Post	8.8	8.8	6.5	6.5	7.8	7.5
alachlor	1.68	E Post	8.8	9.0	8.5	8.5	7.5	7.0
DCPA	6.72	PPI	8.0	7.8	7.0	7.8	6.8	7.0
followed by:								
fluazifop-butyl (F)	0.28	Post	7.8	8.8	4.8	5.5	6.8	5.3
fluazifop-butyl (F)	0.56	Post	8.0	9.0	6.5	6.8	7.0	6.5
fluazifop-butyl (P)	0.28	Post	8.0	8.8	6.3	6.5	7.0	6.5
fluazifop-butyl (P)	0.56	Post	7.5	9.0	5.8	6.0	6.3	5.8
sethoxydim	0.56	Post	8.3	9.0	5.3	5.8	7.0	5.8
Waller-Duncan (0.05)			(1.1)	(ns)	(1.5)	(1.3)	(ns)	(1.3)

a/ Transplanted 8/2/84 (some cabbage replanted on 8/13/84). Plot size 3.5 m by 7.6 m, four replications.

b/ All treatments applied with CO_2 pressurized sprayer. Dates of application PPI = 8/1/84, Pre = 8/2/84, E Post = 8/7/84 (8/20/84 on replanted cabbage) and Post = 8/30/84 with (P) treatments applied again 9/18/84. (F) = commercial formulation of Fusilade, (P) = experimerimental formulation PP005. All applications of fluazifop-butyl and sethoxydim applied in 1% v/v dilution of Booster plus E.

c/ Weed control ratings based on a scale of 1 to 9; 9 = absence of weed species, 7 = a few weeds but commercially acceptable, 1 = complete ground cover with weeds.

Table 2. The effect of selective grass herbicides on crucifer injury[a/].

Treatment[b/]		Phytotoxicity ratings[c/]					
		Cabbage		Cauliflower		Broccoli	
Chemical	kg/ha /appl.	9/5	9/25	9/5	9/25	9/5	9/25
No herbicide		9.0	9.0	9.0	9.0	9.0	9.0
trifluralin							
followed by:							
fluazifop-butyl (F)	0.28	8.8	-	8.0	-	8.8	-
fluazifop-butyl (F)	0.56	7.5	-	6.5	-	7.3	-
fluazifop-butyl (P)	0.28	8.8	9.0	8.0	8.3	8.0	8.3
fluazifop-butyl (P)	0.56	7.0	7.3	6.0	7.0	6.3	6.8
sethoxydim	0.56	7.0	-	6.3	-	6.0	-
Waller-Duncan (0.05)		(0.9)	(0.6)	(0.7)	(0.6)	(0.9)	(1.0)

a/ See Table 1, footnote a.

b/ See Table 1, footnote b.

c/ Phytotoxicity ratings based on a scale of 1 = 9; 9 = no injury, 7 = moderate injury but no yield or quality reduction, 1 = all crop plants killed.

EFFECT OF SEEDING DEPTH AND IRRIGATION ON ETHALFLURALIN INJURY TO CUCUMBER

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ABSTRACT

Ethalfluralin (N-ethyl-N-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoromethyl)benzenamine) was phytotoxic to cucumber (Cucumis sativus L.) when surface sprayed at 1.7 or 3.4 kg ai/Ha. The injury was significantly greater when irrigation rates of 3 mm and 13 mm were applied after spraying the herbicide.

Cucumber plants seeded 2.5 cm deep were less injured than when a 1.3 cm depth was used. The literature and data obtained indicate that ethalfluralin is more injurious to the plants when it is moved into the root zone by irrigation.

INTRODUCTION

Cucumbers, because of their vining growth habit are difficult to weed with a cultivator. They are equally difficult to weed with a herbicide. Currently, only a few herbicides are available for weed control in cucumber and these compounds have specific limitations (2,5,6). Because weed control has been of short duration or variable with available herbicides, their use has not been extensive (4).

Ethalfluralin has shown great potential for use on cucumbers. However, some researchers have found erratic control when ethalfluralin was applied (2,3,4,5,7,8).

This experiment was conducted at the University of Connecticut Plant Science Field Laboratory in Storrs, Connecticut, to evaluate phytotoxicity to cucumber plants seeded at different depths when irrigation was applied after spraying of ethalflualin.

MATERIAL AND METHODS

On June 8, 1983, cucumber cultivar 'Roadside Fancy' was planted in rows 3 M long with 0.91 M between rows and 15 cm between plants. The soil type was a Woodbridge fine sandy loam (coarse loamy, mixed, mesic, Aquic Dystrochrept) with a pH of 6.2 and 6 to 7% organic matter. The field was plowed and then disked twice and all surface stones removed with a metal rake.

Ethalfluralin rates were: an untreated control, 1.7 kg ai/Ha (the commercial rate) and 3.4 kg ai/Ha. The plants were seeded at two different depths: 1.3 cm and 2.5 cm. Ethylfluralin was applied immediately after seeding with a compressed air sprayer in 374.1 L/Ha of water at a pressure of 2.81 kg/cm at normal walking speed (5 km/h).

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Treatments were arranged in a split plot design, with four replicates per treatment. There were three irrigation rates: an unirrigated control, 3 mm and 13 mm applications of water.

An hour after the herbicide was sprayed, irrigation was applied. The plants were handweeded when required and the entire field managed according to standard commercial practices. Cucumbers were harvested on July 26, July 29, August 3 and August 15 and total yield recorded.

June of 1983 was very dry. After planting and treating this experiment on June 8 no natural rainfall occurred for 19 days. On June 28-29, 2.5 cm of rainfall was recorded. A summary of monthly rainfall is found in Table 1.

Table 1. Summer 1983 Rainfall Data

Month	1983 precp. (cm)	30 year avg. precp. (cm)	Percentage of avg.
May	14.5	9.9	148
June	5.6	8.8	64
July	3.8	9.9	39
August	7.6	12.5	60
September	3.6	10.4	35

RESULTS AND DISCUSSION

The data indicates that as irrigation increases, the injury to cucumbers from ethalfluralin becomes greater (Table 2). This observation suggests leaching of the product and supports findings by Derr and Monaco (2) regarding root absorption of ethalfluralin as the main cause of injury.

Table 2. Effect of irrigation on phytotoxicity of ethalfluralin to cucumber.

Water (mm)	Avg. Yield/Plot (kg)	Perctg. surv.
0	12.6 a[1]	83.7 ab[1]
3	10.3 b	89.0 a
13	8.0 c	78.8 b

1 = Means in the same column followed by the same letter are not significantly different at the 5% level using Duncan's Multiple Range Test. Means represent the average of three herbicide rates and two seeding depths.

The higher rate of irrigation (13 mm) brought about the greatest injury at both seeding depths and for both herbicide rates (Table 3). At the 1.3 cm seeding depth, with no irrigation the commercial herbicide rate (1.7 kg/Ha) reduced the yield by only 0.8 kg; but when 13 mm of water were applied after the spraying, the reduction was of 5.6 kg. For the double rate (3.4 kg/Ha) the yield decreased by 6.7 kg when the 13 mm rate of water was applied. For the 3 mm rate, the injury and yield reductions were not as high as for the 13 mm rate, but proved to be sufficient to provoke a significant herbicidal injury at both herbicide rates and seeding depths.

Table 3. The effect of irrigation and seeding depth on phytotoxicity of ethalfluralin to cucumber.

Seed depth (cm)	Ethalfluralin rate (kg/Ha)	Water (mm)	Avg. yield Plot (kg)[1]	Perctg surv.[1]
1.3	0	0	13.0 a[2]	87 abc[2]
1.3	1.7	0	12.1 cd	76 c
1.3	1.7	3	10.8 e	87 abc
1.3	1.7	13	7.4 h	81 bc
1.3	3.4	0	11.9 g	81 bc
1.3	3.4	13	5.3 i	60 d
2.5	0	0	13.0 a	84 bc
2.5	1.7	0	12.8 ab	87 abc
2.5	1.7	3	10.7 e	100 a
2.5	1.7	13	10.0 f	93 ab
2.5	3.4	0	12.5 bc	87 abc
2.5	3.4	3	10.2 f	87 abc
2.5	3.4	13	9.2 g	81 bc

1 = The weights and percentages are the averaged result of 4 rows.
2 = Means in the same column followed by the sameletter are not significantly different at the 5% level using Duncan's Multiple Range Test.

Irrigation was the main factor in the manifestation of the injury problem. Where there was no water applied after spraying, the herbicide was only slightly phytotoxic at the 1.3 cm depth and there has no injury at the 2.5 cm depth. Irrigation cause a significant injury at both herbicide rates and seeding depths. These results support the findings of Derr and Monaco (2) on greater injury related to presence of rain and also explains why there are so many apparent contradictions in the literature concerning the phytotoxicity of ethalfluralin to cucumbers. Injury would depend on the amount of rainfall or irrigation following treatment.

There were also significant differences between the results found for the two planting depths (Table 4). The 2.5 cm depth proved to be safer for the plants under high rates of water and herbicide. When there was no irrigation applied, a slight yield reduction was observed where the 3.4 kg/Ha rate of ethalfluralin was applied although no stand reduction was observed. No injury was noted from the 1.7 kg/Ha application (Table 3). At the 1.3 cm depth, all treatments resutled in crop injury as indicated by yield reductions. As the herbicide rate and /or irrigation rate increased the injury was more severe.

It can be concluded that the phytotoxicity of ethalfluralin to cucumber plants is directly related to its leaching by water. Irrigation or rainfall can alter drastically the safety of the product, which can explain its erratic behavior. Ethalfluralin works well when applied on the soil surface under low rainfall conditions, providing good weed control and causing little injury. When soil incorporated (4,5,9) it becomes phytotoxic to cucumber plants. Rain provides the same type of incorporating effect by leaching the product and increasing the possibility of injury. This finding does not agree with the literature that states ethalfluralin, like most dinitroaniline herbicides, shows negligible leaching (1).

Table 4. Effect of seeding depth on phytotoxicity of ethalfluralin in cucumbers.

Seeding depth (cm)	Avg. Yield/Plot (kg)	Perctg. surv.
1.3	10.0 b[1]	79.1 b[1]
2.5	11.2 a	88.4 a

1 = Means in the same column followed by the same letter are not significantly different at the 5% level using Duncan's Multiple Range Test. Means represent the average of three herbicide rates and three irrigation levels.

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ALACHLOR, DIETHATYL-ETHYL, AND METOLACHLOR ON SEEDED BEETS, SPINACH, CARROTS, AND CABBAGE

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In May, 1983 crop safety and weed efficacy ratings were taken from field plots which included alachlor, diethatyl-ethyl, and metolachlor on seeded table beets, 'Ruby Queen' and spinach 'Dk Gr Bloomsdale'. All three herbicides were applied at 2.0 lb/A either preplant incorporated or preemergence on a Howard Gravelly Loam with a pH of 6.2 and O.M. content of 3.3%.

All herbicides at both timings provided excellent control of pigweed (Amaranthus retroflexus L.) and common lambsquarter (Chenopodium album L.) in both crops. Crop safety, however, was another matter. At both timings alachlor eliminated the beet crop and reduced spinach stand vigor by 40-50%. The preemergence timing of metolachlor also caused early stunting of both beets and spinach, but the two crops quickly recovered and subsequent crop development appeared unaffected. Diethatyl-ethyl did not injure either crop and was considered the safest of the three materials.

In 1984 these same three materials at the same rates and timings were used on beets 'Ruby Queen', carrot 'Royal Chantenay' and seeded cabbage 'Amager Green Storage' in late July. The soil type was an Eel Silt Loam with a pH ranging between 6.2-7.3 and an O.M. content of 3.1-3.6%. Weed efficacy, crop safety ratings and crop yields were taken.

The preplant incorporated timing of all three materials provided similar and acceptable control of both pigweed and lambsquarters, while a preemergence timing of diethatyl-ethyl was less effective on both of these weed species than either alachlor or metolachlor.

When applied as preplant incorporated treatments all three materials were safe on beets. The preemergence timing of alachlor alone significantly reduced beet root numbers by 50%. The lowest root yield was also associated with the preemergence timing of alachlor.

All applications of alachlor, metolachlor and diethatyl-ethyl significantly reduced stands and yields of carrots when compared to the standard chemical checks, trifluralin plus linuron. Greater stand reductions occurred with alachlor than with metolachlor or diethatyl-ethyl when applied as preplant incorporated treatments. However, the differences were not statistically significant.

No significant differences in average head weight, head number, or total yields of cabbage were observed among the three herbicides.

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ANNUAL WEED CONTROL IN EARLY TRANSPLANTED CABBAGE

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ABSTRACT

Two field experiments were conducted at the Massachusetts Agricultural Experiment Station in South Deerfield to evaluate the effectiveness and safety of several herbicides for use in early transplanted cabbage. Major weed species were large crabgrass [*Digitaria sanguinalis* (L.) Scop.], fall panicum [*Panicum dichotomiflorum* Michx.], redroot pigweed [*Amaranthus retroflexus* (L.)]. Herbicide treatments were applied on May 15 and 16 on one row plots of cabbage 'Market Prize'. Rows were 7 m long and 1 m apart while the seedlings were hand transplanted 45cm apart into a Hadley fine sandy loam soil. Treatments were replicated four times in a randomized complete block design. Weed control and crop injury ratings were taken on June 21. Ten cabbage heads were harvested per plot and separated into marketable and non-marketable types. Total yield, marketable and non-marketable cabbage yields, and head size were determined. At harvest weed biomass samplings were taken.

In the first experiment, treatments were applied using various rates of bensulide, DCPA, trifluralin, napropamide, alachlor, metolachlor, and oxyfluorfen, either alone or in combination. In the second experiment, same herbicide treatments at lower rates were followed by a hand cultivation four weeks later. Each experiment contained hoed and untreated checks for comparison.

Five weeks after application, all herbicide treatments provided excellent (above 90%) control of annual weeds. Weed control was 100% for all treatments with cultivation. Significant crop injury was noted with the treatments of napropamide at 1.68, metolachlor at 1.68, trifluralin plus oxyfluorfen at 0.84 + 1.68, and alachlor plus oxyfluorfen at 1.68 + 0.43 kg/ha. All plants recovered by harvest and resulted in no significant yield reduction.

Cultivation following any of the herbicide treatments increased total cabbage yield as compared to herbicide treatments alone. Yield increases ranged from 7% for the trifluralin plus oxyfluorfen treatment to 63% for the DCPA treatment. Cabbage yield reduction (9 to 30%) was observed when no weed control method was used and the quality of cabbage declined. The best marketable cabbage head yield came from the treatment of trifluralin plus oxyfluorfen at 0.84 and 1.68 kg/ha, with an increase of 54% over the untreated check. On the other hand, the treatment providing the best cabbage yield was DCPA at 5.6 kg/ha, with a 56% increase over the untreated check. Comparing these two, the herbicide plus cultivation treatment yielded 22% more than the herbicide treatment alone. The average largest head diameter for herbicide treatments alone was 17.8 cm as compared to 19.3 cm for those with cultivation following herbicide treatments. Smallest head diameters averaged 13.9 and 15.7 cm for herbicide and herbicide plus cultivation, respectively. Data indicate that cabbage yields can be maintained with low rates of herbicides if they are followed by one cultivation.

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HERBICIDE EVALUATION FOR SPRING & FALL COLE CROPS

W. Edwin Kee[1]

ABSTRACT

Three field experiments were conducted over two years to evaluate weed efficacy and crop safety of several pretransplant incorporated, pretransplant, and post transplant herbicides on several varieties of cabbage [Brassica oleracea var. capitata L. ("Round Dutch", "Jersey Wakefield", "Marketprize" and "Rio Verde)], cauliflower (Brassica oleracea var. italica L. "Snow Crown"), broccoli (Brassica oleracea var. botrytis L. "Waltham 29"), and brussels sprouts (Brassica oleracea var. gemmifera L. "Jade Cross"). Good grass and broadleaf weed control occurred at all rates of oxyfluorfen. Phytotoxic injury occurred on spring planted cabbage with oxyfluorfen at 0.50 and 1.00 lbs ai/acre. Napropamide at 2 and 4 lbs ai/acre and metolachlor at 1.25 lbs ai/acre also provided injury in the spring. In 1984 spring cabbage yield data were taken and napropamide and the metolachlor-oxyfluorfen combination adversely affected yields.

Oxyfluorfen at the lower rates of 0.25 + 0.375 lbs ai/acre and in combination with trifluralin at 0.75 lbs ai/acre provided good weed control and crop safety. All crops were tolerant to sethoxydim and fluozifop-butyl.

INTRODUCTION

Trifluralin (a, a, a-trifluoro-2,6-dinitro-N, N-dipropyl-p-toluidine) incorporated prior to transplanting is the standard herbicide for cole crops in Delaware. This material is excellent for grass control, but can be lacking on certain broadleaf weeds such as lambs quarters (Chenopodium album L), galinsoga (Galinsoga spp.) and common purslane (Portulaca oleraca L.). Several newly developed or recently labeled herbicides were evaluated for efficacy and crop safety. Oxyfluorfen (2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-trifluoromethyl)benzene), napropamide (2-(a-naphthoxy)-N, N-diethylpropionamide), and metolachlor (2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide) were evaluated for possible effectiveness on broadleaf weeds both alone and in certain combinations. The post-emergent grass control materials sethoxydim (2- {1-(ethoxyimino) butyl} -5- {2-(ethylthio) propyl} -3-hydroxy-2-cyclohexen-1-one) and fluazifop-butyl) ((±)-butyl 2- {4-{{5-trifluoromethyl)-2-pyridinyl}3 oxy}3 phenoxy} propanate) were evaluated for grass control and crop safety.

Reports in New York[2, 3, 6], New Jersey[5], Beltsville, Maryland[4] and Virginia[1] indicate that these materials may be effective on cole crops in Delaware.

MATERIALS AND METHODS

In spring of 1983, pretransplant surface applied sprays of oxyfluorfen alone at 0.25, 0.375, 0.50, and 1.00 lbs ai/acre; pretransplant surface applied sprays of oxyfluorfen at 0.375 lbs ai/acre in combination with metolachlor at 1.25 lbs ai/acre; pre-transplant surface applied sprays of metolachlor alone at 1.25 lbs ai/acre; and post transplant sprays of fluazifop-butyl at 0.25 and 0.50 lbs ai/acre

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and sethoxydim at 0.38 lbs ai/acre were evaluated for efficacy and crop safety. All sprays in all experiments were applied in water at 20 gals/acre with 8003 tips at 34 psi, except the post-emergent treatments which were applied in petroleum based or vegetable based crop oil on a 1% volume to volume basis. The "Round Dutch" and "Jersey Wakefield" cabbage varieties were planted in two row plots, each variety in one row, the rows 30 inches apart and plants 18 inches apart in the row. This spacing is constant for all experiments. The transplants were planted in April 13. All pre-transplant sprays were applied on April 13 and post-emergence grass control sprays were applied on June 10. Ratings were made on May 11 and June 25.

On August 16, 1983, broccoli var. "Waltham 29", cauliflower var. "Snow Crown", cabbage var. "Marketprize" and Brussels sprouts "Jade Cross" were planted to evaluate crop tolerance to oxyfluorfen at 0.25, 0.375, and 0.50 lbs ai/acre. Ratings were made on October 15.

On April 11, 1984, a cabbage (var. "Rio Verde") study was set out. Pre-transplant incorporated treatments of trifluralin at 0.75 lbs ai/acre alone and in combination with pre-transplant surface applied sprays of oxyfluorfen at 0.25, 0.38, 0.50, and 1.00 lbs ai/acre were applied. Oxyfluorfen was evaluated alone as a surface applied spray at 0.38 lbs ai/acre. Metolachlor at 1.25 lbs ai/acre alone and in combination with oxyfluorfen at 0.38 lbs ai/acre were also applied. The metolachlor was applied after transplanting while the oxyfluorfen was applied pre-transplant. A treatment of fluazifop-butyl at 0.25 lbs ai/acre was also applied on June 12. Pre-transplant incorporated treatment of napropamide alone at 2 and 4 lbs ai/acre and napropamide pre-transplant incorporated at 2 lbs ai overlayed with a surface spray oxyfluorfen at 0.38 lbs ai were also evaluated.

Ratings were made on May 15. Harvest data from two harvest dates seven days apart were taken on June 28 and July 5. The eight largest heads were cut and weighed for each harvest.

RESULTS AND DISCUSSION

In the spring of 1983 test oxyfluorfen at 0.25 and 0.375 lbs ai/acre gave acceptable grass and broadleaf control with no crop injury. There were no varietal differences. The higher rates of oxyfluorfen (0.50 and 1.00) produced significant crop injury. Metolachlor also produced crop injury. Fluazifop-butyl and sethoxydin produced essentially no crop injury whether sprayed with petroleum based crop oil or vegetable oil (Table 1).

TABLE 1

RESULTS OF SPRING 1983 HERBICIDE EVALUATION ON CABBAGE VAR. "JERSEY WAKEFIELD" AND "ROUND DUTCH"

	Treatment	Rate lbs ai/A	Timing	Rating 5/11 Grass	Rating 5/11 Bd Leaf	Rating 5/11 Phyto	Rating 6/25 Grass	Rating 6/25 Bd Leaf	Rating 6/25 Phyto
1.	Oxyfluorfen	0.25	Pre-trans.	9.75	10	0	7	10	0
2.	Oxyfluorfen	0.375	Pre-trans.	10	10	0	9	10	0
3.	Oxyfluorfen	0.50	Pre-trans.	10	10	3.75	10	10	3.5
4.	Oxyfluorfen	1.00	Pre-trans.	10	9.5	4	10	9	4
5.	Fluazifop-butyl	0.25	Post	9.5	8.5	0	10	7	0
6.	Fluazifop-butyl	0.50	Post	8.75	8.5	0	10	8	2
7.	Fluazifop-butyl	0.25	Post	9.75	8.75	1	10	7	0
8.	Sethoxydim	0.38	Post	9.25	8	0	10	8	1
9.	Metolachlor	1.25	Pre-trans.	10	10	3.5	9	10	5
10.	Metolachlor + Oxyfluorfen	1.25 + .375	Pre-trans.	10	10	4	10	10	6
11.	Check	------	----------	9.5	8.75	0	6	6	0

[1]Treatments 5, 6, and 8 were applied with a petroleum based crop oil on a 1% U/U basis. Treatment 7 was applied with vegetable oil on a 1% U/U basis.

Weed Control Ratings: 0 - No Control 10 - 100% Control
Phytoxocity Ratings: 0 - No Damage 10 - 100% Kill

The four cole crops planted in August, 1983, exhibited good tolerance to oxyfluorfen. The oxyfluorfen provided good weed control (Table 2).

TABLE 2

EFFECT OF OXYFLUORFEN
ON 4 FALL PLANTED COLE CROPS

	Rate Lbs ai/A	Rating 10/15/83 Grass	Bd Leaf	Phyto
Cauliflower				
Var. "Snow Crown"				
Oxyfluorfen	0.25	9	10	0
Oxyfluorfen	0.375	9	10	0
Oxyfluorfen	0.50	9	10	0
Check	-----	5	5	0
Cabbage				
Var. "Marketprize"				
Oxyfluorfen	0.25	9	9	0
Oxyfluorfen	0.375	10	10	0
Oxyfluorfen	0.50	9	9	0
Check	-----	6	5	0
Broccoli				
Var. "Waltham 29"				
Oxyfluorfen	0.25	9	10	0
Oxyfluorfen	0.375	9	9	0
Oxyfluorfen	0.50	9	10	0
Check	-----	6	6	0
Brussels Sprouts				
Var. "Jade Cross"				
Oxyfluorfen	0.25	10	10	0
Oxyfluorfen	0.375	9	10	0
Oxyfluorfen	0.50	10	10	0
Check	-----	7	5	0

Weed Control Ratings: 0 - No Control 10 - 100% Control
Phytoxocity Ratings: 0 - No Damage 10 - 100% Kill

In the spring of 1984 test, all herbicides gave some stunting when compared to the untreated check as indicated by the May 15 ratings. The most severe were metolachlor, napropamide, and oxyfluorfen at 0.5 and 1.0 lb ai/acre. Grass control was excellent in all treated plots. Oxyfluorfen and trifluralin, either alone or in combination gave acceptable grass and broadleaf control. Oxyfluorfen at 0.25 and 0.38 lbs ai/acre in combination with trifluralin produced some crop injury although it was commercially acceptable. By harvest, many of the treatments grew out of early season stunting as indicated by the harvest weight (Table 3).

TABLE 3

RESULTS OF SPRING 1984 HERBICIDE EVALUATION ON SPRING CABBAGE VAR. "RIO VERDE"

Common Name	Timing	Lbs ai/A	Ratings - 5/15 Grasses	Bd Leaf	Phytotoxicity	Yield Weight of 8 Heads Harvest Dates 6/28		Harvest Dates 7/5	
1. Trifluralin + oxyfluorfen	PPI + Pre-Trans.	0.75 + 0.25	10	10	1.6	25.83 lbs	ab	26.50 lbs	a
2. Trifluralin + oxyfluorfen	PPI + Pre-Trans.	0.75 + 0.38	10	10	2.3	26.25 lbs	ab	26.92 lbs	a
3. Trifluralin + oxyfluorfen	PPI + Pre-Trans.	0.75 + 0.5	10	10	4.3	20.41 lbs	abc	25.58 lbs	a
4. Trifluralin + oxyfluorfen	PPI + Pre	0.75 + 1	10	10	6	21.75 lbs	abc	28.75 lbs	a
5. Napropamicle	PPI	2	10	7	5	19.83 lbs	bc	26.50 lbs	a
6. Napropamicle	PPI	4	10	9.3	6.3	16.16 lbs	c	17.58 lbs	bc
7. Napropamicle + oxyfluorfen	PPI + Pre-Trans.	2 + 0.38	10	10	5.3	23.67 lbs	ab	24.25 lbs	ab
8. Oxyfluorfen + Fluazifop-butyl	Pre-Trans. Post	0.38 + 0.25	10	10	3	23.33 lbs	ab	25.92 lbs	a
9. Oxyfluorfen	Pre-Trans.	0.38	10	10	3	26.67 lbs	ab	26.08 lbs	a
10. Metolachlor	Post-Trans.	1.25	10	9.3	2.3	23.50 lbs	ab	26.92 lbs.	a
11. Metholachlor + oxyfluorfen	Post-Trans. Pre-Trans.	1.25 + 0.38	10	10	8.6	9.16 lbs	c	12.42 lbs	c
12. Trifluralin	PPI	0.75	10	8.3	1.3	25.67 lbs	ab	27.83 lbs	a
13. Check			3	2.6	---	27.33 lbs	a	24.67 lbs	ab

Weed Control Ratings: 0 - No Control 10 - 100% Control
Phytoxocity Ratings: 0 - No Damage 10 - 100% Kill

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WEED CONTROL IN TRANSPLANTED COLE CROPS WITH SOME NEW HERBICIDES[1]

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ABSTRACT

Post-transplant, surface-applied DCPA, pre-transplant, surface-applied dimethazone and oxyfluorfen alone, and preplant incorporated trifluralin: pre-transplant, surface-applied alachlor and metolachlor, post-transplant, surface-applied SD 94581, and postemergence sethoxydim applied alone and in combination with pre-transplant, surface-applied oxyfluorfen were evaluated in transplanted cabbage and cauliflower. Dimethazone completely controlled common lambsquarters *(Chenopodium album* L.), redroot pigweed *(Amaranthus retroflexus* L.), and common purslane *(Portulaca oleracea* L.), as well as grassy weeds but had no effect on carpetweed *(Mollugo verticillata* L.). Sethoxydim did not control broadleaf weeds and SD 94581 provided control only at the higher rate. DCPA and trifluralin applied alone gave inconsistent broadleaf control. Alachlor produced poor control of lambsquarters and metolachlor poor control of purslane and lambsquarters. Oxyfluorfen applied alone and in combination with all other herbicides produced excellent broad spectrum weed control. Oxyfluorfen applied alone and in combination with some rates of sethoxydim, SD 94581 or alachlor resulted in high cabbage yields which were significantly greater than the uncultivated check as well as some other treatments. Differences between treatments were not as common in cauliflower.

INTRODUCTION

To date, oxyfluorfen, [2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene], has not been labelled for use in cole crops. Recent studies have shown, though, that soil incorporated or surface-applied oxyfluorfen does not injure cabbage (2,3,4) or cauliflower (3). Oxyfluorfen has also been shown to be effective on some broadleaf weeds (1) and combinations of oxyfluorfen and herbicides possessing grass activity as well as with new postemergence grass herbicides have been shown to produce excellent broad spectrum weed control without reducing yields (5). Experiments in Massachusetts have shown trifluralin (α, α, α-trifluoro-2,6-dinitro-*N,N* dipropyl-*p*-toluidine) in combination with oxyfluorfen to be the most effective treatment for cabbage with respect to weed control and yield (2).

The objective of this study was to evaluate the effects of oxyfluorfen alone and in combination with other grass and broadleaf herbicides and to evaluate crop and weed tolerance to dimethazone (FMC 57020) [2-(2-chlorophenyl) methyl-4,4-dimethyl-3-isoxazolidinone] in both cabbage and cauliflower.

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[1]New Jersey Agricultural Experiment Station Publication No. J-15274-10-84.

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MATERIALS AND METHODS

A field study was conducted at the Soils and Crops Research Center, New Jersey Agricultural Experiment Station, Adelphia, N.J., 1984, to determine the effect of selected herbicides (Table 1) on transplanted cabbage and cauliflower. Separate but identical experiments were established for ball cabbage and cauliflower. The design was a randomized complete block with three replications. Plots were 1.8 m x 4.9 m with 10 plants per plot and were irrigated to insure adequate soil moisture.

Five-week old seedlings of 'Bravo' cabbage and 'Snow Crown' cauliflower were transplanted into a Freehold sandy loam soil having 1.5% organic matter on August 1. Herbicide treatments were applied either one day before transplanting and soil incorporated (PPI), one day before transplanting to the soil surface (PET), one day after transplanting over the top of the plants (POT), one day before transplanting to the soil surface followed by a treatment one day after transplanting over the top of the plants (PET + POT), and one day before transplanting to the soil surface followed by a treatment five weeks after transplanting over the plants (PET + POT I). 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 (Spraying Systems, Inc., Chicago, Ill.). PPI treatments were incorporated to a depth of 6.75 cm immediately after application using a rotovator.

Plots were rated for crop tolerance and weed control on August 31. Weed species rated were common lambsquarters (CHEAL), redroot pigweed (AMARE), and common purslane (POROL). Grasses were rated as a group and included fall panicum (*Panicum dichotomiflorum* Michx.), crabgrass *(Digitaria sanguinalis* (L.) Scop.), barnyardgrass *(Echinochloa crus-galli* (L.) Beauv.), and yellow foxtail *(Setaria glauca* (L.) Beauv.).

Ball cabbage was harvested on October 3, 11 and 12. Cauliflower was harvested on September 26, October 3, 11, 18, 22, 25 and 31. Herbicides used in the study were oxyfluorfen, trifluralin, dimethazone, DCPA (dimethyl tetrachloroterephthalate), metolachlor (2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)acetamide), alachlor (2-chloro-2',6'-diethyl-*N*-(methoxymethyl)acetanilide), SD 94581 [7-oxabicyclo (2.2.1) heptane, 1-methyl-4-(1-methylethyl)-2-(2-methyl-phenylmethoxy)-,exo-.], and sethoxydim [2-(1-(ethoxyimino)butyl)-5-(2-ethylthio)propyl)-3-hydroxy-2-cyclohexen-1-one].

RESULTS AND DISCUSSION

Data on crop injury, weed control and yield for cabbage and cauliflower are presented in Table 1. There were no significant differences between treatments for crop vigor but there were for weed control and yield for both crops.

Excellent grass control was effected by most herbicide treatments and there were no significant differences between them. Oxyfluorfen applied alone or in combination produced excellent broad spectrum weed control which was reflected in yield and related to herbicide rate for both cabbage and cauliflower. DCPA and trifluralin applied alone provided inconsistent control of broadleaf weeds. DCPA did not control pigweed in cauliflower while trifluralin did not control purslane or lambsquarters in cabbage. Plot variability was responsible for this response. Metolachlor did not control lambsquarters adequately and control of purslane was poor. Alachlor treatments also resulted in poor lambsquarters

control. Sethoxydim did not control broadleaf weeds and SD 94581 at 0.5 and 0.75 lb/A provided poor control of all broadleaf weeds.

Dimethazone did not control carpetweed but completely controlled grassy weeds, pigweed, lambsquarters, and purslane. Dimethazone caused significant visible injury to cabbage during the season. Bleaching occurred along the leaf margins and moved inwardly and plants were stunted. Cabbage yields from dimethazone treatments were significantly lower than most other herbicide treatments. This was not so for dimethazone in cauliflower.

No one single herbicide treatment resulted in yields significantly greater than the uncultivated check for both cabbage and cauliflower. Oxyfluorfen applied alone at 0.5 lb/A, the lowest rate of oxyfluorfen in combination with sethoxydim or with 1.0 lb/A alachlor, and oxyfluorfen applied at .38 lb/A with 0.5 or 0.75 lb of SD 94581 yielded significantly higher than the uncultivated check for cabbage. Oxyfluorfen applied at 0.38 lb resulted in significantly greater yields than the uncultivated check for cauliflower.

CONCLUSIONS

Soil applied oxyfluorfen at rates of 0.38 and 0.5 lb/A produced broad spectrum weed control and high yields of cabbage and cauliflower without crop injury. The low rate of oxyfluorfen at 0.25 lb effected the same result if combined with other herbicides. With regard to crop response, oxyfluorfen was more effective in cabbage than in cauliflower as indicated by increased yields in cabbage.

Dimethazone at both applied rates is not an appropriate herbicide for use in cabbage since it produces serious crop injury. Not as much injury was evident in cauliflower.

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Table 1. Crop tolerance, weed control, and yield for transplanted cabbage and cauliflower, Adelphia, N.J., 1984.(a)

Herbicide	Rate (lb.a.i./A) and Method[b]	Vigor		Weed Control (Stand)[c]							Yield (metric tons/ha)	
				Grasses		AMARE		POROL		CHEAL		
		Cabb.	Caul.	Cabb.	Caul.	Cabb.	Caul.	Cabb.	Caul.	Cabb.	Cabb.	Caul.
DCPA	9.0 POT	1.3	1.0	8.4a	9.0a	8.0a	3.1b	8.0a	7.3a	9.0a	1.76	1.17
trifluralin	0.75 (PPI)	2.3	1.0	4.1a	7.8a	9.0a	9.0a	4.6a	6.6a	3.6ab	1.59	1.48
oxyfluorfen	0.25 (PET)	1.3	1.6	6.8a	9.1a	10.0a	9.8a	10.0a	9.8a	10.0a	1.65	1.36
	0.38 (PET)	0.6	0.3	9.0a	9.8a	10.0a	10.0a	10.0a	10.0a	10.0a	1.75	2.01
	0.50 (PET)	1.6	1.3	9.1a	9.3a	10.0a	10.0a	10.0a	10.0a	10.0a	1.87	1.50
trifluralin + oxyfluorfen	0.75 (PPI) + 0.25	2.0	0.2	9.1a	9.8a	10.0a	10.0a	10.0a	10.0a	10.0a	1.45	1.74
alachlor	1.0 (PET)	3.0	2.3	10.0a	10.0a	10.0a	9.9a	9.2a	9.6a	4.6a	1.56	1.44
	1.5 (PET)	3.3	1.0	9.6a	9.8a	10.0a	10.0a	9.5a	9.6a	7.3a	1.12	1.13
metolachlor	1.0 (PET)	2.6	1.6	9.6a	9.3a	8.1a	5.6a	3.3a	2.6ab	1.0bc	1.18	0.89
	1.5 (PET)	2.3	1.6	9.8a	9.6a	9.6a	9.6a	7.3a	6.0a	3.0bc	1.13	1.19
oxyfluorfen + alachlor	0.25 + 1.0 (PET)	1.6	1.3	9.7a	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	1.82	1.20
	0.38 + 1.0 (PET)	3.3	0.3	9.9a	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	1.76	1.31
oxyfluorfen + metolachlor	0.25 + 1.0 (PET)	3.0	2.3	9.9a	10.0a	10.0a	10.0a	10.0a	10.0a	9.7a	1.59	1.61
	0.38 + 1.0 (PET)	2.6	1.3	9.9a	10.0a	10.0a	10.0a	9.8a	10.0a	9.9a	1.46	1.31
SD 94581	0.5 (POT)	2.3	1.6	9.8a	10.0a	7.1a	6.3a	5.0a	2.0ab	4.4ab	1.40	1.30
	0.75 (POT)	1.6	2.3	9.8a	9.6a	6.3a	4.5a	5.3a	4.8a	7.3a	1.65	1.04
	1.0 (POT)	2.0	1.6	10.0a	9.7a	8.6a	8.1a	7.8a	8.1a	9.3a	1.46	1.05
oxyfluorfen + SD 94581	0.25 + 0.5	1.3	0.3	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	1.71	1.79
	0.25 + 0.75	2.0	3.0	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	1.52	1.50
	0.25 + 1.0	1.3	3.0	10.0a	9.8a	10.0a	10.0a	10.0a	10.0a	10.0a	1.61	1.26
(PET) + (POT)	0.38 + 0.5	1.3	2.6	10.0a	10.0a	10.0a	10.0a	9.9a	10.0a	9.9a	1.92	1.31
	0.38 + 0.75	1.0	2.0	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	1.92	1.89
	0.38 + 1.0	4.3	3.0	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	1.64	1.25
sethoxydim + COC 1 qt/A	0.5 (POT I)	0.6	1.0	0.0c	0.0c	1.6b	7.8a	0.0b	1.0b	3.0bc	1.38	1.10
oxyfluorfen f. by sethoxydim + COC 1 qt/A	0.25 (PET) + 0.25 (POT I)	1.0	2.0	5.5a	8.3a	10.0a	10.0a	10.0a	9.9a	9.7a	1.96	1.39
	0.25 (PET) + 0.50 (POT I)	1.3	1.0	5.8a	8.0a	10.0a	10.0a	9.8a	9.8a	10.0a	2.09	1.72
dimethazone (FMC 57020)	0.75 (PET)	5.3	5.6	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	0.65	1.36
	1.0 (PET)	7.0	3.3	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	0.46	1.41
Uncultivated Check		1.6	1.6	0.0b	3.3b	0.0c	3.0b	0.0b	3.3b	0.0c	1.26	0.65
Cultivated Check		0.6	1.6	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	10.0a	2.25	1.23
LSD 0.05											0.55	0.75

(a)Means in each column with different letters are significantly different at the LSD = 0.05.

(b)(POT) = Post-transplanting (Preemergence to weeds)
(POT I) = Post-transplanting (Postemergence to weeds, 5 weeks after planting).
(PET) = Pre-transplanting
(PPI) = Pre-transplanting Incorporated

(c)Based on a scale of 0 to 10, where 0 = no effect on weed or crop and 10 = complete kill.
AMARE = Redrood Pigweed; POROL = Common Purslane; CHEAL = Common Lambsquarters
Cabb. = cabbage; Caul. = cauliflower

HEXAZINONE AND TERBACIL TO SUPPRESS WEEDS IN A COMMERCIAL LOWBUSH BLUEBERRY FIELD

Antonia L. Hoelper and David E. Yarborough[1]

ABSTRACT

A study to determine the effect of 0, 1.1 and 2.2 kg/ha hexazinone tank-mixed with 0, 1.1 and 2.2 kg/ha terbacil on weed populations and on lowbush blueberry (Vaccinium angustifolium and V. myrtilloides) growth and yield was established on a commercial blueberry field in Crawford, ME in May 1983. Experimental design was a randomized complete block with 9 treatments replicated 7 times. Subjective ratings of weed control, in both prune and crop years, and population counts of meadowsweet (Spiraea latifolia), goldenrod (Solidago sp.) and bracken fern (Pteridium aquilinum) revealed that adding terbacil did not increase efficacy compared to applying hexazinone alone. Combining the herbicides did not increase blueberry stem or flower bud count over the control, but blueberry flower buds and yield increased with hexazinone treatment.

INTRODUCTION

Improved weed control has been identified by the lowbush blueberry growers in Maine as a priority to increase yield and quality of wild blueberries (7). Few herbicides have been registered and resistant and invading weed species continue to increase despite control practices.

Hexazinone [3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4-(1H,3H)dione] has a half life of less than four months on a silt loam and is readily broken down by soil microorganisms (9). This lack of persistence allows weeds to recolonize bare spots (3). Doohan (1) controlled grasses (Gramineae sp.) with hexazinone, but regrowth occurred at the end of the summer. Doohan (2) and Jensen (6) proposed that tank-mixing hexazinone with a more residual herbicide may increase and prolong suppression.

In a study conducted by Doughty (4), terbacil (3-tert-butyl-5-chloro-6-methyluracil) residues remained active in the soil one year after being applied in a highbush blueberry (V. corymbosum) planting. Shawa (10) applied terbacil for weed control in cranberries (V. macrocarpon) and observed that terbacil residues were evident up to three years later. In both studies, no phytotoxicity to blueberry or to cranberry occurred.

The objectives of this study are to determine the effect of terbacil combined with hexazinone for woody and herbaceous weed control in a lowbush blueberry field and to determine their effect on blueberry growth and yield.

MATERIALS AND METHODS

This study was established on 10 May 1983 in a commercial blueberry field on a Marlowe, fine, sandy loam with a thick organic mineral layer in

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the A horizon[2]. A randomized complete block design was replicated 7 times. Each plot was 3 by 15 m with 2 by 15 m buffer zones between plots.

Hexazinone was applied on 11 May 1983 at 0, 1.1 and 2.2 kg/ha in all possible combinations with 0, 1.1 and 2.2 kg/ha of terbacil for a total of 9 treatments. Treatments were applied after pruning by fire, but before blueberry and weed stems began to emerge. Plots were sprayed twice with the 1.1 kg/ah mixtures to produce the 2.2 kg/ha rates. Herbicides were diluted in 187 L/ha water and applied at 241 kPa pressure.

On 15 September 1983 and on 30 July 1984, the effect of herbicide on grasses, bracken fern, meadowsweet, goldenrod and phytotoxicity to blueberries were subjectively rated using a 0 to 10 scale, where 0 = no effect and 10 = complete suppression. In September 1983, meadowsweet, goldenrod and bracken fern stems were counted from a 1 by 15 m subsample in each plot.

Two - 0.1 m^2 subsamples of blueberry stems were cut to ground level from each plot on 20 October 1983. Stem length was measured and stems, flower buds per stem and laterals were counted. Average number of buds per stem, average stem length per plot and number of stems per plot were calculated from these data.

Blueberries were harvested using hand-held rakes on 13 and 14 August 1984. Berries were weighed to the nearest 20 g with a suspended, spring scale.

The Statistical Analysis System (SAS) (8) was used to analyze data by variance with an F test at the 5% level of probability to establish significance. Orthogonal contrasts at a single degree of freedom were used to identify trends for herbicide rates.

RESULTS AND DISCUSSION

Subjective ratings in 1983 revealed that terbacil effected a 9 (PR>F=.0004) control rating for grasses on the untreated hexazinone plots, but 1.1 kg/ha hexazinone gave complete control even when no terbacil was applied. Terbacil did not reduce any of the other weed species rated (Table 1), and when added to hexazinone did not increase efficacy. Hexazinone controlled meadowsweet and goldenrod in both years, but bracken fern control was only detected in the crop year (Table 1). Ratings made in 1984, revealed that terbacil did not suppress any of the species evaluated, but hexazinone still suppressed weeds (Table 1). Weed counts of meadowsweet, goldenrod and bracken fern had the same trends as subjective ratings (Table 1). As Trevett and Durgin (11) indicated, terbacil effectively controlled grasses but not woody weeds. Residual grass control from terbacil in the crop year was not obtained.

Increasing the rate of terbacil from 0 kg/ha to 2.2 kg/ha within the 0, 1.1 or 2.2 kg/ha hexazinone rates did not affect blueberry stems or buds (Table 2). Hexazinone applied without terbacil, increased average buds per stem from 0.89 in the control to 1.73 at 1.1 kg/ha to 1.69 at 2.2 kg/ha (PR>F = .0091). Ismail and Yarborough (5) detected a similar

[2]Soil classification determined by Dana Nelson, Washington County Soil and Water District Conservationist, Machias, ME 04654.

Table 1. Effect of hexazinone and terbacil on weed control in a lowbush blueberry field - Crawford, ME

Hexazinone Rate (kg/ha)	Terbacil Rate (kg/ha)	Grasses 1983 (0-10)[a]	Grasses 1984 (0-10)	Meadowsweet 1983 ($15m^2$)	Meadowsweet 1983 (0-10)	Meadowsweet 1984 (0-10)	Bracken Fern 1983 ($15m^2$)	Bracken Fern 1983 (0-10)	Bracken Fern 1984 (0-10)	Goldenrod 1983 ($15m^2$)	Goldenrod 1983 (0-10)	Goldenrod 1984 (0-10)
0	0	0	1	356	0	0	28	0	0	38	0	0
0	1.1	6	5	350	0	0	18	0	0	60	0	1
0	2.2	9	6	293	0	1	9	0	0	43	0	0
F-test		**[b]	NS[c]	NS	NS	NS	NS	NS	NS	NS	NS	NS
Trend		L[c]										
1.1	0	10	9	0	10	10	21	3	6	0	10	9
1.1	1.1	10	9	5	10	8	7	8	6	0	10	8
1.1	2.2	10	10	0	10	10	4	7	9	0	10	10
F-test		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
2.2	0	10	9	0	10	10	5	8	6	0	10	10
2.2	1.1	10	10	0	10	10	0	10	9	0	10	10
2.2	2.2	10	10	0	10	10	0	10	9	0	10	9
F-test		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
0	0	0	1	356	0	0	28	0	0	38	0	0
1.1	0	10	9	0	10	10	21	3	6	0	10	9
2.2	0	10	9	0	10	10	5	8	6	0	10	10
F-test		**	**	**	**	**	NS	NS	**	**	**	**
Trend		L	L	L	L	L			L	L	L	L

[a] 0-10 Scale - 0 = no effect and 10 = complete control

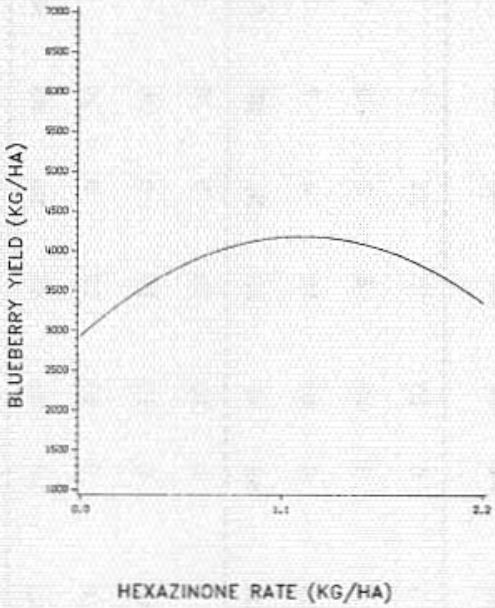
[b] ** = significance at 1%

[c] L = Linear Trend, NS = Non-significant

response on flower buds in an earlier experiment. Blueberry stem number and length were not affected by hexazinone (Table 2).

Terbacil applied within all rates of hexazinone had no effect on yield. When hexazinone was applied alone, yields increased from 2936 kg/ha for the control to 4148 kg/ha at the 1.1 kg/ha rate, but decreased to 3654 kg/ha at the 2.2 kg/ha rate (PR>F=.0266) (Figure 1). The increase in yield may be associated with the reduced competition between blueberry plants and weeds.

FIGURE 1
EFFECT OF HEXAZINONE ON BLUEBERRY YIELD



No advantage was obtained from tank-mixing terbacil and hexazinone to suppress weeds in the crop year. Hexazinone alone was more effective for woody and herbaceous weed control and terbacil did not provide residual control of grasses in the year following application.

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Table 2. Effect of hexazinone and terbacil on blueberry growth - Crawford, ME

Hexazinone Rate (kg/ha)	Terbacil Rate (kg/ha)	Injury 1983 (0-10)[a]	Injury 1984 (0-10)	Stem/0.1m^2	Average Stem length/0.1m^2	Average buds/stem
0	0	0	0	102	9cm	1
0	1.1	0	0	87	9	1
0	2.2	0	0	94	8	1
F-test		NS[b]	NS	NS	NS	NS
1.1	0	2	0	93	9	2
1.1	1.1	1	0	90	9	2
1.1	2.2	1	0	108	8	2
F-test		NS	NS	NS	NS	NS
2.2	0	1	0	107	9	2
2.2	1.1	3	0	107	8	1
2.2	2.2	3	0	87	8	2
F-test		**[c]	NS	NS	NS	NS
Trend		L				
0	0	0	0	102	9	1
1.1	0	2	0	93	9	2
2.2	0	1	0	107	9	2
F-test		**	NS	NS	NS	**
Trend		Q[b]				L[b]

[a]0-10 Scale - 0 = no effect and 10 = complete kill

[b]NS = Non-significant, L = Linear Trend, Q = Quadratic Trend

[c]** = Significance at 1%

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EFFECT OF TOMATO AND BLACK NIGHTSHADE GROWTH STAGE ON ACIFLUORFEN-SODIUM SELECTIVITY

S.F. Gorski[1/]

Black nightshade is increasing in severity in tomato fields throughout Ohio and surrounding states. Since it is a close relative of tomato, it is difficult to control with herbicides. Chloramben, a preemergence herbicide, is the only registered herbicide for use in tomatoes which will control black nightshade. Acifluorfen-sodium is a post emergence applied herbicide which provides control of black nightshade at relatively low use rates. At these low rates tomatoes exhibit some degree of tolerance. The purpose of this study is to evaluate low rates of acifluorfen-sodium for control of black nightshade and tolerance to tomatoes.

Field seeded tomatoes, as young as 2 true leaves, exhibit some tolerance to acifluorfen-sodium. At this early stage of growth use rates must not exceed 0.13 lbs ai/A and be of the commercial formulation without a surfactant. As the tomato plant grows it gains tolerance. At the 5 or 6 leaf stage plants will tolerate 0.25 to 0.38 lbs ai/A with little injury. Injury symptoms are typical contact type burning of the leaves. Apical meristermatic regions are generally not killed and regrowth soon occurs. Yield reductions occur if the rate is exceeded for the particular tomato growth stage.

Black nightshade seedlings can be controlled with rates as low as 0.13 lbs ai/A. Seedlings should be in the 2-4 leaf stage to be controlled at this rate. As the nightshade grows to the 3-4 inch stage rates of 0.25 to 0.38 lbs ai/A are required. Control of the broadleaf weeds is poor at these low use rates. Therefore acifluorfen-sodium would be considered for use as a black nightshade herbicide only.

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ACTIVATED CARBON FOR SAFENING METRIBUZIN IN PEPPERS (*Capsicum annum* L.)

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ABSTRACT

Metribuzin applied pretransplant injured peppers transplanted bare root or in plugs at 0.07 to 0.14 kg/ha. Activated carbon applied in the transplant water of bare root transplanted peppers, or incorporated into the greenhouse mix of plug transplanted peppers before seeding protected the crop from metribuzin injury at rates up to 0.56 kg/ha. The increase in crop tolerance to metribuzin was dependent on the rate of activated carbon added. One gram was needed to protect peppers from 0.56 kg/ha metribuzin. The level of crop protection for plug transplants depended on the amount of activated carbon per plant, not the percent in the greenhouse mix by dry weight. One gram was required to protect plug transplants grown in cells that held 10 g or 20 g of greenhouse mix.

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Combinations of Metribuzin and Post-Emergence Grass Herbicides for Weed Control in Transplanted Tomatoes

C.B. Lindgren and R.A. Ashley[1/]

Abstract

Metribuzin, alone and in combination with sethoxydim, fluazifop-butyl, SC-1084 and PP005 was evaluated for control of large crabgrass, redroot pigweed and lambsquarters in transplanted tomatoes. Field experiments were conducted during the summer of 1983 and 1984 at the University of Connecticut Plant Science Field Laboratory, Storrs, CT. In 1983, acceptable weed suppression and high tomato yields were obtained when the combination of metribuzin, sethoxydim and crop oil concentrate was applied. Similar results were obtained in 1984 although the combination of PP005 and metribuzin resulted in the highest yield. Some of the herbicide treatments caused significant crop injury and reduction in tomato yields were observed.

Introduction

Fluazifop-butyl (butyl 2(4-(5-trifluoromethyl-2-pyridinyl oxy)phenoxy) propanoate) and sethoxydim (2-(1-(ethoxyimino)-butyl)-5-(2-(ethylthio)-propyl)-3-hydroxy-2-cyclohexene-1-one) have received much attention for their post-emergence control of grasses in various horticultural crops. Along with fluazifop-butyl and sethoxydim, SC-1084 and PP005 butyl(R)-2{4-({5-(trifluoromethyl)-2-pyridinyl}oxy}phenoxy}propanoate have also shown promise as post-emergence grass herbicides. Metribuzin (4-amino-6-*tert*-butyl-3-(methylthio)-*as*-triazin-5(*4H*)-one), alone and in combination with the various post-emergence grass herbicides was evaluated for maximum efficacy. It was the objective of this study to compare rates and combinations of the various herbicides for weed suppression. Herbicide treatments were compared with clean cultivated check plots. Yield, crop injury and weed control ratings for large crabgrass (*Digitaria sanguinalis* (L.) Scop.), redroot pigweed (*Amaranthus retroflexus* L.) and lambsquarters (*Chenopodium album* L.) were obtained.

Materials and Methods

Plot size consisted of a single row three meters long with 1.22 meters between rows. The soil was a Woodbridge fine sandy loam (0-3 percent slope) having an organic matter content of 5-6%. Plots were arranged in a randomized complete block design with three replications.

In 1984 herbicides were applied with a compressed air pressurized tractor-mounted sprayer at 2.8 kg/cm^2 pressure and 374 liters of water per hectare. 1983 treatments were applied using a compresed air knapsack sprayer having the same pressure and delivery specifications.

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Tomatoes (Lycopersicon esculentum Mill.) were transplanted into the field on June 13 in 1983 and June 6 in 1984. Herbicides were applied June 24 in 1983 and June 20 in 1984. Air temperatures at treatment were 85°F in 1983 and 83°F in 1984 with virtually no wind either year. No rain fell during the first week after treatment in 1983 while 0.45 inches of rain fell during the first week after treatment in 1984. Tomato varieties consisted of 'Crimsonvee' in 1983 and 'Campbell 1327' in 1984. Weed control and crop injury ratings were taken on July 7 in 1983 and on June 25 and August 8 in 1984. Application rates are presented in Table 1 and Table 2.

Results and Discussion

Because treatments in 1983 and 1984 were somewhat different, each year will be discussed separately.

In 1983 (Table 1), the combination of metribuzin (0.28 kg/ha) and sethoxydim (0.22 kg/ha) was the only chemical treatment that resulted in significantly lower weed control ratings. Untreated plots had no effect on weed control. Both of the above treatments resulted in significant yield reduction. Combinations of metribuzin (0.28 kg/ha), SC-1084 (0.22 kg/ha) and crop oil (1% v/v) and metribuzin (0.28 kg/ha) fluazifop (0.22 kg/ha) and crop oil (1% v/v) resulted in significant crop injury but did not effect yields. The combination of metribuzin (0.28 kg/ha) and SC-1084 (0.22 kg/ha) resulted in poor yields even though crop injury and weed control were not significantly different from other combinations. Further investigation of this treatment was conducted in 1984.

In 1984 (Table 2), only the untreated plots resulted in significant yield reductions. Metribuzin without a post-emergence grass herbicide resulted in poor crabgrass and pigweed control. Metribuzin (0.56 kg/ha) plus sethoxydim (0.56 kg/ha) plus crop oil (1% v/v) and metribuzin (0.28 kg/ha) plus SC-1084 (0.22 kg/ha) plus crop oil (1% v/v) resulted in significant crop injury but did not reduce yields. The combination of metribuzin (0.28 kg/ha) plus PP005 (0.14 kg/ha) plus crop oil (1% v/v) was the only treatment that significantly increased tomato yields. Rapid reinfestation of weeds soon after weed control ratings were taken can account for lower yields in the cultivated check.

TABLE 1. Evaluation of combinations of metribuzin and several postemergence grass herbicides for weed control in transplanted tomatoes - 1983.

	TREATMENT	RATE (Kg ai/ha)	CROP INJURY[1]	WEED CONTROL RATINGS[1] CG[2]	PW[3]	LQ[4]	YIELD Kg/PLOT
1)	Metribuzin	0.28	0	8	9	9	10.9
2)	Metribuzin + Crop Oil	0.28 + 1% v/v	1	9	10	10	12.6
3)	Untreated	---	0	0	0	0	3.0
4)	Cultivated Check	---	0	10	10	10	17.4
5)	Metribuzin + SC-1084	0.28 + 0.11	0	9	9	10	10.7
6)	Metribuzin + SC-1084	0.28 + 0.22	0	9	10	10	8.4
7)	Metribuzin + SC-1084 + Crop Oil	0.28 + 0.11 + 1% v/v	1	10	10	10	13.1
8)	Metribuzin + SC-1084 + Crop Oil	0.28 + 0.22 + 1% v/v	2	10	9	10	15.9
9)	Metribuzin + Sethoxydim	0.28 + 0.11	1	9	9	10	12.0
10)	Metribuzin + Sethoxydim	0.28 + 0.22	1	4	5	6	7.1
11)	Metribuzin + Sethoxydim + Crop Oil	0.28 + 0.11 + 1% v/v	1	9	9	10	17.2
12)	Metribuzin + Sethoxydim + Crop Oil	0.28 + 0.22 + 1% v/v	1	10	9	10	12.2
13)	Metribuzin + Fluazifop	0.28 + 0.22	1	10	9	10	11.5
14)	Metribuzin + Fluazifop	0.28 + 0.33	1	10	9	10	13.6
15)	Metribuzin + Fluazifop + Crop Oil	0.28 + 0.22 + 1% v/v	2	10	10	10	13.9
16)	Metribuzin + Fluazifop + Crop Oil	0.28 + 0.33 + 1% v/v	0	10	10	10	14.5
LSD (0.05)			1.9	2.0	1.3	1.7	6.8

1. Rated on 0 to 10 scale with 0 = no effect and 10 = complete kill.
2. CG = Large Crabgrass (*Digitaria sanguinalis* (L.) Scop.)
3. PW = Redroot Pigweed (*Amaranthus retroflexus* L.).
4. LQ = Lambsquarters (*Chenopodium album* L.).

TABLE 2. Evaluation of combinations of metribuzin and several postemergence grass herbicides for weed control in transplanted tomatoes - 1984.

	TREATMENT	RATE (Kg ai/ha)	CROP INJURY[1]	WEED CONTROL RATINGS[1] CG[2]	PW[3]	LQ[4]	YIELD Kg/PLOT
1)	Metribuzin	0.28	0	3	2	6	5.4
2)	Metribuzin + Crop Oil	0.28 + 1% v/v	1	3	5	9	8.1
3)	Metribuzin + Crop Oil	0.56 + 1% v/v	0	5	10	10	9.6
4)	Untreated	---	0	0	3	0	0.9
5)	Cultivated Check	---	0	10	10	10	11.4
6)	Metribuzin + SC-1084	0.28 + 0.11	1	9	5	10	7.9
7)	Metribuzin + SC-1084	0.28 + 0.22	1	9	8	10	13.2
8)	Metribuzin + SC-1084 + Crop Oil	0.28 + 0.11 + 1% v/v	0	8	6	9	10.6
9)	Metribuzin + SC-1084 + Crop Oil	0.28 + 0.22 + 1% v/v	2	9	8	10	10.7
10)	Metribuzin + Sethoxydim	0.56 + 0.56	0	10	9	10	13.6
11)	Metribuzin + Sethoxydim	0.56 + 0.56 + 1% v/v	3	9	9	10	10.5
12)	Metribuzin + Fluazifop + Crop Oil	0.28 + 0.28 + 1% v/v	1	9	5	7	9.0
13)	Metribuzin + PP005 + Crop Oil	0.28 + 0.14 + 1% v/v	0	9	9	10	19.6
14)	Metribuzin + PP005 + Crop Oil	0.28 + 0.21 + 1% v/v	0	9	7	10	13.8
15)	Metribuzin + PP005 + Crop Oil	0.28 + 0.28 + 1% v/v	0	10	7	10	12.2
LSD (0.05)			1.8	4.3	4.0	4.0	8.0

1. Rated on 0 to 10 scale with 0 = no effect and 10 = complete kill.
2. CG = Large Crabgrass (*Digitaria sanguinalis* (L.) Scop.)
3. PW = Redroot Pigweed (*Amaranthus retroflexus* L.).
4. LQ = Lambsquarters (*Chenopodium album* L.).

EFFECT OF RATE AND TIME OF CLOPROPOXYDIM APPLICATIONS ON GRASS CONTROL IN WHITE POTATOES

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

ABSTRACT

Clopropoxydim was evaluated for grass control at four rates and two split applications. Rates of 0.14, 0.28, 0.34, and 0.42 kg ai/ha were applied at early post emergence of the round white potato (*Solanum tuberosum* L. 'Katahdin') crop. Rates for the split applications were 0.14 plus 0.14 and 0.34 plus 0.22 kg ai/ha. Quackgrass (*Agropyron repens* L.) control improved from unacceptable to acceptable levels as clopropoxydim rates increased. Both split applications provided the best quackgrass control in the experiment.

INTRODUCTION

Clopropoxydim [(E,E)-2-[1-[[(3-chloro-2-propenyl)oxy]imino]butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one] is a recently developed selective grass herbicide. It has been tested for the first time in Northern Maine for early post emergence (EP) grass control in potato culture. Metribuzin [4-amino-6-*tert*-butyl-3-(methylthio)-*as*-triazin-5(4*H*)-one] or linuron [3-3,4-dichloropheny1)-1-methoxy-1-methylurea] were applied preemergence (PE) for control of broadleaved weeds. For comparison, treatments included our standard of dinoseb [2-*sec*-butyl-4,6-dinitrophenol] plus metolachlor [2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl) acetamide] and post grass herbicides sethoxydim [2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one], and fluazifop-butyl [(±)-butyl 2-[4-[[5-trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoate]. To evaluate herbicide efficacy, ratings were made at two dates for crop phytotoxicity and control of several weed species.

MATERIALS AND METHODS

Herbicides were applied to plots with a compressed-air back-pack sprayer at 2.8 kg/cm^2 of pressure and 744 l/ha of water. Crop oil concentrate (0.3% v/v) was included with the post grass herbicides. Two raindrop nozzles were attached to the spray boom for PE treatments; while flat fan nozzles #8003 were used for the EP and layby (LB) treatments. Plots were single rows, 6.2 meters long and located on Caribou gravelly silt loam soil. They were arranged according to a completely randomized block design and replicated five times. The trial field was commercially cultivated except for the uncultivated check plots.

RESULTS AND DISCUSSION

Table 1 indicates that there was essentially no crop phytotoxicity and, except for the uncultivated treatment, mean yields were similar. Satisfactory quackgrass control was accomplished with 0.34 and 0.42 kg ai/ha rates of clopropoxydim. Table 2 shows that clopropoxydim appears promising for post emergence control of perennial quackgrass, especially when applied as a split treatment. The 0.14 plus 0.14 kg ai/ha split application of clopropoxydim compared with 0.28 kg ai/ha of fluazifop-butyl and provided excellent control.

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Table 1. Rate evaluation of clopropoxydim on crop yield, crop injury, and barnyardgrass control in Katahdin potatoes. Maine - 1984.

Treatments[a]	Rate kg ai/ha	Yield Mt/ha	Crop Injury and Weed Control Ratings[b]			
			Crop Injury[c]		Barnyardgrass[c]	
			7-2	8-9	7-2	8-9
Uncultivated check	--- ---	29.3	9.0	9.0	7.4	7.8
Cultivated check	--- ---	38.5	9.0	9.0	8.2	9.0
Dinoseb + Metolachlor, PE	5.0 + 3.4	34.2	9.0	8.8	8.8	9.0
Metribuzin, PE	0.28	33.8	9.0	9.0	8.2	8.8
Metribuzin, PE + Metribuzin, EP	0.28 + 0.28	33.1	9.0	8.8	8.4	9.0
Metribuzin, PE + Clopropoxydim, EP[d]	0.28 + 0.14	36.9	9.0	9.0	8.2	9.0
Metribuzin, PE + Clopropoxydim, EP[d]	0.28 + 0.28	33.2	9.0	9.0	8.2	9.0
Metribuzin, PE + Clopropoxydim, EP[d]	0.28 + 0.34	34.8	9.0	8.8	8.6	9.0
Metribuzin, PE + Clopropoxydim, EP[d]	0.28 + 0.42	38.6	9.0	9.0	8.0	9.0
Metribuzin, PE + Clopropoxydim, EP[d]	0.28 + 0.14					
+ Clopropoxydim, LB[d]	+ 0.14	38.0	9.0	9.0	8.2	9.0
Metribuzin, PE + Clopropoxydim, EP[d]	0.28 + 0.34					
+ Clopropoxydim, LB[d]	+ 0.22	37.8	9.0	9.0	7.8	9.0
Metribuzin, PE + Sethoxydim, EP[d]	0.28 + 0.34	34.3	9.0	9.0	7.4	9.0
Metribuzin, PE + Fluazifop-butyl, EP[d]	0.28 + 0.28	37.4	9.0	9.0	8.2	9.0
Linuron, PE	1.12	37.8	9.0	9.0	8.8	9.0
Linuron, PE + Clopropoxydim, EP[d]	1.12 + 0.28	36.7	9.0	9.0	8.6	9.0
Waller Duncan L.S.D. (0.05)		7.0				

[a]Planted - May 29; killed - September 10; harvested - September 27, 1984.

Preemergence (PE) treatments applied June 8. Temp. 27C, hazy; moist soil; 1.3-2.2 m/sec s.e. wind.

Early Post emergence (EP) treatments applied June 27. Temp. 20C, sunny; wet soil; 3.6-4.4 m/sec s.e. wind.

Layby (LB) treatments applied July 25. Temp. 19C, sunny; moist soil; 4.4-6.6 m/sec n. wind.

[b]Rating code: 9 = perfect crop or no weeds; 1 = all crop plants killed or weeds cause crop abandonment; less than 7 = unacceptable injury or weed control.

[c]Number of *Echinochloa crus-galli* plants per 0.093 square meter (five replicate average) = 4.0.

[d]Applications included 0.3% v/v crop oil concentrate.

Table 2. Rate evaluation of clopropoxydim on weed control in Katahdin potatoes. Maine - 1984.

Treatments[a]	Rate kg ai/ha		Weed Control Ratings[b]					
			Quackgrass[c]		Mustard sp.[c]		Lambsquarters[c]	
			7-2	8-9	7-2	8-9	7-2	8-9
Uncultivated check	---	---	5.6	4.6	8.4	6.0	8.6	6.6
Cultivated check	---	---	5.6	4.8	8.8	7.8	8.8	9.0
Dinoseb + Metolachlor, PE	5.0	+ 3.4	6.2	6.0	9.0	9.0	9.0	9.0
Metribuzin, PE	0.28		5.4	5.2	9.0	8.6	9.0	9.0
Metribuzin, PE + Metribuzin, EP	0.28	+ 0.28	5.4	5.4	9.0	9.0	9.0	9.0
Metribuzin, PE + Clopropoxydim, EP[d]	0.28	+ 0.14	5.6	6.2	9.0	9.0	9.0	9.0
Metribuzin, PE + Clopropoxydim, EP[d]	0.28	+ 0.28	5.8	6.6	9.0	8.8	9.0	9.0
Metribuzin, PE + Clopropoxydim, EP[d]	0.28	+ 0.34	5.8	7.2	9.0	8.8	9.0	9.0
Metribuzin, PE + Clopropoxydim, EP[d]	0.28	+ 0.42	6.0	7.6	9.0	8.6	9.0	9.0
Metribuzin, PE + Clopropoxydim, EP[d]	0.28	+ 0.14						
+ Clopropoxydim, LB[d]		+ 0.14	6.0	8.2	9.0	8.8	9.0	9.0
Metribuzin, PE + Clopropoxydim, EP[d]	0.28	+ 0.34						
+ Clopropoxydim, LB[d]		0.22	5.8	8.4	9.0	9.0	9.0	9.0
Metribuzin, PE + Sethoxydim, EP[d]	0.28	+ 0.34	5.6	6.6	9.0	8.2	9.0	9.0
Metribuzin, PE + Fluazifop-butyl, EP[d]	0.28	+ 0.28	5.6	8.2	9.0	8.8	9.0	9.0
Linuron, PE	1.12		5.6	5.4	9.0	9.0	9.0	9.0
Linuron, PE + Clopropoxydim, EP[d]	1.12	+ 0.28	5.8	7.8	9.0	9.0	9.0	9.0

[a,b]See Table 1.

[c]Number and species of weeds per 0.093 square meter (five replicate average):

Agropyron repens - 5.4

Brassica species - 0.5

Chenopodium album - 4.2

[d]Applications included 0.3% v/v crop oil concentrate

NEW BLEACHING HERBICIDES FOR WEED CONTROL IN WHITE POTATOES[1]

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

ABSTRACT

In 1984, two bleaching herbicides, dimethazone and fluorochloridone, were investigated for suitability for weed control in white potatoes. Dimethazone at rates higher than 0.56 kg/ha and fluorochloridone at 0.56 and 0.84 kg/ha provided good residual weed control of barnyardgrass *(Echinochloa crus-galli* (L.) Beauv.), common lambsquarters *(Chenopodium album* L.), and common ragweed *(Ambrosia artemisiifolia* L.). When compared to alachlor, linuron, and metribuzin, the two bleaching herbicides at the above rates provided better residual broad spectrum weed control than these herbicides applied alone, and performed as well as some combinations of these compounds, such as alachlor + linuron or alachlor + metribuzin. Both dimethazone and fluorochloridone produced yields as high as or higher than the standard herbicide check of alachlor + linuron, and dimethazone at 0.84 and 1.12 kg/ha produced significantly higher yields than the herbicide check. Combinations of dimethazone + linuron and dimethazone + metribuzin also provided yield values significantly higher than the herbicide check. Bleaching of a rye cover crop planted after potato harvest occurred in some dimethazone treated plots but after 8 weeks this effect was no longer observed.

INTRODUCTION

Herbicides currently available to growers for use in white potatoes *(Solanum tuberosum* sub-sp. *tuberosum)* may not provide adequate season-long weed control. Although many compounds, applied alone or in combinations, provide good early season weed control when potatoes cannot compete well with weeds, late germinating weeds, particularly annual grasses, can pose problems in harvesting. Additionally, some compounds may not provide consistent weed control in any given growing season due to variations in environmental conditions. Furthermore, many compounds provide control of only a narrow spectrum of weeds requiring use of herbicide combinations for adequate weed control. Formerly innocuous weed species can also become major problem weeds from growers lack of crop and herbicide rotation. For these reasons, new herbicides are constantly evaluated for their suitability to control weeds in white potatoes. We recently reported that fluorochloridone (formerly R-40244 [1-(m-trifluoromethyl phenyl)-3-chloro-4-chloromethyl-2-pyrolidone)] may be a suitable candidate herbicide for use in potato culture in New Jersey[2]. The mode of action of

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fluorochloridone is an inhibition of carotenoid biosynthesis, with a resulting complete bleaching of susceptible species due to chlorophyll photo-oxidation, followed by death of the affected plant[1]. Dimethazone [2-(2-chlorophenyl)-methyl-4,4-dimethyl-3-(ioxalidinone] is another herbicide that causes bleaching of suceptible species.

In 1984, we investigated the suitability of these new bleaching herbicides, alone and in combination with other herbicides for use in controlling annual weeds in potatoes. Especially important was determining whether these compounds provided broad-spectrum, season-long weed control. Dimethazone and fluorochloridone were compared to alachlor [(2-chloro-2,6-diethyl-*N*(methoxy methyl) acetonilide], linuron [3-(3-4-dichlorophenyl)-1-methoxy,1-methylurea], and metribuzin (3-methylthio-4-amino-6-tert-butyl-1,2,4-triazine-5[4H]-one) each applied alone and in combination and in various combinations with each other..

MATERIALS AND METHODS

Potatoes (var. Superior) were planted on April 27, 1984, in a Holmdel loam (organic matter 1.5%) at the Soils and Crops Research Center, New Jersey Agricultural Experiment Station, Adelphia, N.J. Plots were 3.7 m (12 ft) wide by 5.8 m (19 ft) long, with potatoes planted in four rows 0.9 m (36 in) wide. Herbicide treatments were applied on May 3, to the soil surface, using a CO_2-propelled backpack sprayer at 273 L/ha (40 gpa) at a pressure of 220 kPa (32 psi), with water as a carrier. Nozzles were Unijet flat fan spray tips, number 730616 (Spraying Systems, Inc.). Plots were rated for potato stand and vigor, and control of barnyardgrass, common lambsquarters, and common ragweed on June 5 and July 26 using a scale of 0 to 10, where 0 is no effect on weed or crop and 10 is complete control. Potatoes were harvested on August 20, 1984. All yields were converted to hundredweight per acre. Statistical analysis of crop yield and weed control rating data were performed using the ANOVA programs of the Statistical Analysis System (SAS Institute, Inc., Box 8000, Cory, N.C. 27511). Analysis of weed control ratings was performed on the arctan of these values.

RESULTS AND DISCUSSION

None of the treatments evaluated caused significant long-term injury to potatoes (data not shown), measured as reduction in crop stand or vigor. Values for weed control and yield for individual treatments are found in Table I. On June 5, all treatments provided acceptable to excellent control of barnyardgrass, common lambsquarters, and common ragweed. Both fluorochloridone and dimethazone provided excellent control of all three species when applied alone at rates as low as 0.56 kg/ha. By July 26, many of the treatments exhibited reduced weed control. The standard herbicide check, alachlor + linuron at 2.24 + 0.84 kg/ha, respectively, provided good residual control of grasses and common lambsquarters, but exhibited reduced control of common ragweed. This reflects the lack of residual control of common ragweed exhibited by either herbicide applied alone. Both barnyardgrass and common lambsquarters were controlled better by the combination of alachlor + linuron than was obtained from either compound alone. Another widely used herbicide, metribuzin, exhibited reduced residual control of barnyardgrass and ragweed when applied at 0.43 kg/ha, and of barnyardgrass at 0.56 kg/ha. The combination of alachlor and metribuzin provided better long-season control of

all three weed species, particularly barnyardgrass, than these two compounds alone. Thus, for season-long, broad spectrum control with these three compounds, it is necessary to apply them in combinations, since they were not effective applied alone. Dimethazone at rates of 0.84 kg/ha and higher, and fluorochloridone at both rates investigated, provided acceptable to good control of all three weed species at the July 26 rating date. Combinations of dimethazone with 0.26 kg/ha metribuzin or 1.12 kg/ha linuron did not provide increased weed control compared to the same rate of dimethazone alone. Some improvement in residual barnyardgrass control was obtained by addition of 0.56 kg/ha of metribuzin to both rates of fluorochloridone. Both bleaching compounds, at the rates noted above, provided better broad-spectrum residual weed control than alachlor, linuron, or metribuzin alone, and provided equivalent weed control to the herbicide check, except that ragweed control was better with the bleaching herbicides.

All treatments investigated, except alachlor applied alone, effected increased yields compared to the uncultivated check. Of the herbicides applied alone, only dimethazone at 0.84 and 1.12 kg/ha provided yields greater than the alachlor + linuron standard chemical check. All others did not result in yield values that were statistically different from that of the herbicide check. The yield value for 0.84 kg/ha dimethazone may be an aberration, as the yield values for the same rate of dimethazone in combination with 0.84 kg/ha linuron or 0.26 kg/ha metribuzin were not significantly different from the herbicide check. Combination of 0.84 kg/ha dimethazone with 1.12 kg/ha linuron, or with the rates reversed, exhibited increased yields compared to the standard chemical check, but not greater than the equivalent rate of dimethazone alone. When applied in combination with 0.56 kg/ha metribuzin, yields for fluorochloridone were not higher than for the latter compound alone. Thus, for the new bleaching herbicides, combinations with other compounds did not result in increased yields. Additionally, dimethazone alone, at 1.12 kg/ha, provided yields equivalent to the best combination of older herbicides, alachlor + metribuzin, 2.24 + 0.56 kg/ha.

Following harvest, treated areas were planted to a cover crop of rye (*Secale cereale* L.). Approximately four weeks after planting, rye became bleached in some plots that were treated with dimethazone at 1.12 and 1.40 kg/ha, and 0.84 kg/ha dimethazone in combination with 0.84 and 1.12 kg/ha linuron. This effect was temporary, and rye in these plots appeared normal approximately eight weeks after planting. Fluorochloridone treated plots did not appear bleached, possibly due to lower residual activity of this herbicide or a greater tolerance of rye to this herbicide.

In summary, two bleaching herbicides, dimethazone and fluorochloride, provided good season-long control of barnyardgrass, common lambsquarters, and common ragweed. Dimethazone applied alone at rates greater than 0.84 kg/ha provided weed control as good as the best combinations of older herbicides, such as alachlor + linuron or alachlor + metribuzin. Fluorochloridone also provided good weed control when applied alone, but provided slightly better residual control of barnyardgrass when applied in combination with 0.56 kg/ha metribuzin. Combinations of dimethazone with linuron or metribuzin did not significantly improve weed control or yield relative to the same rates of dimethazone alone. Both compounds, applied alone, provided yields of white potatoes as good or better than the standard chemical treatment of alachlor + linuron. We conclude that both of these new bleaching herbicides show promise for use in white potato culture in New Jersey.

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Table 1. Preemergence Weed Control in White Potatoes

Herbicide Name	Rate, kg a.i./ha	Weed Control[a] ECHCG[c] 6/5	ECHCG[c] 7/26[b]	CHEAL[c] 6/5	CHEAL[c] 7/26	AMBEL[c] 6/5	AMBEL[c] 7/26	Yields CWT/A[d]	Yields T/ha[d]
dimethazone (FMC 57020)	0.56	10.0	4.7	10.0	8.3	9.6	5.7	183.4	20.6
	0.84	9.0	7.0	10.0	9.2	9.9	8.7	282.7	31.7
	1.12	10.0	8.5	10.0	9.7	10.0	9.8	261.7	29.3
	1.40	10.0	8.8	10.0	9.2	10.0	9.8	204.4	22.9
linuron	0.84	7.0	2.7	10.0	5.7	7.0	1.7	155.7	17.5
	1.12	9.3	3.7	9.6	4.0	9.1	2.7	201.5	22.6
metribuzin	0.43	9.0	2.3	9.6	9.3	9.3	4.3	145.8	16.3
	0.56	10.0	4.3	9.6	9.6	9.3	8.5	177.0	19.8
alachlor	2.24	10.0	3.3	10.0	6.3	7.3	2.0	145.1	16.3
fluorochloridone (R-40244)	0.56	10.0	7.2	10.0	8.2	9.6	8.3	210.7	23.6
	0.84	10.0	7.0	10.0	6.3	9.5	3.3	168.7	18.9
dimethazone + linuron	0.84 + 0.84	10.0	8.2	10.0	9.5	10.0	9.7	238.8	26.8
	1.12 + 0.84	10.0	8.3	10.0	9.7	10.0	9.5	246.4	27.6
	0.84 + 1.12	10.0	7.3	10.0	9.7	10.0	9.2	267.4	30.0
dimethazone + metribuzin	0.84 + 0.28	10.0	8.3	10.0	9.8	10.0	10.0	185.9	20.8
	1.12 + 0.28	10.0	9.3	10.0	10.0	10.0	9.8	251.5	28.2
fluorochloridone + metribuzin	0.56 + 0.56	10.0	9.0	10.0	8.5	9.5	7.3	206.7	23.2
	0.84 + 0.56	10.0	8.5	10.0	9.6	9.6	8.3	215.8	24.2
Check - alachlor + linuron	2.24 + 0.84	10.0	7.8	10.0	8.3	8.8	4.3	166.8	18.7
Uncultivated Check	-	0.0	3.3	0.0	0.0	0.0	0.0	70.7	7.9
LSD 0.05								75.0	8.4

[a]Weed control ratings (0 = no control, 10 = complete control).
[b]Rating date: 6/5 = June 5, 1984, 7/26 = July 26, 1984.
[c]Weed species abbreviations are from Weed Science, Vol. 32, supplement 2, 1984.
ECHCG = Echinochloa crus-galli (L) Beauv; CHEAL = Chenopodium album L; AMBEL = Ambrosia artemisiifolia L.
[d]CWT/A = hundredweight per acre; T/ha = metric tons per hectare

EFFECT OF VARIOUS COMBINATIONS OF EPTC, LACTOFEN, AND PPG-1013 ON BROAD SPECTRUM WEED CONTROL IN WHITE POTATOES

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

ABSTRACT

An efficacy study conducted with EPTC from two sources, lactofen, and PPG-1013 for broadleaved weed and grass control in white potatoes indicated good control of annual barnyardgrass, lambsquarters, and mustard species. Acceptable commercial control of quackgrass was also obtained.

INTRODUCTION

Control of broadleaved and grass species in white potatoes is a standard cultural practice in potato production in Maine. Evaluations of new herbicides to meet this objective were conducted in 1984 at Aroostook Farm, Presque Isle, Maine. EPTC (S-ethyl dipropylthiocarbamate), lactofen (1'-[Carboethoxy]ethyl 5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoate), and PPG-1013 (5-[2-chloro-4-(trifluoromethyl-phenoxy]-2-nitroacetophenone oxime-O-acetic acid, methyl ester) were compared for broad spectrum weed control and crop injury to white potatoes (*Solanum tuberosum* L. 'Katahdin').

EPTC from both sources was applied as preplant incorporated treatments and all other herbicides were applied preemergence to control *Brassica* species, lambsquarters (*Chenopodium album*), quackgrass (*Agropyron repens*), and barnyardgrass (*Echinochloa crus-galli*).

Broadleaved grass control in white potatoes is necessary for labor reduction at harvest and for esthetic values during the growing season.

MATERIALS AND METHODS

Herbicides were applied to one row test plots on a Caribou gravelly silt loam of about 2.5 percent organic matter. Plots measured 20 feet long and were arranged in a randomized complete block design with six replicates. A compressed air sprayer equipped with a hand boom and Delavan raindrop nozzles was used for the applications. Pressure of 40 psi and a carrier volume of 80 gallons per acre were used. Standard treatment in this test was dinoseb (2-*sec*-butyl-4,4-dinitrophenol) plus metolachlor (2-chloro-*N*-[2-ethyl-6-methyl=phenyl]-*N*-[2-methylethyl]acetamide). Pertinent data for application dates and weed control ratings are presented in Tables 1 and 2. Weed control ratings and crop injury ratings were made using the modified "Cornell" rating system.

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RESULTS AND DISCUSSION

Early crop injury was recorded for dinoseb plus metolachlor, EPTC plus lactofen, metolachlor plus PPG-1013, and eptam plus metribuzin (4-amino-6-*tert*-butyl-3-(methylthio)*as*-triazin-5(4*H*)-one. By August, however, the potatoes had outgrown all symptoms of herbicidal crop injury. Barnyardgrass was controlled but weed pressure from barnyardgrass was very low. None of the treatments provided acceptable commercial control (<7.0) of quackgrass. Lambsquarters was effectively controlled by all treatments and Brassica species was effectively controlled except where EPTC and metolachlor treatments only were applied.

Table 1. Effect of EPTC, Lactofen, and PPG-1013 in combination on yield and crop injury in Katahdin potatoes. Maine - 1984.

Treatments[a] Lbs. A.I. Per Acre	Yield Cwt./A.	Crop Injury 7-6	Crop Injury 8-6
No treatment (no cultivation)	55	9.0	9.0
No treatment (no herbicide)	137	9.0	9.0
4.5 Dinoseb + 3.0 Metolachlor, PE	214	8.7	9.0
3.0 EPTC, PPI + 0.25 Lactofen, PE	267	8.8	9.0
3.0 EPTC, PPI + 0.50 Lactofen, PE	269	8.8	9.0
3.0 EPTC, PPI + 0.15 PPG-1013, PE	251	9.0	9.0
3.0 EPTC, PPI + 0.20 PPG-1013, PE	222	9.0	9.0
2.0 Metolachlor + 0.25 Lactofen, PE[b]	245	9.0	9.0
2.0 Metolachlor + 0.15 PPG-1013[b]	199	8.8	9.0
3.0 EPTC, PPI	199	9.0	9.0
2.0 Metolachlor, PE	179	9.0	9.0
3.0 EPTC 7E, PPI	179	9.0	9.0
3.0 EPTC 7E, PPI + 0.25 Metribuzin, PE	260	8.8	9.0
3.0 EPTC, PPI + 0.25 Metribuzin, PE	230	9.0	9.0
0.25 Metribuzin, PE	219	8.8	9.0
Waller Duncan L.S.D. (0.05)	47		

[a]Planted - June 12; killed - September 27; harvested - October 10, 1984.

Preplant incorporated (PPI) treatments applied June 12. Temperature - 78F., sunny; soil - moist; wind - 1-3 mph, southwest.

Preemergence (PE) treatments applied June 21. Temperature - 66F., sunny; soil - moist; wind - 2.5 mph, northwest.

[b]Applied as tank mix.

Table 2. Effect of EPTC, Lactofen, and PPG-1013 in combination for broad spectrum weed control in Katahdin potatoes. Maine - 1984.

Treatments[a] Lbs. A.I. Per Acre	Weed Control Ratings							
	Barnyardgrass		Quackgrass		Mustard sp.		Lambsquarters	
	7-6	8-6	7-6	8-6	7-6	8-6	7-6	8-6
No treatment (no cultivation)	8.5	9.0	3.8	3.7	3.5	2.5	8.7	9.0
No treatment (no herbicide)	9.0	9.0	4.8	4.5	5.0	3.7	8.6	9.0
4.5 Dinoseb + 3.0 Metolachlor, PE	9.0	9.0	5.8	5.0	9.0	8.8	9.0	9.0
3.0 EPTC, PPI + 0.25 Lactofen, PE	9.0	9.0	6.3	5.5	8.8	8.2	9.0	9.0
3.0 EPTC, PPI + 0.50 Lactofen, PE	9.0	9.0	6.8	5.2	9.0	8.7	9.0	9.0
3.0 EPTC, PPI + 0.15 PPG-1013, PE	9.0	9.0	6.5	6.2	9.0	8.5	9.0	9.0
3.0 EPTC, PPI + 0.20 PPG-1013, PE	9.0	9.0	6.3	5.3	9.0	8.5	9.0	9.0
2.0 Metolachlor + 0.25 Lactofen, PE[b]	9.0	9.0	5.0	4.0	8.7	8.7	9.0	9.0
2.0 Metolachlor + 0.15 PPG-1013, PE[b]	9.0	9.0	5.8	4.8	9.0	8.5	9.0	9.0
3.0 EPTC, PPI	9.0	9.0	6.5	6.5	5.8	4.0	9.0	9.0
2.0 Metolachlor, PE	9.0	9.0	5.7	5.2	5.2	4.0	9.0	9.0
3.0 EPTC 7E, PPI	9.0	9.0	7.0	6.5	6.2	4.3	9.0	9.0
3.0 EPTC 7E, PPI + 0.25 Metribuzin, PE	9.0	9.0	6.2	4.8	9.0	8.8	9.0	9.0
3.0 EPTC, PPI + 0.25 Metribuzin, PE	9.0	9.0	6.7	6.0	9.0	8.7	9.0	9.0
0.25 Metribuzin, PE	9.0	9.0	4.8	4.2	9.0	8.3	9.0	9.0

[a,b]See notes in Table 1.

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

Echinochloa crus-galli - 0.5

Agropyron repens - 10.5

Chenopodium album - 3.1

Brassica species - 10.3

EFFECT OF R40244 AND SC5676 ON PREEMERGENCE WEED CONTROL IN KATAHDIN POTATOES

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

ABSTRACT

Six rates of R40244 and two rates of SC-5676 were applied preemergence to a round white potato (*Solanum tuberosum* L. 'Katahdin') crop. Neither herbicide affected the perennial grass present; while SC-5676 was relatively ineffective against the broadleaved weeds. Only the lowest rate applied of R40244, 0.28 kg ai/ha, was required for broadleaved weed control; yet the highest rate, 2.24 kg ai/ha, produced unacceptable crop injury symptoms.

INTRODUCTION

Experimental preemergence herbicides R40244 and SC-5676 (both have confidential chemistry) were evaluated for broad spectrum weed control in Northern Maine potato production. R-40244 was applied alone or in combination with metolachlor [2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl) acetamide]. SC-5676 was also applied alone or in combination with metribuzin [4-amino-6-*tert*-butyl-3-(methylthio)-*as*-triazin-5(4*H*)-one]. Comparisons were made with check plots or the standard treatment of dinoseb [2-*sec*-butyl-4, 6-dinitrophenol] plus metolachlor.

MATERIALS AND METHODS

This efficacy trial was conducted in 1984 at Aroostook Farm; Presque Isle, Maine on a field of Caribou gravelly silt loam with no more than 3.5 percent organic matter. Herbicides were applied on June 20, which was 13 days after planting of the potato crop. Plots were replicated, randomly arranged, and consisted of one potato row, 6.2 meters in length. A compressed-air, backpack sprayer was used with two raindrop nozzles. The rate of water was 744 l/ha (80 gal./a.) and air pressure was 2.8 kg/cm^2 (40 psi). Visual ratings were made of phytotoxicity and weed control at 16 and 47 days following herbicide applications. Yields in all plots were recorded at crop maturity.

When comparing treatments, it should be noted that uncultivated check plots were not cultivated with tractor mounted cultivators or hoes, as were all other check and herbicide plots.

RESULTS AND DISCUSSION

Table 1 indicates that both R40244 and SC-5676 did not affect perennial quackgrass (*Agropyron repens* L.). While the 1.12 and 2.24 kg ai/ha rates of R40244 produced phytotoxic symptoms in potato plants, the results are inconclusive whether or not these injuries decreased yield of the crop. In any event, the lowest rate of R40244, 0.28 kg ai/ha, was all that was required to control mustards (*Brassica* sps.) and other broadleaved weeds, as noted in Table 2. SC-5676 affected the mustard population but did not provide satisfactory control. It was shown that R40244 is a promising candidate herbicide for control of problem broadleaf weeds in Aroostook County potato production, at low rates; while SC-5676 was not as effective as commercial treatments, at the rates tested.

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Table 1. Effect of R40244 and SC-5676 applied preemergence on yield, crop injury, and quackgrass control in Katahdin potatoes. Maine - 1984.

Treatments[a]	Rate kg ai/ha	Yield Mt/ha	Crop Injury and Grass Control Ratings[b]			
			Crop Injury		Quackgrass[c]	
			7-6	8-6	7-6	8-6
Uncultivated check	--- ---	22.9	9.0	9.0	6.0	6.0
Cultivated check	--- ---	20.2	9.0	9.0	5.5	6.5
Dinoseb + Metolachlor	3.9 + 3.4	38.8	9.0	9.0	6.2	6.8
R40244 + Metolachlor	0.28 + 1.7	34.1	9.0	9.0	5.8	6.2
R40244 + Metolachlor	0.42 + 1.7	36.0	8.0	9.0	6.5	7.2
R40244 + Metolachlor	0.56 + 1.7	32.4	8.3	9.0	5.7	5.3
R40244 + Metolachlor	0.84 + 1.7	33.4	8.2	9.0	5.8	6.2
R40244 + Metolachlor	1.12 + 1.7	31.0	7.5	9.0	6.2	6.2
R40244 + Metolachlor	2.24 + 1.7	32.3	6.2	7.3	6.2	7.5
R40244	0.28 ---	34.6	9.0	9.0	5.5	5.8
R40244	0.42 ---	36.7	8.8	9.0	5.8	5.8
R40244	0.56 ---	32.6	8.7	9.0	5.3	5.5
Metolachlor	1.7 ---	35.0	9.0	9.0	6.2	6.3
Metribuzin + Metolachlor	0.56 + 1.7	31.4	9.0	9.0	6.3	6.2
Metribuzin	0.56 ---	37.2	9.0	9.0	5.5	6.3
Metribuzin + SC-5676	0.56 + 1.7	34.2	9.0	9.0	6.2	7.5
SC-5676	1.7 ---	32.9	9.0	9.0	5.8	6.2
SC-5676	3.4 ---	32.3	9.0	9.0	6.2	6.2
Waller Duncan L.S.D. (0.05)		6.5				

[a]Planted - June 7; killed - September 27; harvested - October 9, 1984.

All treatments applied June 20. Temperature - 20C., partly cloudy; moist soil; 2.2-3.6 m/sec, n.w. wind.

[b]Rating code: 9 = perfect crop or no weeds; 1 = all crop plants killed or weeds cause crop abandonment; less than 7 = unacceptable crop injury or weed control.

[c]Number of *Agropryon repens* plants per 0.093 square meter (six replicate average): = 2.3.

Table 2. Effect of R40244 and SC-5676 applied preemergence on broadleaved weeds. Maine - 1984.

Treatments[a]	Rate kg ai/ha			Broadleaf Weed Control Ratings[b]			
				Mustard sp.[c]		Other[c]	
				7-6	8-6	7-6	8-6
Uncultivated check	---	-	---	4.3	3.7	8.2	9.0
Cultivated check	---	-	---	3.5	4.2	8.2	9.0
Dinoseb + Metolachlor	3.9	+	3.4	7.7	9.0	8.3	9.0
R40244 + Metolachlor	0.28	+	1.7	8.8	9.0	9.0	9.0
R40244 + Metolachlor	0.42	+	1.7	8.8	9.0	9.0	9.0
R40244 + Metolachlor	0.56	+	1.7	8.8	9.0	9.0	9.0
R40244 + Metolachlor	0.84	+	1.7	8.7	9.0	9.0	9.0
R40244 + Metolachlor	1.12	+	1.7	9.0	9.0	9.0	9.0
R40244 + Metolachlor	2.24	+	1.7	8.8	9.0	9.0	9.0
R40244	0.28		---	8.5	9.0	8.8	9.0
R40244	0.42		---	8.5	9.0	8.7	9.0
R40244	0.56		---	8.8	9.0	8.8	9.0
Metolachlor	1.7		---	4.8	5.3	8.5	9.0
Metribuzin + Metolachlor	0.56	+	1.7	8.5	9.0	8.8	9.0
Metribuzin	0.56		---	8.8	9.0	8.8	9.0
Metribuzin + SC-5676	0.56	+	1.7	8.7	9.0	9.0	9.0
SC-5676	1.7		---	5.0	5.3	8.3	9.0
SC-5676	3.4		---	6.0	7.0	9.0	9.0

[a,b]See Table 1.

[c]Number and species of weeds per 0.093 square meter (six replicate average):

Brassica species - 14.0

Other - 2.9

WEED CONTROL OF POTATOES ON LONG ISLAND, 1984[1/]

Joseph B. Sieczka and James F. Creighton[2/]

ABSTRACT

Preemergence and postemergence application herbicides were evaluated for weed control and crop tolerance in potatoes (Solanum tuberosum L.) at the Long Island Horticultural Research Lab in 1984. The results of three experiments are presented. Postemergence applications which were effective in controlling barnyardgrass (Echinochloa crus-galli (L.) Beauv.) are: clopropoxydim at 0.14 and 0.28 kg/ha, sethoxydim at 0.22, 0.33, 0.56 kg/ha, fluazifop-butyl at 0.14, 0.21, 0.28 and 0.56 kg/ha, and SC1084 at 0.43 and 0.56 kg/ha. The effectiveness of the commercial formulation of fluazifop-butyl at 0.28 kg/ha appears to be intermediate between the 0.14 and the 0.21 kg/ha rates of the PP005 formulation. Propanil applied at 3.36 and 4.48 kg/ha caused severe crop injury. Preemergence application of metolachlor or pendimethalin at 1.68 kg/ha was less effective than split applications of the respective materials applied at 0.84 kg/ha at preemergence followed by 0.84 kg/ha after hilling. FMC 57202 at 0.56 and 1.12 kg/ha provided good control of barnyardgrass, but AC252-214 at 0.07, 0.14 and 0.28 did not. The addition of pendimethalin to AC252-214 did not significantly improve control. Preemergence applications of metribuzin at 0.56 kg/ha, PPG-844 at 0.28 and 0.56 kg/ha and fluorochloridone at 0.28 kg/ha were effective in controlling smartweed (Polygonum pensylvanicum L.) throughout the season, however, when used alone did not provide good grass control. The addition of metolachlor at 2.24 kg/ha to these treatments significantly improved grass control. Fluorochloridone at 0.56 kg/ha provided commercially acceptable barnyardgrass control.

INTRODUCTION

Barnyardgrass and smartweed are significant weed control problems in commercial potato fields on Long Island. The recent development of selective postemergence grass herbicides may have a great impact on barnyardgrass control in the future. Likewise there are some preemergence herbicides that have shown promise for both barnyardgrass and smartweed control. The purpose of these experiments is to evaluate the effectiveness of recently labelled materials and promising experimental compounds on these and other weed species and determine crop tolerance.

MATERIALS AND METHODS

Three potato weed control experiments were established at the Long Island Horticultural Research Laboratory, Riverhead, N.Y. on a Haven sandy loam soil. Herbicide treatments were applied with a tractor-mounted CO_2-pressurized sprayer delivering 359 l/ha at 2.5 kg/cm^2. The cultivar 'Katahdin' was grown in all experiments. Plot size for these experiments was 2 rows (1.7 m) by 7.6 meters. Yield data were collected on the center six meters of both rows. The experimental design was a randomized complete block with 4 replications. Pertinent information for each of the experiments is as follows:

		Dates of application					
Exp.	Planted	Pre	Post	Hill	Irrigation No.	Vine Kill	Harvest Date
1	5/14	5/25	7/10		3	9/13	10/12
2	5/15	5/22		7/5	1	9/13	10/10
3	5/14	5/24			3	9/13	10/16

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The postemergence applications in Experiment 1 were made on July 10, 1984 when potatoes were in flower and barnyardgrass plants were approximately 14" tall. All the postemergence treatments were applied in a 1% dilution of Booster plus E crop oil except a 0.56 kg/ha rate of sethoxydim (2-{1-(ethoxyimino)butyl}-5-{2-(ethylthio)propyl}-3-hydroxy-2-cyclohexen-1-one) and both rates of propanil (3',4'-dichloropropionanilide). Experiments 1 and 2 were sprayed with dinoseb (2-sec-butyl-4,6-dinitrophenol) at 3.36 kg/ha on June 6, 1984. The preemergence treatments in all experiments were applied before ground crack.

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

RESULTS AND DISCUSSIONS

Experiment 1. Phytotoxicity was only observed when propanil was applied at 3.36 and 4.48 kg/ha (see Table 1). The damage was severe and appeared to affect crop yield. Yield differences, however, were not significantly different from other herbicide treatments. Injury to barnyardgrass plants was most dramatic with the propanil treatments on July 13. However, neither rate of propanil produced commercially acceptable control of barnyardgrass at the end of the season. Barnyardgrass was not effectively controlled by the 0.28 kg/ha rate of SC1084. Control improved with increasing rates of this material and the PP005 formulation of fluazifop-butyl [(±)-butyl 2-{4-{{5-trifluoromethyl)-2-pyridinyl}oxy}phenoxy}propanoate]. The commercial formulation of fluazifop-butyl at 0.28 kg/ha gave weed control ratings which were intermediate between the 0.14 and 0.21 rates of the PP005 formulation. A rate effect was not apparent with clopropoxydim (E,E)-2-1[1-[(3-chloro-2-propenyl) oxy imino butyl]-5-[2-(ethylthio) propyl]- 3-hydroxy-2-cyclohexene-1) (tested at 0.14 and 0.28 kg/ha) and sethoxydim (tested at 0.22, 0.33 and 0.56 kg/ha). The exclusion of crop oil at the 0.56 kg/ha rate of sethoxydim did not significantly affect the performance. The preemergence application of metolachlor (2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl) acetamide) at 2.24 kg/ha gave season long control on barnyardgrass.

Experiment 2. None of the treatments tested caused phytotoxicity to the crop (see Table 2). Barnyardgrass pressure was light. Preemergence applications of 1.68 kg/ha of metolachlor and pendimethalin (N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobezenamine) were less effective in controlling barnyardgrass than split applications of the same material applied at 0.84 kg/ha at preemergence and again after hilling. The hilling application was applied as a directed spray with nozzles mounted on hillers. The metolachlor treatments were more effective than pendimethalin. AC252-214 at rates of 0.07, 0.14 and 0.28 kg/ha did not effectively control barnyardgrass. The addition of pendimethalin at 1.12 kg/ha did not significantly improve control. The 0.56 and 1.12 kg/ha rates of FMC-57020 were effective in controlling barnyardgrass, but 0.84 kg/ha was not. This difference cannot be explained.

Experiment 3. All herbicide treatments gave significantly better control of smartweed throughout the season and barnyardgrass at the first evaluation (see Table 3). When used alone, metribuzin at 0.56, PPG844 at 0.28 and 0.56 and fluorochloridone (1-(m-trifluoromethylphenyl)-3-chloro-4-chloromethyl-2-pyrrolidone) at 0.28 had significantly higher barnyardgrass control ratings than the no herbicide treatment, however, control was not commercially acceptable on August 15. The addition of metolachlor at 2.24 kg/ha to these treatments resulted in near perfect control of barnyardgrass. Fluorochloridone at 0.56 kg/ha alone gave commercial control of barnyardgrass. There were no significant differences in crop yields or size distribution (See Table 4). However, the weedy no-herbicide treatment produced the lowest yield and the smallest tubers.

Table 1. The effect of selective grass herbicide treatments on crop injury, barnyardgrass control and potato yield, Riverhead, N.Y., 1984, Experiment 1[a].

Treatment[b]		Ratings[c]						Total Yield
		Phyto (7/13)		Barnyardgrass				
Chemical	kg/ha	Potato	Bygr	7/6	7/13	8/14	9/12	(t/ha)
Control		8.3	8.8	6.8	6.0	5.8	4.8	29.0
clopropoxydim	0.14	8.8	7.8	7.8	7.5	8.3	7.5	30.4
clopropoxydim	0.28	8.3	7.0	7.3	6.8	8.3	7.5	28.6
sethoxydim	0.22	8.8	7.5	7.8	7.5	8.8	8.3	31.7
sethoxydim	0.33	8.5	8.3	7.3	7.5	9.0	8.5	27.0
sethoxydim	0.56	8.5	7.0	7.0	7.0	8.8	8.5	28.1
sethoxydim*	0.56	8.8	6.8	7.3	6.5	8.5	8.0	33.4
fluazifop-butyl (P)	0.14	8.5	8.3	8.0	8.0	8.0	7.3	32.4
fluazifop-butyl (P)	0.21	8.8	7.3	7.0	6.5	8.0	8.0	31.7
fluazifop-butyl (P)	0.28	8.8	8.0	7.5	6.5	8.8	8.5	31.5
fluazifop-butyl (P)	0.56	8.5	7.3	7.3	7.0	9.0	8.8	30.6
fluazifop-butyl (F)	0.28	8.5	7.5	7.5	6.8	8.3	7.8	31.3
SC1084	0.28	8.3	7.3	6.5	5.8	6.3	5.8	28.1
SC1084	0.43	8.5	7.5	6.5	6.3	7.5	7.5	30.0
SC1084	0.56	9.0	8.8	7.3	7.5	8.5	7.8	32.0
metolachlor*	2.24	9.0	8.8	8.7	8.5	9.0	8.3	37.4
propanil*	3.36	4.3	6.3	7.7	8.0	7.8	6.8	26.2
propanil*	4.48	3.5	5.8	7.0	8.3	6.5	5.3	21.9
Waller-Duncan (0.05)		(0.3)	(2.6)	(1.3)	(1.7)	(0.8)	(1.0)	(ns)

a/ 'Katahdin' potatoes planted 5/14/84, experimental design is randomized complete block with 4 replications. Plot size is 1.7 m by 7.6 m.

b/ Entire experimental area was sprayed with dinoseb at 3.36 kg/ha on 6/6/84. All treatments applied with a CO_2 sprayer. The metolachlor treatment was applied 5/25/84, all others applied on 7/10/84. Treatments followed by an * did not contain a 1% v/v dilution of "Booster plus E" oil adjuvant, all others including the control did contain the adjuvant. Abbreviations (P) = the experimental formulation PP005, (F) = the commercial formulation Fusilade.

c/ Rating based on a scale of 1 to 9; phytotoxicity 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.

Table 2. The effect of thirteen herbicide treatments on crop injury, barnyardgrass control and yield of potatoes, Riverhead, N.Y., 1984, Experiment 2[a/].

Treatment[b/]		Ratings[c/]				Total Yield
		Phyto	Barnyardgrass			
Chemical	kg/ha	6/22	6/22	8/15	9/7	(t/ha)
Control		8.0	9.0	7.0	6.5	25.2
metolachlor	1.68	7.5	9.0	8.0	7.5	24.6
metolachlor	0.84 + 0.84	8.3	9.0	8.5	8.3	21.5
pendimethalin	1.68	7.3	9.0	7.0	6.8	26.1
pendamethalin	0.84 + 0.84	7.3	9.0	7.8	7.0	23.0
AC252-214	0.07	8.5	9.0	6.3	5.8	19.9
AC252-214	0.14	8.3	9.0	6.3	6.3	22.8
AC252-214	0.28	7.8	9.0	6.3	6.3	21.9
AC252-214	0.07					
plus pendimethalin	1.12	8.3	9.0	7.0	6.5	23.9
AC252-214	0.14					
plus pendimethalin	1.12	7.8	9.0	7.0	6.5	25.4
FMC 57020	0.56	8.0	9.0	8.0	7.5	25.2
FMC 57020	0.84	7.8	9.0	7.3	6.5	22.3
FMC 57020	1.12	8.0	9.0	8.0	7.8	20.1
Waller-Duncan (0.05)		(ns)		(1.0)	(1.1)	

a/ 'Katahdin' potatoes planted on 5/15/84. Experimental design is a randomized complete block with 4 replications. Plot size is 1.7 m by 7.6 m.

b/ Entire experimental area was sprayed with dinoseb at 3.36 kg/ha on 6/6/84. All treatments applied with a CO_2-pressurized sprayer. All materials were applied prior to crop emergence on 5/22/84. Follow-up applications of metolachlor and pendimethalin applied as directed sprays at hilling on 7/5/84. AC252-214 plus pendimethalin treatment applied as a tank mix.

c/ See Table 1, footnote c.

Table 3. The effect of metribuzin, fluorochloridone and PPG-844, alone and in combination with metolachlor, on weed control and crop injury, Riverhead, N.Y., 1984, Experiment 3[a].

Treatment[b]		Ratings[c]						
		Phyto	Barnyardgrass			Smartweed		
Chemical	kg/ha	6/19	6/19	8/15	9/10	6/19	8/15	9/10
No herbicide		8.8	5.0	5.0	4.8	6.8	5.0	4.8
metribuzin	0.56	8.8	8.3	6.5	5.8	9.0	8.8	8.0
metolachlor	2.24	7.5	9.0	9.0	8.8	9.0	8.3	7.8
metribuzin	0.56							
plus metolachlor	2.24	8.3	9.0	9.0	8.8	9.0	9.0	8.5
PPG-844	0.28	9.0	6.8	6.8	6.3	8.5	7.8	6.5
PPG-844	0.28							
plus metolachlor	2.24	8.5	9.0	8.8	8.5	9.0	9.0	8.5
PPG-844	0.56	8.3	7.8	6.8	5.5	9.0	8.5	8.3
PPG-844	0.56							
plus metolachlor	2.24	8.5	9.0	9.0	9.0	9.0	9.0	8.3
fluorochloridone	0.28	8.5	7.8	6.8	6.0	9.0	8.5	7.3
fluorochloridone	0.28							
plus metolachlor	2.24	8.5	9.0	9.0	8.8	9.0	9.0	8.5
fluorochloridone	0.56	8.5	8.3	7.5	7.0	9.0	8.8	8.3
fluorochloridone	0.56							
plus metolachlor	2.24	8.5	9.0	9.0	9.0	9.0	8.8	9.0
Waller-Duncan (0.05)		(ns)	(1.1)	(0.9)	(1.2)	(1.3)	(1.0)	(1.1)

a/ See Table 1, footnote a.
b/ All treatments applied with CO_2-pressurized sprayer before potato emergence on 5/14/84.
c/ See Table 1, footnote c.

Table 4. The effect of metribuzin, fluorochloridone and PPG-844, alone and in combination with metolachlor, on potato yield, Riverhead, N.Y., 1984, Experiment 3.

Treatment		Yield (t/ha)		% of Total Yield			
Chemical	kg/ha	Total	5-10cm	<5 cm	5-6cm	6-8cm	8-10cm
No herbicide		23.4	18.0	23	37	40	0
metribuzin	0.56	31.4	25.9	17	33	49	1
metolachlor	2.24	34.3	28.7	16	33	49	2
metribuzin	0.56	31.4	25.1	20	30	49	1
plus metolachlor	2.24						
PPG-844	0.28	31.6	26.2	16	34	48	2
PPG-844	0.28	33.5	27.8	17	32	49	2
plus metolachlor	2.24						
PPG-844	0.56	30.8	25.0	19	34	44	3
PPG-844	0.56	32.5	27.2	16	34	48	2
plus metolachlor	2.24						
fluorochloridone	0.28	32.4	26.9	17	32	49	2
fluorochloridone	0.28	34.1	28.5	16	32	51	1
plus metolachlor	2.24						
fluorochloridone	0.56	32.5	27.2	17	33	48	2
fluorochloridone	0.56	32.1	26.7	17	32	49	2
plus metolachlor	2.24						
Waller-Duncan (0.05)		(ns)	(ns)				

EFFECT OF DPX-Y6202 AND DPX-F6025 HERBICIDES ON WEED CONTROL IN MAINE POTATOES

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

ABSTRACT

Several combinations of metribuzin applied preemergence followed by post emergence or layby treatments of fluazifop-butyl, sethoxydim, DPX-Y6202, and DPX-F6025 were tested for annual and perennial grass control in Katahdin potatoes. Most combinations provided satisfactory commercial control of grasses. Some crop injury occurred when a high rate of DPX-Y6202 was applied at layby; and crop injury and yield declines were found when DPX-Y6025 was applied as post emergence treatments.

INTRODUCTION

In Maine, we have seen an increase in annual grass (*Echinochloa crus-galli* (L.)Beauv.) and perennial grass (*Agropyron repens*) populations as potato culture changed from monoculture to two and three year rotations. Because of this increased incidence of common lambsquarters (*Chenopodium album* (L.)), growers have requested increased research emphasis on new pre and post emergence herbicide combinations for control of these grass and broadleaved weeds. In this study, various combinations of metribuzin (4-amino-6-*tert*-butyl-3-(methylthio)-*as*-triazin-5(4*H*)-one), fluazifop-butyl (butyl 2-[4-(6-trifluoromethyl-2-pyridyl oxy)phenoxy] propionate), sethoxydim (2-[1-ethoxyimino) butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one), DPX-Y6202 (2-[4-[(6-chloro-2-quinoxalinyl)oxy]-phenoxy]-propionic acid, ethyl ester), and DPX-F6025 (2-(([(4-chloro-6-methoxypyrimidine-2-yl)amino carbonyl]amino sulfonyl))benzoic acid, ethyl ester) 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 recorded for all weed species present but only the weed control ratings for barnyardgrass, quackgrass, and lambsquarters are presented in this paper. The potato cultivar used in this study was (*Solanum tuberosum* L.'Katahdin').

MATERIALS AND METHODS

The test site was located on a gravelly silt loam soil with 2.5 percent organic matter. Plot size was a single row, 20 feet in length, arranged in a randomized block design with five 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. Crop injury and weed control ratings were made at two dates using the modified "Cornell" rating system of 9 = no injury and perfect weed control, and 1 = crop elimination and no weed control. Pertinent dates of application, conditions at time of application, and planting and harvest dates are presented in Table 1.

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RESULTS AND DISCUSSION

Yield of potatoes was significantly reduced when DPX-F6025 was applied as a post emergence treatment and crop injury was very severe. DPX-Y6202 applied at a rate of 3.0 oz. per acre at layby did not reduce yield of potatoes but did cause crop injury, as shown in Table 1. All other combinations of metribuzin (pre) and DPX-Y6202 (post) or DPX-F6025 (pre) and fluazifop (post) did not affect yield or injure the potato crop.

Barnyardgrass control was satisfactory (7.0 or higher) with all treatments except where 0.25 lb. of metribuzin was used alone, as shown in Table 2. Quackgrass control was satisfactory with all treatments except where the low rate of metribuzin was applied alone and when 0.8 oz. and 1.6 oz. of DPX-Y6202 rates were applied at layby. All treatments gave satisfactory control of lambsquarters primarily because there was very little pressure from this weed in these plots.

Table 1. Effect of DPX-Y6202 and DPX-F6025 herbicides on yield and crop injury of Katahdin potatoes. Maine - 1984.

Treatments[a] A.I. Per Acre	Yield Cwt./A.	Crop Injury 7-2	Crop Injury 8-9
No treatment (no cultivation)	280	9.0	9.0
No treatment (no herbicide)	284	9.0	9.0
4.5 lbs. Dinoseb + 3.0 lbs. Metolachlor, PE	308	9.0	9.0
0.25 lb. Metribuzin, PE + 0.8 oz. DPX-Y6202[b], LB	306	9.0	8.8
0.25 lb. Metribuzin, PE + 1.6 oz. DPX-Y6202[b], LB	331	9.0	9.0
0.25 lb. Metribuzin, PE + 2.0 oz. DPX-Y6202[b], LB	330	9.0	8.8
0.25 lb. Metribuzin, PE + 3.0 oz. DPX-Y6202[b], LB	341	9.0	7.6
0.25 lb. Metribuzin, PE + 4.0 oz. DPX-Y6202[b], LB	280	9.0	6.0
0.25 lb. Metribuzin, PE	322	9.0	9.0
0.25 lb. Metribuzin, PE + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	322	9.0	9.0
0.25 lb. Metribuzin, PE + 8.0 oz. Sethoxydim[b] (0.25%), LB	296	9.0	9.0
1/25 oz. DPX-F6025[c] (0.5%), POST + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	219	9.0	5.8
1/16 oz. DPX-F6025[c] (0.5%), POST + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	160	9.0	3.6
1/8 oz. DPX-F6025[c] (0.5%), POST + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	168	9.0	3.0
1/25 oz. DPX-F6025[c] (0.25%), PE + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	325	9.0	9.0
1/3 oz. DPX-F6025[c] (0.25%), PE + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	304	9.0	9.0
1/25 oz. DPX-F6025[c] + 0.25 lb. Metribuzin, PE + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	282	9.0	9.0
1/3 oz. DPX-F6025[c] + 0.25 lb. Metribuzin, PE + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	310	9.0	9.0
Waller Duncan L.S.D. (0.05)	67		

[a]Planted - May 29; killed - September 10; harvested - September 27, 1984.

Preemergence (PE) treatments applied June 8. Temperature - 77F., hazy; soil - moist; wind - 3-5 mph, south.

Post emergence (POST) treatments applied June 10. Temperature - 75F., partly sunny; soil - moist; wind - 3-6 mph, southeast.

Layby (LB) treatments applied July 24. Temperature - 72F., sunny; soil - moist; wind - 15-18 mph, west.

[b]With crop oil concentrate.

[c]With non-ionic surfactant.

Table 2. Effect of DPX-Y6202 and DPX-F6025 herbicides on weed control in Katahdin potatoes. Maine - 1984.

Treatments[a] A.I. Per Acre	Barnyardgrass		Quackgrass		Lambsquarters	
	7-2	8-9	7-2	8-9	7-2	8-9
No treatment (no cultivation)	5.0	4.0	5.8	5.0	9.0	7.0
No treatment (no herbicide)	4.2	5.0	5.6	6.6	9.0	8.6
4.5 lbs. Dinoseb + 3.0 lbs. Metolachlor, PE	9.0	9.0	6.2	7.0	9.0	9.0
0.25 lb. Metribuzin, PE + 0.8 oz. DPX-Y6202[b], LB	4.6	8.0	6.0	7.2	9.0	9.0
0.25 lb. Metribuzin, PE + 1.6 oz. DPX-Y6202[b], LB	5.0	9.0	5.8	8.6	9.0	9.0
0.25 lb. Metribuzin, PE + 2.0 oz. DPX-Y6202[b], LB	4.6	9.0	5.8	8.6	9.0	9.0
0.25 lb. Metribuzin, PE + 3.0 oz. DPX-Y6202[b], LB	4.6	9.0	6.0	8.8	9.0	8.8
0.25 lb. Metribuzin, PE + 4.0 oz. DPX-Y6202[b], LB	5.4	9.0	6.0	9.0	9.0	9.0
0.25 lb. Metribuzin, PE	4.8	5.2	5.8	6.0	9.0	9.0
0.25 lb. Metribuzin, PE + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	4.4	9.0	6.0	8.6	9.0	9.0
0.25 lb. Metribuzin, PE + 8.0 oz. Sethoxydim[b] (0.25%), LB	4.6	9.0	6.0	8.2	9.0	9.0
1/25 oz. DPX-F6025[c] (0.5%), POST + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	4.4	9.0	5.4	9.0	9.0	8.2
1/16 oz. DPX-F6025[c] (0.5%), POST + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	4.2	9.0	5.8	8.8	9.0	8.2
1/8 oz. DPX-F6025[c] (0.5%), POST + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	3.8	9.0	5.4	8.8	9.0	8.2
1/25 oz. DPX-F6025[c] (0.25%), PE + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	5.6	8.6	6.2	8.6	9.0	8.8
1/3 oz. DPX-F6025[c] (0.25%), PE + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	5.4	9.0	6.8	8.2	9.0	9.0
1/25 oz. DPX-F6025[c] + 0.25 lb. Metribuzin, PE + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	4.8	9.0	6.2	8.2	9.0	9.0
1/3 oz. DPX-F6025[c] + 0.25 lb. Metribuzin, PE + 4.0 oz. Fluazifop-butyl[b] (0.25%), LB	6.6	9.0	6.6	8.4	9.0	9.0

[a,b,c]See notes on Table 1.

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

Echinochloa crus-galli - 45.6

Agropyron repens - 2.0

Chenopodium album - 1.7

EFFECTS OF FLUAZIFOP AND BARLEY WINDBREAK COMPETITION ON SEEDED ONIONS IN ORGANIC SOIL

W. S. Lanterman, D. T. Warholic, L. A. Ellerbrock, P. J. Stachowski[1/]

ABSTRACT

Two experiments were conducted in 1984 to study the effects of fluazifop-butyl, fluazifop-P-butyl and barley windbreaks on the growth and yield of seeded onions on organic soil. In Experiment 1, fluazifop-butyl was applied at four timings based on onion growth stage (loop to 2 leaf) and three rates of barley (0, 1, 3 bu/A). The high rate of barley reduced onion yields by 40% compared to no barley whereas the low rate of barley did not reduce yields and had the added benefit of reducing wind erosion. Fluazifop-butyl did not adversely affect onion growth or yields. In Experiment 2, fluazifop-P-butyl was applied at three rates (.14, .28, .56 kg ai/ha); two timings (early or late) and with or without barley. The presence of barley reduced midseason onion height by 17% but final yield was not decreased if spray applications were made early, regardless of the rate. There was no evidence in either experiment of chemical phytotoxicity at any rate nor any adverse effect on onion yield.

INTRODUCTION

Some New York State onion growers have been interplanting strips of barley on organic soils between onion rows as a method of reducing wind erosion early in the season. Soil particles, when moved by wind, can cause severe abrasion of the young onion seedlings, and these losses are often great enough to necessitate replanting of entire acreages. This barley has been removed, when protection is no longer needed, by mechanical means or with shielded sprays of non-selective herbicides. With the introduction of the new postemergence grass herbicides, growers have requested information about the use, safety, and efficacy of these materials as broadcast sprays for barley windbreak removal.

Two experiments were conducted on organic soils in growers fields in 1984 in order to provide answers to these inquiries. The objective of the first experiment was to determine the effect of barley density and timing of barley removal with fluazifop-butyl ((+)-butyl 2-[4-[(5-trifluoromethyl)-2-pyridinyl]oxy] phenoxy] propanoate) on onion yield. The second experiment examined barley competition with onions, and rate and timing of barley removal with the (R) enantiomer of fluazifop-butyl, fluazifop-P-butyl (butyl (R)-2[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy] phenoxy]propanoate).

MATERIALS AND METHODS

EXPERIMENT 1. This experiment was carried out in Elba, NY on a woody muck with an organic matter content of 80% and a pH of 5.2. In a conventionally tilled field, barley (Hordeum vulgare 'Lud') was broadcast by hand at a rate of 0, 1, and 3 bu/A on April 14 and lightly covered by a hand rake. Onions (Allium cepa L. 'Benny's Red') were then seeded in rows shortly thereafter on the same day. A factorial treatment design was used with 3 levels of barley density and 4 timings of fluazifop-butyl arranged in split plots. A non-factorial check with no barley and no chemical was also included. Blocks were randomized and replicated 3 times. Plot size was 1.8 m by 5.5 m with four rows of onions per plot. On April 25 the total experimental area was treated with 6.7 kg ai/ha of propachlor (2-chloro-N-isopropylacetanilide) 20G for preemergence grass and broadleaf weed control. The timing of the fluazifop butyl sprays for barley windbreak removal are summarized in Table 1.

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Table 1. Timing of fluazifop-butyl for barley windbreak control. Experiment 1. Elba, NY, 1984.

TIMING	DATE	ONION GROWTH STAGE	BARLEY GROWTH STAGE	RATE (kg ai/ha)
1	5/7	LOOP	1 TRUE LEAF	0.14
2	5/15	FLAG	3 to 5 LEAVES	0.28
3	5/22	1-LEAF	1 to 2 TILLERS 10 to 12 cm TALL	0.28
4	5/30	2-LEAF	8 TILLERS 12 to 22 cm TALL	0.28

A crop oil concentrate at 1% v/v was included in all sprays. All fluazifop sprays were made with a single nozzle boom applying a 30 cm wide band over the onion row. This left some barley escapes between the onion rows but these were removed on June 7. All sprays were applied with a hand held, CO2 pressurized, backpack sprayer with 8004 LP, Tee-Jet flat fan nozzles with 542.3 L/ha and 137.9 kPa. Standard pest control measures for insect and disease control were used throughout the season.

EXPERIMENT 2. This experiment took place in another muck area in Oswego, NY. The soil was also a woody muck with 80% organic matter but with a pH of 5.9. After conventional tillage and fitting onions ('Downing Yellow Globe') were planted in rows on May 2. The next day, depending on treatment, a single row of barley ('Lud') at a rate of .125 bu/A was planted betweeen every two rows of onions. A factorial design was used with two barley levels, two timings, and three rates of fluazifop-P-butyl. In addition, one non-factorial treatment was included as an untreated control. Plot size was 1.8 m by 5.5 m with 4 rows of onions per plot.

The early fluazifop-P-butyl application was made on June 15 when onions were in the 2-3 leaf stage. At this time, the barley was 30 cm tall and just closing in on the onion row. The late application was made on June 26 when the onions were in the 4-leaf stage and the barley was 50-60 cm in height. At this stage the barley was considered quite competitive. All barley remaining upright from the late application was removed by hand two weeks later (July 19).

All herbicide applications were made with a hand held, CO2 pressurized backpack sprayer with four 8004 LP Tee-Jet nozzles at 420 L/ha and 172 kPa.

RESULTS

EXPERIMENT 1. The high rate of barley significantly reduced onion yields, onion stand, and mean bulb weight over all timings (Table 2). The lowest yields were recorded at high barley seeding rates or at low seeding rates and the late timing of fluazifop-butyl. These results can be explained by insufficient barley control in the former, due to the cool, wet weather, and to barley competition in the latter, respectively. In addition, the yields where barley was seeded at the low rate and controlled by fluazifop-butyl were comparable to yields where onions were grown alone. This was true over all four timings. The highest, but not necessarily significant, yields occurred when barley was chemically removed when the onions were at the 1-leaf stage (3rd timing). Barley competition with onions was evident, if removal was delayed beyond this time. Mean bulb weight was also significantly reduced by the high barley seeding rate and by the low seeding rate if not removed by the onion 2-leaf stage. In no case did fluazifop-butyl reduce plant stand, mean bulb weight, or onion yield.

Table 2. Effect of fluazifop-butyl application time and barley seeding rate on seeded onions. Experiment 1. Elba, NY, 1984.

Spray timing (onion growth stage)		Barley seeding rate (bu/A)	Plant stand (bulbs/foot)	Mean bulb weight (kg)	Yield (bu/A)
Control	-	-	8.5	.12	1527
	Loop	0	7.9	.13	1498
		1	9.6	.10	1442
		3	6.1	.05	663
	Flag	0	8.6	.12	1499
		1	9.8	.11	1490
		3	8.8	.09	1120
	1 leaf	0	8.6	.12	1533
		1	10.6	.11	1628
		3	7.9	.10	1090
	2 leaf	0	8.6	.12	1501
		1	8.1	.09	1104
		3	6.0	.09	770
Waller-Duncan M.S.D. (.05)			2.5	.02	455

EXPERIMENT 2. The presence of barley between onion rows reduced midseason onion height by 17% as compared to onions grown without barley (Table 3). However, when chemical removal of barley was accomplished early, yields were comparable to onions grown without barley. On the other hand, onion yields were decreased 25% and bulb weight by 36% when chemical removal of barley was late. This is in contrast to mean bulb weight increase if the barley was removed early. The rate of fluazifop-P- butyl did not affect yield regardless of the application time, nor did it have any adverse affect on onion growth.

Table 3. The effects of timing and rate of application of fluazifop-P-butyl and presence or absence of barley windbreaks on seeded onions. Experiment 2. Oswego, NY, 1984.

Trt #	Presence of barley	Timing of chemical application	Chemical rate (kg ai/ha)	Onion plant height (cm)	Mean bulb wt (kg)	Yield (bu/A)
1	-		0	13.7	.12	857
2	-	early	.14	13.3	.12	717
3	-	"	.28	13.1	.15	691
4	-	"	.56	13.9	.12	718
5	-	late	.14	11.9	.16	737
6	-	"	.28	13.6	.16	593
7	-	"	.56	14.6	.14	941
8	+	early	.14	12.7	.13	794
9	+	"	.28	10.2	.09	606
10	+	"	.56	11.2	.11	699
11	+	late	.14	10.3	.08	577
12	+	"	.28	11.1	.10	507
13	+	"	.56	11.2	.10	571
Waller-Duncan M.S.D. (.05)				2.4	.04	407

DISCUSSION

The conclusions drawn from these two experiments are complimentary. It was shown that the presence of barley can lead to pronounced yield reductions when high seeding rates are used, regardless of the time of removal (Table 4). It was also shown that a low barley seeding rate can also reduce yields if the barley is removed too late in the season (Figure 1).

In neither experiment was there any observable phytotoxicity to onions at any timing or rate, nor yield loss or change in bulb weight due to the presence of fluazifop-butyl or fluazifop-P-butyl. The chemical was beneficial not only from the standpoint of removing the barley at the early timings, but also was shown to improve yields by stopping growth of barley up to 30 cm tall. It was noted, however, that the low rates of fluazifop-P-butyl did not kill this tall barley and would have severely affected onion yields had it not been removed by hand. In both experiments, the barley still competed with onions after spraying due to the length of time required for killing. This, in turn, was also prolonged by adverse weather conditions.

These tests utilized single spray applications made at very low pressures. Most onion growers tend to tank mix a large number of pesticides at one time and spray them at very high pressures. Further tests are necessary to evaluate the ramifications of these practices.

Table 4. ANOVA and probability values for main effects and interactions. Experiment 2. Oswego, NY, 1984.

		p > f		
Treatment	df	Plant height	Bulb weight	Yield
Control vs. others	1	NS	NS	NS
Barley	1	.0001	.0001	.02
Timing	1	NS	NS	NS
Barley x Timing	1	NS	.04	.04
Chemical rate	2	NS	NS	NS
Remaining interactions	6	NS	NS	NS

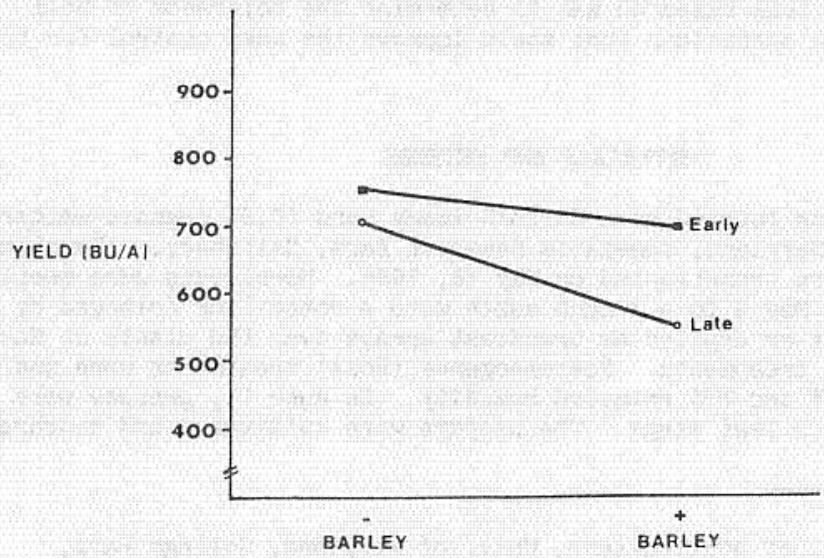

Figure 1. Effects of barley and fluazifop-P-butyl application time on onion yield. Experiment 2. Oswego, N.Y., 1984.

HERBICIDES FOR TRANSPLANTED BELL PEPPERS

C. Edward Beste[1/]

ABSTRACT

Alachlor was less injurious to transplanted bell peppers than metolachlor on a Norfolk loamy sand as either preplant incorporated (PPI) or preemergence (Pre) applications broadcast over the plants; however, metolachlor, preemergence was less phytotoxic than preplant incorporated. Acceptable yields occurred with alachlor from 1.0 to 2.0 lb/A as PPI or Pre treatments but acceptable yields occurred with metolachlor at 1.0 lb/A, PPI or 1.0 to 3.0 lb/A, Pre. Grass control was slightly better with alachlor than metolachlor. Napropamide, 1.0 lb/A, PPI, provided slightly better grass control than Pre treatments and injury was not observed. Trifluralin, 0.5 lb/A, provided 100% grass control and was the only treatment that controlled annual morningglory (Ipomoea hederacea (L.)Jacq. and I. hederacea var. integriuscula Gray). Diphenamid provided acceptable weed control and yields; however, postemergence treatments with DPX Y6202, HOE 33171 and PP 005 improved late season grass control. Postemergence treatments with crop oil concentrate during 99°F conditions did not injure peppers.

INTRODUCTION

Bell peppers (Capsicum annuum L.) are a major vegetable crop in Maryland; however, annual nightshade weeds (Solanum sp.) and yellow nutsedge (Cyprus esculentum L.) are serious weeds that are difficult to control with presently labeled herbicides. Majek (1) has shown effective hairy galinsoga (Galinsoga ciliata (Ref.) Blake) control with alachlor [2-chloro-2,6-diethyl -N-(methoxymethyl) acetanilide] and diethatyl ethyl [N-chloroacetyl-N-(2,6-diethylphenyl)-glycine ethyl ester]. Acceptable hot pepper tolerance with surface applied post transplant treatments of alachlor and diethatyl ethyl was observed (1).

The objective of this research was to determine the tolerance of bell peppers to several new herbicides that would improve the weed control for this crop.

MATERIALS AND METHODS

The experiment was located on a Norfolk loamy sand (0.6% organic matter) at the University of Maryland, Vegetable Research Farm, Salisbury. 'Keystone' bell pepper plants were transplanted on May 10, 1984. Herbicides were preplant incorporated (PPI) on May 9 to a 3 inch depth with a rotatiller followed by a crowfoot cultipacker or applied as broadcast sprays over the plants on May 11 as preemergence (Pre) treatments. Postemergence (Post) treatments were applied on June 11 during 99°F and 95% relative humidity. On June 11, grasses were present in the one to 3 leaf stage. The peppers were cultivated and sidedressed

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with 300 lb/A of 10-10-10 fertilizer on May 21 and 300 lb/A of 16-8-8 on June 8. Green peppers were harvested on July 12, 19, 26 and August 2 and 9 and reported as the first harvest and total for all five harvests.

The plot size was 5 ft 4 inches by 17 ft with one row of 10 plants per plot and the plants were spaced 18 inches apart. The experimental design was a randomized complete block with three replications.

Pertinent rainfall in inches was as follows: May 4 = 0.5, May 6 = 0.2, May 7 = 0.3, May 16 = 0.75 (irrigation), May 24 = 1.72, May 27 to 31 = 4.78, June 7 = 0.01, June 13 = 0.75 (irrigation), June 16 & 17 = 1.27.

Weed control was observed for large crabgrass (Digitaria sanguinalis (L.) Scop., goosegrass (Eleusine indica (L.)Gaertn.), lovegrass (Eragrostis cilianensis (All.)Lutati), common lambsquarters (Chenopodium album L.), common purslane (Portulaca oleracea L.), ivyleaf morningglory (Ipomoea hederacea (L.) Jacq.) and entireleaf morningglory (I. hederacea var integriuscula Gray).

RESULTS AND DISCUSSION

Diphenamid (N,N-dimethyl-2,2-diphenylacetamide) at 3.0 lb/A, Pre, was not injurious to peppers but was weak on late season grass control. Diphenamid, in conjunction with cultivation provided acceptable control of lambsquarters and purslane. Postemergence applications of 1 qt/A crop oil concentrate alone and with PP005 at 0.25 lb ai/A in 30 GPA spray volume did not injure peppers when applied during 99°F temperature at flowering. Napropamide, PPI, provided full season grass control at 1.0 lb/A; however, Pre treatments were weak on grasses. Napropamide, PPI, controlled lambsquarters and purslane 100%; whereas the Pre treatments provided 90 to 97% control. No difference was observed between the 2E and 50W formulation of napropamide. PP 005,HOE 33171 and DPX Y6202 at 0.25 lb/A with non-ionic surfactant controlled late season grasses without crop injury; however, the downward early yield trend with HOE 33171 appeared to be due to a weak replicate (Table 1).

Trifluralin (α,α,α-trifluoro-2,6-dinitro-N-N-dipropyl-p-toluidine) 0.5 lb/A, did not reduce early pepper growth and was the only treatment to control annual morningglory besides providing complete control of grasses, lambsquarters and purslane. Morningglory vines were removed by hand weeding on July 12 to prevent them from covering the pepper plants in all treatments.

Alachlor was less phytotoxic than metolachlor [2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide] as a PPI or Pre application broadcast over the plants; however, metolachlor was less phytotoxic Pre than PPI. Acceptable yields occurred with alachlor from 1.0 to 2.0 lb/A as PPI or Pre treatments or with metolachlor at 1.0 lb/A, PPI or 1.0 to 3.0 lb/A Pre. Grass control was slightly better with metolachlor than alachlor but purslane and lambsquarters control was slightly better with alachlor than metolachlor.

Trifluralin, napropamide and diphenamid were efficacious for weed control in transplanted bell peppers, however, alachlor should be registered for the control of several problem weeds in bell peppers. Metolachlor as a Pre treatment only should be further evaluated at 1.0 to 2.0 lb/A for bell peppers.

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Table 1. Evaluations of weed control in transplanted 'Keystone' bell peppers in a Norfolk loamy sand (0.6% O.M.) planted on May 10, 1984.

Treatment			Pepper Growth (% of Control)			Weed Control 2/ (% Control)									Yield 3/ (Lb/A) Harvests	
						CG		LQ		7/8				8/23		
Herbicide	Lb/A	Method 1/	5/21	6/6	7/8	6/6	7/8	6/6	7/8	LG	GG	PL	MG	Grasses	First	Total
1. Control	---	---	100	100	100	0	0	0	0	0	0	0	0	0	850 b	8600 a-f
2. Handweeded	---	---	97	100	100	100	100	100	100	100	100	100	100	100	2000 ab	11,500 a
3. alachlor (4E)	1.0	PPI	83	100	93	93	63	100	84	77	50	53	0	7	900 b	9000 a-f
4. alachlor	1.5	PPI	90	100	100	100	70	100	95	85	90	90	0	47	1000 b	8450 a-f
5. alachlor	2.0	PPI	95	100	95	100	82	100	67	97	97	97	0	53	1300 b	9050 a-f
6. alachlor	3.0	PPI	85	90	77	100	98	100	97	97	93	89	47	78	850 b	6550 def
7. metolachlor(8E)	1.0	PPI	93	90	87	100	100	100	83	98	100	80	0	63	1250 b	9050 a-f
8. metolachlor	1.5	PPI	93	100	83	100	98	100	100	99	100	80	48	75	850 b	7650 b-f
9. metolachlor	2.0	PPI	100	93	77	100	99	100	90	97	99	87	33	89	850 b	6750 c-f
10. metolachlor	3.0	PPI	100	93	52	100	100	100	100	98	100	83	48	88	600 b	5650 f
11. alachlor	1.0	Pre	85	100	97	100	82	100	100	85	87	87	23	13	2850 a	10,800 ab
12. alachlor	1.5	Pre	90	95	100	100	70	100	100	67	70	85	27	17	1400 b	11,200 ab
13. alachlor	2.0	Pre	85	90	95	100	78	100	100	77	82	90	33	30	850 b	10,150 a-d
14. alachlor	3.0	Pre	90	92	93	100	82	100	93	82	82	82	0	32	1000 b	9000 a-f
15. metolachlor	1.0	Pre	85	100	98	100	92	100	95	83	89	82	27	40	1250 b	9000 a-f
16. metolachlor	1.5	Pre	82	93	80	100	92	100	90	77	93	88	0	33	850 b	7850 a-f
17. metolachlor	2.0	Pre	92	100	95	100	98	100	100	77	93	58	0	20	1250 b	9800 a-d
18. metolachlor	3.0	Pre	100	97	72	100	99	100	100	92	100	92	0	73	800 b	5820 ef
19. napropamide(50W)	1.0	PPI	95	100	98	100	100	100	100	100	100	100	0	100	1950 ab	10,100 a-d
20. trifluralin(4E)	0.5	PPI	97	98	97	100	100	100	100	100	100	100	98	100	1250 b	11,400 ab
21. napropamide(50W)	1.0	Pre	98	97	95	87	80	100	90	83	85	97	27	77	1350 b	10,550 abc
22. napropamide(2E)	1.0	Pre	93	100	100	100	82	100	100	85	85	95	0	70	1300 b	9450 a-e
23. diphenamid(90W)+ crop oil conc.	3.0 + 1 qt/A	Pre + Post	97	100	100	90	73	100	98	73	80	85	0	27	1400 b	9500 a-e
24. diphenamid + PP 005(1E) + crop oil conc.	3.0 + 0.25 + 1 qt/A	Pre + Post	100	97	100	100	100	100	90	100	100	90	25	98	1750 ab	10,600 ab
25. diphenamid + PP 005(1E)*+	3.0 + 0.25	Pre + Post	100	100	100	90	100	100	100	100	100	98	0	97	1700 ab	11,050 ab
26. diphenamid + HOE 33171(1E)*	3.0 + 0.25	Pre + Post	93	90	97	100	100	100	100	100	100	83	0	97	650 b	9250 a-f
27. diphenamid + DPX Y6202(0.8E)*	3.0 + 0.25	Pre + Post	100	100	100	57	100	100	98	100	100	83	0	97	1900 ab	10,500 abc

*Non-ionic surfactant - 2 pt/100 gal. Mean separation within columns by Duncan's MRT at the 5% level.

1/ PPI - May 10 - preplant incorporated to a 3 inch depth with a rotatiller followed by a crowfoot cultipacker. Pre - May 11 - preemergence, broadcast spray over the transplants. Post - June 11 - broadcast over the plants - 30 GPA spray volume.

2/ Weed population - June 6 - large crabgrass - 5 plants/ft^2, common lambsquarters - 1 plant/ft^2. July 8 - large crabgrass - 1.5 plant/ft^2, common lambsquarters - 0.1 plant/ft^2, lovegrass - 5 plants/ft^2, goosegrass 2.4 plants/ft^2, common purslane - 4 plants/ft^2, entireleaf and ivyleaf morningglory - 0.8 plants/ft^2. August 23 - a mixture of fall panicum, goosegrass, lovegrass and large crabgrass - 3 plants/ft^2.

3/ First harvest on July 12, total yield of 5 harvests from July 12 to August 9.

PEACH RESPONSE TO SEVERAL POSTEMERGENCE TRANSLOCATED HERBICIDES

B.A. Majek[1]

ABSTRACT

Glyphosate, sulfosate, and glufosinate were applied to the trunk and one scaffold limb of three-year-old peach trees in separate treatments on October 4, 1983. The rate applied was a 2.0, 2.0 and 3.5% solution (v/v), respectively, sprayed to the drip point to simulate spot treatment type applications. Glyphosate and sulfosate did not injure the tree when applied to the mature bark of the tree, but translocated throughout the tree and caused tree death within four weeks of application when applied to a scaffold limb. Glufosinate applied to the mature bark of a peach tree killed the bark and associated living tissue in the treated area but did not translocate to other parts of the tree. When applied to a scaffold limb, glufosinate killed only that limb in 1983 but may have been translocated to and stored in the roots that fall. The following spring the rest of the above-ground portion of the treated trees were killed. The roots were not affected. Suckers that sprouted in the summer after the limbs and trunk died were not affected.

INTRODUCTION

Standard orchard floor vegetation management practices in New Jersey attempt to maintain vegetation free strips under the fruit trees and grass sod between the tree rows. Weed control techniques practiced by many growers include mowing and the use of contact and residual herbicides. Primary weed species in orchards are perennial weeds, including dandelion (**Taraxacum officinale** Weber in Wiggers), white heath aster (**Aster pilosus** Willd.), Virginia creeper [**Parthenocissus quinquefolia** (L.) Planch], Canada thistle [**Cirsium arvense** (L.) Scop.], wild onion (**Allium canadense** L.), common milkweed (**Asclepias syreaca** L.), hemp dogbane (**Apocynum cannabinum** L.), and multiflora rose (**Rose multiflora** Thumb. ex Murr.). Certain biennial and white annual weeds have also become serious problems, including prickly lettuce (**Lactuca serriola** L.), horseweed [**Conyza canadensis** (l.) Cronq.], camphorweed [**Heterotheca subaxillaris** (Lam) Britt. & Rusby], and common chickweed [**Stellaria media** (L.) Cyrillo] (5).

Glyphosate [N-(phosphonomethyl)glycine] is a foliar applied postemergence herbicide that translocates throughout most plants (8), and controls many perennial weeds. Fruit trees have also been killed or severely injured when glyphosate was applied to the leaves or green bark of the tree (7, 9). Directed applications of glyphosate that have avoided contact with the fruit tree or only contacted brown, mature bark have not caused crop injury (1, 3, 6). Differences that have been observed in fruit tree tolerance to glyphosate have been attributed to species, cultivar, tree age, exposure, and time of application during the year (4, 6, 9). Changing translocation patterns during the year have been suggested as reasons for differences observed in glyphosate phytotoxicity to fruit trees (2). The maximum translocation of glyphosate throughout a peach tree has been reported to occur when the herbicide was applied in August, September or October (9).

The objectives of this study were to evaluate the phytotoxicity to peaches of glyphosate and two experimental postemergence translocated herbicides, sulfosate

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(trimethylsulfonium carborymethylaminomethylphosphonate) and glufosinate [ammonium-(3-amino-3-carboxypropyl)-methyl phosphinate] following the herbicide translocation patterns in the trees.

MATERIALS AND METHODS

Peach pits from the cultivar, Halford, were planted 2 to 5 cm deep at Cream Ridge, New Jersey, in November, 1980. The pits germinated the following spring and produced seedlings 1 M tall by the end of the growing season. Seedlings were dug and transplanted at the Rutgers Research & Development Center, Bridgeton, New Jersey in March, 1982. The trees were grown using standard cultural practices until October 4, 1983 when the herbicide treatments were applied.

The herbicides were applied to the trees using a hand-held pump type sprayer. They were sprayed to the drip point. Herbicide rates were calculated as a percent solution (v/v) to simulate spot treatment spraying. Each herbicide was applied two ways; to one side of the trunk to a height of 3 dm, and to one scaffold limb in separate treatments. A large sheet of clear plastic was used to shield the rest of the tree when the scaffold limb treatments were applied. The experiment was designed in a randomized, complete block with four replications. Injury was observed on the trunk, the treated limb, the other scaffold limbs and sucker growth from the roots was recorded for 12 months after treatment. The trees were cut and the fresh weight of above-ground portions of the trees were recorded 12 months after treatment.

RESULTS AND DISCUSSION

Glyphosate injury to peaches was similar to sulfosate injury when applied to the trunk or a scaffold limb. Neither herbicide injured peaches when applied to the trunk (Table 1). Both herbicides translocated throughout the tree and eventually caused the death of the peach tree when a scaffold limb was treated (Table 2).

TABLE 1. Injury to peaches caused by postemergence herbicide application to the trunk the fall of 1983[1]

Treatment	Rate (% sol)	Injury 11/1/83 Trunk (%)	Injury 11/1/83 Tree (%)	Injury 9/27/84 Trunk (%)	Injury 9/27/84 Tree (%)	10/8/84 Fresh wt (kg)
Untreated	-	0	0	0 a	0	18.8 a
Glyphosate	2.0	0	0	0 a	0	17.8 a
Sulfosate	2.0	0	0	0 a	0	19.6 a
Glufosinate	3.5	0	0	55 b	0	12.9 b

[1] Applied 10/4/83

The symptoms and time required for their development were the same for glyphosate and sulfosate. The leaves on the treated limb became chlorotic within seven days after application, and the limb was completely defoliated within 10 days. Chlorosis was observed on the other scaffold limbs of the tree within 10 to 14 days of treatment and the trees were completely defoliated within 21 days. Death of new and one-year-old wood was also observed at that time. The trees made no attempt to grow, either from the scaffold limbs, trunk or roots at any time in 1984.

TABLE 2. Injury to peaches caused by postemergence applications to a limb in the fall of 1983.

Treatment	Rate (% sol)	Injury 11/1/83 Trunk (%)	Injury 11/1/83 Limb (%)	Injury 11/1/83 Tree (%)	Injury 9/27/84 Trunk (%)	Injury 9/27/84 Limb (%)	Injury 9/27/84 Tree (%)	Injury 9/27/84 Roots (%)
Untreated	-	0	0 a	0 a	0 a	0 a	0 a	0 a
Glyphosate	2.0	0	90 b	100 b	100 b	100 b	100 b	100 c
Sulfosate	2.0	0	90 b	90 b	100 b	100 b	100 b	100 c
Glyfosinate	3.5	0	90 b	90 b	27 a	100 b	100 b	25 b

Glufosinate injury to peaches was not similar to glyphosate and sulfosate. Application to the mature bark on the trunk caused the death of the cambium and associated tissue under the sprayed bark (Table 1). No injury was observed the fall the application was made. The damage to the tree trunk developed the year after treatment. The bark became darkened and depressed in the sprayed area and some gummosis was observed. No lateral movement and very little, if any vertical movement of the herbicide was indicated by the injury. No injury was observed on the foliage or the scaffold limbs of the tree. Healing of the damaged part of the trunk by the growth of callous tissue on the border of the dead tissue began within one year after treatment.

Application of glufosinate to a scaffold limb caused defoliation of the limb within seven days after treatment and death of the limb within four weeks after treatment, but no injury to the other scaffold limbs or any other part of the tree was observed in 1983.

The untreated scaffold limbs and the trunk of the tree were killed in the spring of 1984. The remaining scaffold limbs appeared to be in good condition in March of 1984, but the buds did not break dormancy and produce leaves later in the spring. The wood began to die as spring progressed. The bark turned a darker color and shrank beginning with the new wood and progressing toward the base of the tree. Sucker growth was observed from the roots of three of the four treated trees following the death of the above-ground portion of the tree. No injury was observed on the suckers. The death of the root system of the fourth tree may have been due to carbohydrate depletion while the limbs and trunk were being killed.

Glyfosinate seemed to have been translocated from the treated limb before it died about four weeks after the herbicide application. The translocation did not appear to be into the other scaffold limbs since no injury was observed. The herbicide may have been translocated into the roots and stored until spring when it may have been remobilized and moved into the scaffold limbs. The lack of translocation observed in the trees treated on the trunks may have been a dose response, less herbicide being absorbed through the mature, brown bark of the trunk than through the leaves, and new wood of the trees that had one scaffold limb treated.

Glufosinate was a long lasting, translocated herbicide when applied to peaches. It was absorbed by the foliage and through mature, brown bark and was capable of killing established three-year-old trees. These characteristics, particularly the absorption through mature bark, reduced the potential of the herbicide for use in peach orchards.

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Grass Suppression in Orchards with EPTC 1/

Roger S. Young 2/

ABSTRACT

Growth regulating response of Kentucky 31 tall fescue from 6.7 kg/ha (ai) application of 10% granular EPTC was effective from a March 13, 1983 application, but not effective from a March 15, 1984 application due to climatic environmental differences. April 11, 1984 EPTC applications of 6.7 kg/ha resulted in significant suppression of grass growth with no inflorescence development. Response from the EPTC treatment was present following a June 27 mowing at a height of 10 to 12 cm.

INTRODUCTION

The preemergence herbicide EPTC (S-ethyl dipropylthiocarbamate) has been used on farm crops and ornamentals as an effective herbicide since 1959. Stauffer (3) research has shown EPTC to have plant growth regulating responses on certain lawn grasses since the mid-1960's. Studies by Chappell (1,2), working with the Virginia State Highway Department, resulted in obtaining a state label for use of EPTC 10-G to be applied at the rate of 6.7 to 9.0 kg/ha (ai) on Kentucky 31 tall fescue (*Festuca arundinacea*) highway plantings after the grass has broken winter dormancy (March 1 to April 15).

The use of a plant growth regulator to suppress ground cover growth in orchards seeded to Kentucky 31 tall fescue could be less costly than the several mowings now used by orchardists in their management program.

MATERIALS AND METHODS

This study was initiated in 1983 at the West Virginia University Experiment Farm, Kearneysville, West Virginia in orchard sites having a Kentucky 31 tall fescue ground cover planted in apple (*Malus domestica* Borkh.) orchards established in 1977 and in peach [*Prunus persica* (L.) Batsch] orchards established in 1978. Plots were established on a Hagerstown-Frederick complex loam soil with 2.5 to 3% organic matter and a pH of 6.8.

A 10% granular formulation of EPTC was applied on March 13, 1983 at the rate of 6.7 kg/ha using a Gandy electrically operated 1.5 m wide spreader. Partial green-up of the grass had occurred at this time. The 1984 applications of EPTC at 6.7 kg/ha were made on March 15 to the same area treated in 1983 and on April 11 to a previously untreated area using a hand-operated spinning-disc spreader.

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Based upon the early phenological apple and peach bud development data, the 1984 season was approximately 15 days later than in 1983. However, by the time of fruit tree bloom, the 1984 season was only 3-4 days later. Growing degree days, using a base temperature of 10°C for the period January 1 to April 1, resulted in 5° days less in 1984 than in 1983.

With the exception of the plot areas in the study, the apple orchards were mowed nine times in 1984 (5/16, 5/30, 6/12, 6/21, 7/12, 8/3, 8/15 and 9/6). The peach orchards were mowed five times (5/16, 6/12, 7/12, 8/3 and 9/6). The rotary mower cut the ground cover vegetation at a height of 10 to 12 cm. Plots mowed June 27 and August 8 had one square meter of cuttings collected and oven dried at 60°C for 48 hours. One square meter areas of ground cover cut to soil level and oven dried were harvested on June 13 and August 15.

RESULTS

The occasional inflorescence development in treated areas in 1983 and 1984, could be attributed to lack of even coverage of EPTC. Some streaks of inflorescence development occurred with the use of the Gandy Spreader. The spinning-disc spreader allowed for scattered inflorescence development in some locations due to wind making coverage uneven.

The March applications caused a browning of the grass which was not observed with the April 11 application. The discoloration lasted till the end of April. The 1983 March 13 EPTC application resulted in effective grass growth suppression, which was not evident for the 1984 March 15, application.

Blade growth suppression and lack of inflorescence development responses were similar for both years of the study. This report is concerned with the 1984 plant growth regulation responses.

One month following the April 11 application, the EPTC treated blade height averaged 11.9 cm as compared to the non-treated blade height of 23.5 cm. This difference in blade height was maintained throughout the season in the non-mowed grass plots. Data indicates that 5.2 months after the EPTC treatment the average grass blade height was 38 cm as compared to 54 cm for the non-treated grass.

At the first mowing of treated plots on June 27, the treated blade height was 25 cm compared to 50 cm for the non-treated (Table 1). The plant growth suppression response continued to be evident at the time of the second mowing on August 8. The inflorescence height was 100 cm for the non-treated grass, while no inflorescence development occurred in the treated grass. At the time of the second mowing on August 8 (42 days following the first mowing), the treated grass blade height was 20 cm as compared to 34 cm for the non-treated. Inflorescence development was not present in treated or non-treated plots at the time of the second mowing. Blade growth was not significantly different for the mowed and non-mowed EPTC treated grass during the 42 day period between the first and second mowing. However, blade growth had reached 50 cm in height in the non-treated, non-mowed plot by June 27 and remained 50 cm in height during the next 42 days.

Table 1. Kentucky 31 fescue cuttings recovered from rotary mower set to cut 10-12 cm high. EPTC applied 4/11/84. Mowings made 6/27 and 8/8.

EPTC Rate kg/ha	Mowing Date 6/27 Dry Weight	6/27 Blade Height	6/27 Inflorescence Height	8/8 Dry Weight	8/8 Blade Height	8/8 Inflorescence Height
	(g)	(cm)		(g)	(cm)	
6.7	51.5	25	0	96.5	20	0
0.0	334.5	50	100	160.0	34	0
6.7				131.0	36	0
0.0				542.2	48	100

Dry weight, blade height and inflorescence development data were taken from one square meter of ground vegetation cut to ground level on June 13 and August 15 in previously non-cut areas (Table 2). Suppression of grass growth due to treatment was significant in both sampling dates. Dry weight and blade height of treated vegetation averaged 52% on June 13 and 34% on August 15 of that of the non-treated vegetation. Grass inflorescence did not develop in the EPTC treated plots.

Table 2. Influence of EPTC applied April 11, 1984 on Kentucky 31 fescue growth in apple and peach orchards at time of removing one square meter of ground vegetation cut to ground level on June 13 or August 15.

EPTC Rate kg/ha	Dry Weight (g)	Blade Height (cm)	Inflorescence Height (cm)
APPLE			
6/13/84			
6.7	245.5	23	0
0.0	480.5	49	98
8/15/84			
6.7	461.5	30	0
0.0	585.5	54	98-100
PEACH			
6/13/84			
6.7	131.7	23	0
0.0	422.2	38	110
8/15/84			
6.7	431.0	38	0
0.0	761.0	53	110

For one who desires to maintain Kentucky 31 tall fescue orchard ground cover in a golf course style, EPTC may be used for this purpose while realizing a considerable reduction in expense by reducing the number of mowings required.

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VEGETATION MANAGEMENT IN THE NEW JERSEY TREE FRUIT IPM PROGRAM

D.F. Polk and B.A. Majek[1]

ABSTRACT

A weed component was initiated as part of the New Jersey Peach IPM program in 1983. Trained field scouts provide growers with written reports detailing weed species, abundance, location(s), soil texture and organic matter. Tree injury from herbicides and nematode levels are also reported. Recommendations are matched to weeds present, soil texture and organic matter.

INTRODUCTION

Integrated pest management (IPM) programs have traditionally dealt with insect and disease pests. A number of pilot programs, as well as private consultants, now offer additional components in total integrated crop management. Included in these programs are leaf tissue and soil analysis, nematode detection, and weed management. Weed management, often overlooked by fruit growers, is one of the newest components in IPM programs. Weed monitoring and vegetation management has become an integral part of the pilot New Jersey Peach IPM Program.

OBJECTIVES

The weed component was initiated during the 1983 growing season. Objectives are to:

1. Identify the grower weed control practices.
2. Identify weed problems.
3. Index a profile of soil organic matters.
4. Note any tree injury or decline associated with herbicide use.
5. Make recommendations designed to improve existing weed control and orchard floor management practices.

METHODS AND REPORTING FORMAT

Scouts are trained in mid-May in a half-day field seminar. Following the training session all scouts are required to make a weed collection. Orchard scouting is done once in late May to early June and again during early- to mid-August. Weed species, abundance, and location are recorded on a double copy, carbonless report form (Figure 1). Species are grouped into **biennial/perennial** and **annual grass/broadleaf** categories. Weed species are recorded as number per yd^2 and whether in the aisle or tree row. Soil samples taken in early September are analyzed for organic matter, fertility, and nematode levels. During 1983, 45 peach blocks from six growers were monitored. A crop freeze during the winter of 1984

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resulted in only 21 blocks from three growers monitored. The following results illustrate data collected during the 1983 growing season.

Figure 1. IPM report form for weed management

NEW JERSEY AGRICULTURAL EXPERIMENT STATION
Tree Fruit IPM Report - Weeds

Grower_____ Date_____ Scout_____ Crop_____ Block(s)_____

MID or LATE Season Examination_____

	WEEDS	WEED ABUNDANCE/YD^2								COMMENTS
		In Row				In Aisle				
		<1	1-3	3-10	>10	<1	1-3	3-10	>10	
Biennials/Perennials										
Ann. Gr./Bdlvs.										

SOIL: Organic Matter:_____ Texture:_____ Cation Ex.Cap. (CEC):_____

FIELD MAP

RESULTS AND DISCUSSION

Weeds listed in Tables 1, 2 and 3 were found in the tree row or within the herbicide strip. All survey data represent combined listings from both early and late season scouting.

During 1983 large crabgrass, foxtail species and pigweed were the prominent annual weeds found (Table 1). Dandelion, white heath aster, Virginia creeper, and Canada thistle represented the major perennial weeds found (Table 2), while prickly lettuce and horseweed were the major biennials seen (Table 3). Dandelion is of particular concern since it is often found in both the rows and aisles and is a reservoir for tomato ring spot virus (TmRSV), the causal organism of **Prunus** stem pitting. It is also an alternate host for dagger nematodes (**Xiphinema** spp.) which transmits the virus.

TABLE 1. Major annuals in peach blocks scouted for weeds in 1983

Common name	Scientific name	Total Scouted	
		45 Blocks	6 Growers
Large crabgrass	**Digitaria sanguinalis** (L.) Scop.	22	5
Foxtail spp.	**Setaria** spp.	15	2
Fall panicum	**Panicum dichotomiflorum** Michx.	3	2
Barnyardgrass	**Echinochloa crus-galli** (L.) Beauv.	1	1
Pigweed	**Amaranthus** spp.	11	4
Common ragweed	**Ambrosia artemisiifolia** L.	2	2
Common lambsquarter	**Chenopodium album** L.	1	1
Ivyleaf morninglory	**Ipomoea hederacea** (L.) Jacq.	1	1
Lady's thumb	**Polygonum persicaria** L.	1	1

TABLE 2. Major perennials in peach blocks scouted for weeds in 1983

Common name	Scientific name	Total Scouted	
		45 Blocks	6 Growers
Dandelion	**Taraxacum officinale** Weber	23	4
White heath aster	**Aster pilosus** Willd.	20	3
Virginia creeper	**Parthenocissus quinquefolia** (L.) Planch.	19	2
Canada thistle	**Cirsium arvense** (L.) Scop.	17	2
Wild garlic/onion	**Allium canadense** L., **A. vineale** L.	11	4
Common milkweed	**Asclepias syriaca** L.	12	3
Hemp dogbane	**Apocynum cannabinum** L.	10	1
Multiflora rose	**Rosa multiflora** Thunb. ex Murr.	10	1

TABLE 3. Major biennials/winter annuals in peach blocks scouted for weeds in 1983

Common name	Scientific name	Total Scouted 45 Blocks	Total Scouted 6 Growers
Prickly lettuce	**Lactuca serriola** L.	18	3
Horseweed (Marestail)	**Conyza canadensis** (L.) Cronq.	10	5
Camphorweed	**Heterotheca subaxillaris** (Lam.) Britt. & Rusby	7	2
Chickweed	**Stellaria media** (L.) Vill.	2	1

Most of the orchard ground in southern New Jersey consist of light sandy soils which are low in organic matter (Table 4). Over half the blocks surveyed had organic matter levels below 1.5%. One farm showed large areas of trees with terbacil (3-tert-butyl-5-chloro-6-methyluracil) injury. Organic matter levels were below 1%.

TABLE 4. Soil texture and percent organic matter in peach blocks scouted for weeds in 1983.

Soil texture/organic matter	Total Scouted 45 Blocks	Total Scouted 6 Growers
Soil texture		
Loamy sand	25	4
Loamy sand/sandy loam	6	2
Sandy loam	8	2
Loam	6	1
Silt loam	0	0
Percent organic matter		
Less than 1.0	9	4
1.0 to 1.5	18	6
1.5 to 2.0	9	4
2.0 to 3.0	8	4
3.0 to 4.0	1	1

Peach growers in southern New Jersey traditionally use a mixture of terbacil and diuron [3-(3,4-dichlorophenyl)-1,1-dimethylurea] at rates between 1.2 kg/ha to 1.8 kg/ha of each. Because of environmental conditions, low organic matter, poor calibration or overtreatment, terbacil injury to peach trees is not unusual. Injury may be avoided by decreasing rates from 25 to 50%. However, since decreased rates often result in poor grass control, alternate controls are often followed. Examples of these are combinations of napropamide [2-(α-naphthoxy)-N,N-diethylpropionamide] or oryzalin (3,5-dinitro-N^4,N^4-dipropylsulfanilamide) plus diuron [3-(3,4-dichlorophenyl)-1,1-dimethylurea] or simazine [2-chloro-4,6-bis(ethylamino)-s-triazine].

The major annual broadleaf weed (Table 1) was pigweed. Growers are often advised to replace terbacil with napropamide or oryzalin where pigweed is the principal annual broadleaf problem.

Perennial or biennial weeds such as Virginia creeper, Canada thistle, prickly lettuce and horseweed have been especially persistent. Over the past two years acceptance has grown for the use of spot treatments or wiping applications of glyphosate [N-(phosphonomethyl)glycine]. Broadcast and spot treatments of glyphosate in peaches were recently labeled in New Jersey in 1984.

Since dandelion is often present at high densities, it is hoped that broadcast 2,4-D applications will become labeled for peach orchards. At present this is the only way to control many broadleaf perennials in sod alleys, which act as reservoirs for TmRSV [dandelion, chickweed, plantains (**Plantago** spp.) and sorrels (**Rumex** spp.)].

As growers gain awareness of their weed populations, we should see a move away from standard controls to more tailored management programs. This should include rate adjustments dependent on soil condition and weed pressure, the mixing of different herbicides for the particular species present, and the maintenance of weed-free sod aisles.

HANDWIPER APPLICATION OF HERBICIDES ON BIRCH, MAPLE AND WILLOW IN A LOWBUSH BLUEBERRY FIELD

David E. Yarborough[1]

ABSTRACT

A handwiper application of 2,4-D, dicamba, glyphosate or hexazinone at 0, 12, 24 or 48 g/L in water was made on birch (Betula sp.), maple (Acer rubrum) and willow (Salix sp.) stems in July 1983. Efficacy ratings were made one year after treatment. Dicamba and glyphosate provided the best suppression in all species. Hexazinone and 2,4-D gave less suppression and more erratic results. Willow was the most easily controlled species followed by birch with maple the most resistant.

INTRODUCTION

Lowbush blueberry (Vaccinium angustifolium) fields in Maine are developed from natural or "wild" stands. Cultural management consists of delaying succession by pruning the field by mowing or burning every other year. Because blueberries are rhizomatous perennials with clones randomly distributed throughout the fields, mechanical cultivation or rotation methods are not feasible for weed control. Consequently, many deep rooted perennials will become established unless measures are taken to limit their spread.

Wiper or spot application of 2,4-D[(2,4-dichlorophenoxy)acetic acid] was recommended by Trevett in 1952 (1). Mechanical wiper equipment has been developed and refined (4) for selective application of herbicides to woody weeds taller than blueberries. Hexazinone [3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione] will reduced the occurrence and density of many woody and herbaceous weeds (3) but some of the well established perennials were not be controlled with a preemergent application. In a field with a lower density of weeds, hand wiping may be more efficient and effective than mechanical wiping. This method would also be more attractive to smaller growers because of the low cost of a hand-wiper compared to the cost of a mechanical-wiper.

MATERIALS AND METHODS

Previous experience has indicated that Sideswipe Weed Wiper[2] will provide the best foliar coverage of herbicides (3), so it was selected for use in this trial. A commercial blueberry field on T-19 MD, which was treated with 2.2 kg/ha hexazinone in May 1983, was selected for the site. A completely randomized design was used with all treatments replicated five times. Birch, maple and willow were wiped with 2,4-D, dicamba (3,6-dichloro-O-anisic acid) and glyphosate [N-(phosphonomethyl)glycine] at 0, 12, 24 or 48 g/L in water. These rates are equivalent to 0, 2.5, 5, 10% v/v for all herbicides except hexazinone, because at 2 lb/gal ai the equivalent percentages would be double. Clumps of stems to be treated were identified by a flag and a numbered tag. The stems were randomly treated in July 1983 using a separate wiper for each herbicide and proceeding from

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lowest to highest rates. Treatment efficacy was rated in July 1984 using a 0 to 10 scale where 0 = no effect and 10 = complete control. Data were plotted using SAS Graph with one standard error of the mean (2).

RESULTS AND DISCUSSION

Phytotoxicity on the treated foliage occurred as chlorosis and necrosis within a week after treatment. Initial ratings were recorded the year of treatment but those taken one year after treatment provide a better measure to evaluate treatment efficacy.

Willow was suppressed by all treatments with nearly complete control at the lowest rate and with no increase in control at the higher rates (Figure 1). Dicamba provided the best suppression followed by glyphosate, hexazinone and 2,4-D.

FIGURE 1
EFFECT OF HERBICIDE BY RATE ON WILLOW

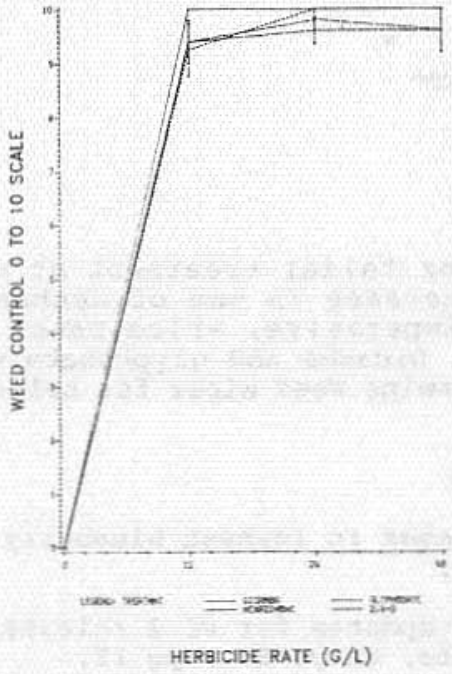
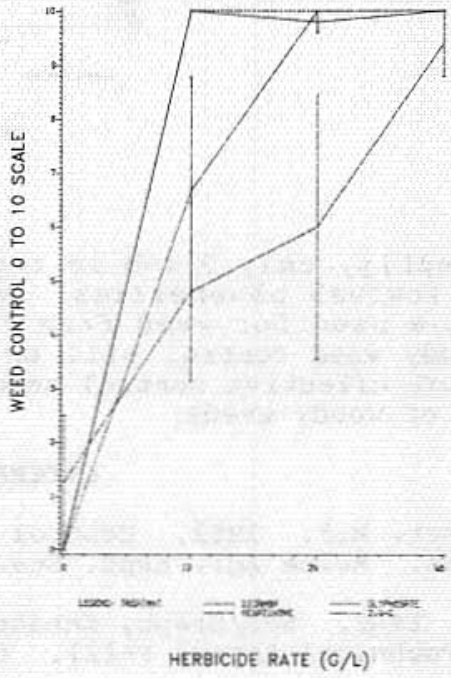


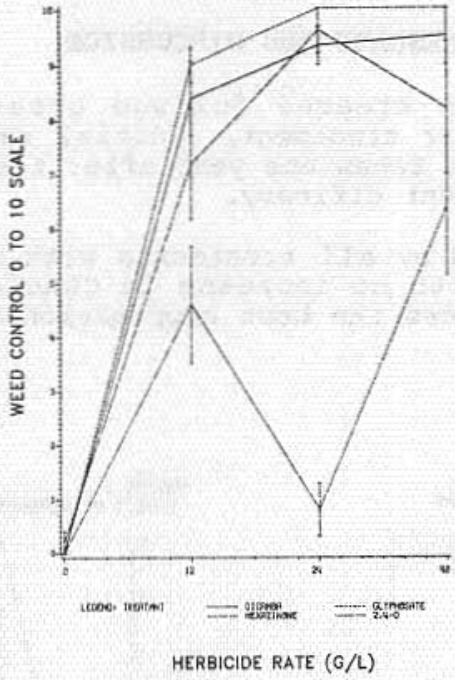
FIGURE 2
EFFECT OF HERBICIDE BY RATE ON BIRCH



Maple was the most resistant species to herbicide treatment. Glyphosate and dicamba followed by hexazinone gave the best suppression which increased with rate (Figure 3). 2,4-D response was erratic and it was the least effective herbicide for the control of maple.

This sequence was the same for birch (Figure 2) with dicamba and glyphosate providing nearly complete suppression at the 12 g/L rate. Hexazinone and 2,4-D treatments were less effective and more variable on birch but at 48 g/L only hexazinone did not provide complete suppression. Considerable injury from birch leaf minor was also seen Birch stems varied from a few up to 30 or more per site. This variation contributed to the wide variation in the treatment response.

FIGURE 3
EFFECT OF HERBICIDE BY RATE ON MAPLE



Currently, only 2,4-D is registered for foliar treatment of woody weeds in lowbush blueberries. With the increase in use of mechanical harveting a need for weed free fields is imperative, which means that better woody weed control will be required. Dicamba and glyphosate would provide more effective control using the Sideswipe Weed Wiper for selective treatment of woody weeds.

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EFFECT OF HEXAZINONE ON BLACK CHOKEBERRY IN A LOWBUSH BLUEBERRY FIELD

David E. Yarborough[1]

ABSTRACT

Black chokeberry (Pyrus melanocarpa) produces a fruit which reduces the quality and USDA grade of lowbush blueberries (Vaccinium angustifolium). Hexazinone from 2.2 to 9 kg/ha was applied preemergent to a commercial blueberry field infested with chokeberry. Injury ratings to blueberry and to chokeberry increased with herbicide rate. Blueberry stems increased at the lower rates but decreased with higher herbicide rates. Blueberry flower buds and the weight and number of chokeberry fruit were reduced as hexazinone rate was increased. Hexazinone application up to 2.2 kg/ha will reduce chokeberry without affecting blueberry yield but at higher rates will reduce yield.

INTRODUCTION

Black chokeberry was a serious competing weed in Maine in 1946 (1), and in 1974, 35% of the growers surveyed indicated it was present in their fields (7). Hall et al. (3) noted that chokeberry has increased in lowbush blueberry fields in Eastern Canada in response to the use of fertilizer. Black chokeberry grows in close association with the lowbush blueberry making it difficult to exclude the chokeberry fruit during harvest. The chokeberry fruit is similar in size, shape and specific gravity to the lowbush blueberry, which makes separation of the berries labor intensive and costly. The presence of chokeberry reduces the USDA grade of the blueberry pack (2) and adversly affects the quality and acceptance of blueberry products (8).

In 1946 (1) the recommended method of control was to pull the chokeberry out by its roots. Foliar sprays of several herbicides reduced chokeberry but caused excessive injury to blueberry plants (9). A properly timed spray of ethephon [(2-chloroethyl)phosphonic acid] induced selective abortion of barrenberry fruit (4) but has not been used by growers because it is expensive and is only temporary. The use of endothall [(7-oxabicyclo(2.2.1) heptane-2,3-dicarboxylic acid] to defoliate blueberry plants followed by a foliar spray of glyphosate[N-(phosphonomethy)glycine] reduced chokeberry stand (11) and yield (12). However, the critical timing required for this procedure would make it difficult to implement commercially. Selective wiper applications with 2,4-D[2,4(dichlorophenoxy)acetic] acid and glyphosate reduced chokeberry stand (10) and yield (5). Black chokeberry persisted after selective wiper applications because those plants shorter than the lowbush blueberry were not treated.

Hexazinone [3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione] provides preemergent control of many woody and herbaceous weeds growing in lowbush blueberry fields (13). The authors observations (14) indicated that black chokeberry was suppressed by hexazinone (14) but Jensen (6) lists chokeberry as tolerant to hexazinone on lowbush blueberry fields in Canada. The objective of this study was to determine the effectiveness of hexazinone to reduce black chokeberry and

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to assess the injury to lowbush blueberry plants.

MATERIALS AND METHODS

Hexazinone was applied at 0, 2.2, 4.5, 6.7 or 9 kg/ha in May 1982 on the Spring Pond barrens in Deblois, ME. Treatments were applied with a hand-pushed pneumatic sprayer in 187 L/ha water at 276 kPa pressure. Experimental design was a randomized complete block with 10 replications. Plots measured 1.5 by 6 m.

Ratings for blueberry and chokeberry injury were made in July 1982 using a scale where 0 = no injury and 10 = dead. In October 1983 all stems from two - $0.1m^2$ quadrats per plot were cut; the number of blueberry stems and buds per $0.1m^2$ and the number of chokeberry stems per $0.1m^2$ were counted. All berries were hand raked and weighed in August 1983. The number and weight of blueberries and chokeberries were determined from a 0.9L sample.

Data were analyzed by variance with orthogonal contrasts used to determine the trend and level of significance. Graphs give data means with one standard error of the mean.

RESULTS AND DISCUSSION

Injury, which was characterized by defoliation, to blueberry and chokeberry stems was visible throughout the season. Injury ratings for blueberries and chokeberries increased with rate, but chokeberry had a higher injury rating, indicating it was more susceptible to the herbicide (Table 1.).

Table 1. Effect of Hexazinone on Blueberry and Chokeberry.

Hexazinone Rate (Kg/ha)	Blueberry			Chokeberry		
	injury (0-10)[a]	stand ($0.1m^2$)	flower buds ($0.1m^2$)	injury (0-10)	stand ($0.1m^2$)	% fruit by weight[c]
0	0	41	70	0	13	11
2.2	2	47	64	3	8	5
4.5	4	54	67	7	3	2
6.7	5	45	51	8	1	2
9	8	37	14	9	1	1
F test significance	*[b]	*	**	**	**	**
Trend Analysis	Q	Q	Q	Q	L	L

[a] 0 = healthy 10 = dead

[b] * = significant at 5%, ** = highly significant at 1%, L = Linear, Q = quadratic

[c] from 0.9L sample taken from harvest = [(grams of chokeberries ÷ grams of blueberries) * 100]

Blueberry stand per $0.1m^2$ showed a significant quadratic response to hexazinone treatment by increasing from 41 for the control to 54 at the 4.5 kg/ha rate and then to 37 at 9. kg/ha . Chokeberry stand exhibited a linear decline from 13 stems at 0 to 1 stem at 9 kg/ha hexazinone (Table 1). The number of blueberry flower buds per $0.1m^2$ was reduced with hexazinone application with the greatest reduction at the 9 kg/ha rate. The percentage of barrenberry fruit, by weight, was reduced from 11% without treatment to 5% at 2.2 kg/ha and to 2% or less at higher rates (Table 1). The number of chokeberry fruit per 0.9L was reduced from 231 on untreated plots to 98 at 2.2 kg/ha and to about 35 at higher rates (Figure 1). This reduction in number and in weight of chokeberry fruit is as good or better than results obtained in previous experiments (4,5,12).

FIGURE 1
EFFECT OF HEXAZINONE ON CHOKEBERRY FRUIT

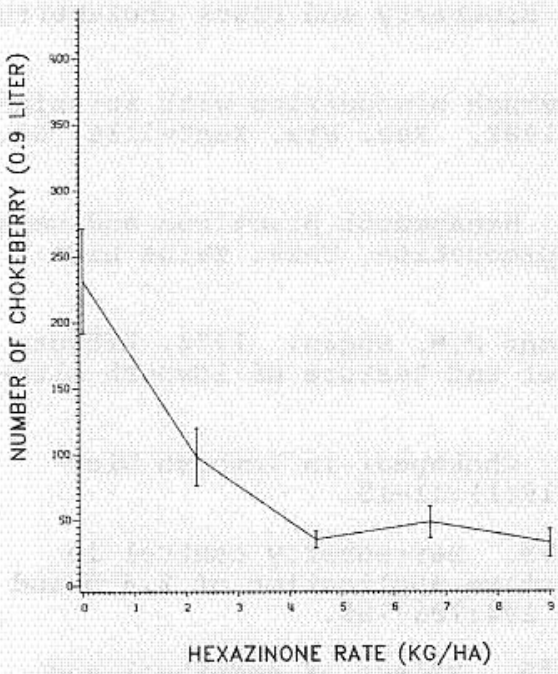
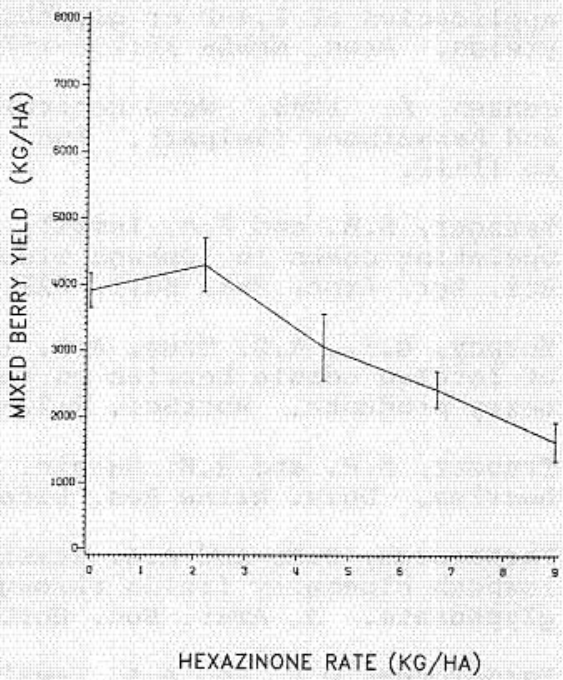


FIGURE 2
EFFECT OF HEXAZINONE ON BLUEBERRY AND CHOKEBERRY YIELD



Total blueberry and chokeberry yield showed a small increase from 0 to 2.2 kg/ha and sharply declined for rates above 2.2 kg/ha (Figure 2). Greater increases in blueberry yield have been obtained with up to 4.5 kg/ha hexazinone in an experiment in Jonesport, ME (14) but yield also declined rapidly at higher rates.

The increase in yield obtained in Jonesport was because of the suppression of herbaceous weeds, which were not a problem on this study site. Although yield was not increased a significant amount at 2.2 kg/ha there was a substantial reduction in chokeberry fruit. At rates above 2.2 kg/ha the losses due to the reduction in blueberry yield are greater than the reduction of chokeberry fruit. The decrease in blueberry yield is due to herbicide injury. However, a preemergent hexazinone application at 2.2 kg/ha will reduce chokeberry numbers and weight without reducing blueberry yield.

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Preemergence Annual Weed Control in a New York Vineyard

R. M. Dunst and R. M. Pool

ABSTRACT

Seventeen preemergence herbicide treatments were evaluated for under the trellis weed control in an established vineyard. No injury symptoms were observed from any treatment. Diuron at 5.4 kg/ha gave commercial control of all annual weeds including giant foxtail (Setaria faberi Herrm.), redroot pigweed (Amaranthus retroflexus L.), ladysthumb smartweed (Polygonum persicaria L.), and velvetleaf (Albutilon theophrasti Medic.). It was the only treatment that did not give commercial control of blackseed, broadleaf, and buckhorn plantain (Plantago rugeli Dcne., P. major L. and P. lanceolata L.). Only oryzalin at 3.4 kg/ha and 4.5 kg/ha pendimethalin + 2.7 kg/ha diuron gave annual weed control that was statistically similar to that of 5.4 kg/ha diuron. Pendimethalin at 2.2 and 4.5 kg/ha and simazine at 5.4 kg/ha did not acceptably control giant foxtail. Norflurazon at 2.2 and 4.5 kg/ha, and metolachlor at 4.5 kg/ha did not give acceptable control of redroot pigweed and ladysthumb smartweed. Metolachlor, pendimethalin, and simazine treatments gave unacceptable velvetleaf control. All combinations tested provided unacceptable control of giant foxtail and/or velvetleaf except for 4.5 kg/ha pendimethalin + 2.7 kg/ha diuron.

INTRODUCTION

The western New York grape belt accounts for nearly two-thirds of New York grape production. It is characterized by the moderating effect on the climate by Lake Erie, and by predominately well drained, acid soils which are well suited for production of native American grape varieties, Vitis labruscana, Bailey. Diuron (3-(3,4-dichlorophenyl)-1,1-dimethylurea) and simazine (2-chloro-4,6-bis(ethylamino)-S-triazine) are the standard preemergence herbicides for established vineyard use in New York State, while glyphosate (N-(phosphonomethyl) glycine) is used to control perennial weeds and annual weed escapes. Diuron provides generally good annual weed control, while perennial plantains escape control. Simazine controls plantains and most annual broadleaf weeds, but control of annual grasses is generally poor. Oryzalin (3,5-dinitro-N^4,N^4-dipropylsulfanilamide) has effectively controlled annual grasses, but not some annual broadleaf weeds, notably common ragweed (Ambrosia artemisiifolia L.). Pendimethalin (N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine), metolachlor (2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide), and norflurazon (4-chloro-5-(methylamino)-2-(alpha,alpha,alpha-trifluoro-m-tolyl)-3(2H)-pyridazinone) are currently being investigated for use on vineyards.

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MATERIALS AND METHODS

This experiment was conducted near Fredonia, New York, on a Niagara silt loam. The vineyard is a 20 year old planting of the Native American variety, Catawba. It is Umbrella Kniffen trained to a two wire vertical trellis. A randomized complete block design was used with four replications. Plot size was 14.6 meters long (two postlengths), with a 1.1 meter spray band applied to rows 2.7 meters apart. The plots were divided in half for data collection. All treatments were made on April 12, 1984, using four 8006 flat fan teejet nozzles, mounted on an over-the-row tractor mounted boom. Applications were made in 2,250 liters per sprayed hectare, at 31 pounds pressure.

A layer of organic residue from prior weed growth was present on the surface of the weed spray band. Rainfall was 2.5 cm within one week, and over five cm. within two weeks of application date. Weed germination was minimal for nearly a month after the treatments were applied. Weed control in 1982 and 1983 was 4.7 - 5.4 kg/ha simazine, followed by a spot applicaton of glyphosate and hand cutting of velvetleaf.

Weed control ratings were made in early September. Ratings were made individually for giant foxtail, redroot pigweed, ladysthumb smartweed and velvetleaf. A single rating was made for combined annual grasses including giant foxtail, yellow foxtail (*Setaria glauca* (L.) Beauv.), fall panicum (*Panicum dichotomiflorum* Michx.), large crabgrass (*Digitaria sanguinalis* (L.)Scop.) and barnyardgrass (*Echinochloa crus-galli* (L.) Beauv.), which were present in amounts too small to justify individual ratings. Scoring was based on a 1-9 scale, where 9 is total control, 7 is commercial control, and 1 is complete ground cover. Commercial control was considered 10% or less ground cover of a weed not reaching above the bottom wire, and 5% or less ground cover of a taller growing weed, such as velvetleaf. Finally, a weed height rating was made using a 0-4 scale as follows: 0, no weeds; 2, tallest weeds reach the bottom trellis wire, about 0.75 meter; and 4, tallest weeds reach the top trellis wire, about 1.7 meter. This rating is viticulturally important for several reasons. In addition to competition for available water and nutrients, tall weeds compete for sunlight, interfere with pesticide penetration into the canopy and reduce air movement through the canopy encouraging fungal infection. Also, contamination of mechanically harvested grapes by weed parts can result in grade and value reduction of the crop by processors.

Mean separations were by Duncan's multiple range test at the 5% level of significance.

RESULTS

No injury symptoms were observed from any herbicide treatment. Weed control ratings are summarized in Table 1. Diuron at 5.4 kg/ha gave the highest numerical rating for each of the annual weeds listed, the lowest percent total weed cover, and the best rating for weed height, but it was the only treatment that did not give commercial control of plantains. It should be noted that plantains and some other weeds are alternate hosts for tomato and tobacco ringspot viruses. French-American grape varieties are susceptible to this disease, which is spread by the

American dagger nematode, Xiphenema americanum Cobb. Plantains and other weeds also serve as hosts for larvae of several cutworm species and larvae of redbanded leafroller, Argyrotaenia velutinana Walker, which can be serious grape pests.

Ratings for 4.5 kg/ha pendimethalin + 2.7 kg/ha diuron were statistically similar in all categories to 5.4 kg/ha diuron. Oryzalin at 3.4 kg/ha was similar in all categories except weed height, which was influenced by lower velvetleaf control.

Simazine at 5.4 kg/ha provided little control of giant foxtail, and poor velvetleaf control. Pendimethalin at 9.0 kg/ha provided good control of all weeds except velvetleaf. Lower rates (2.2 and 4.5 kg/ha) of pendimethalin did not adequately control giant foxtail, and the lowest rate did not adequately control ladysthumb smartweed. Metolachlor at 4.48 kg/ha did not give satisfactory control of redroot pigweed, ladysthumb smartweed, or velvetleaf. Norflurazon at 2.2 and 4.5 kg/ha provided good control of giant foxtail and velvetleaf, but poor control of redroot pigweed and ladysthumb smartweed.

Pendimethalin at 4.5 kg/ha + diuron at 2.7 kg/ha was the only treatment combining lower rates of two herbicides giving annual weed control statistically similar to 5.4 kg/ha diruon. The other six combined treatments gave reduced control of giant foxtail and/or velvetleaf.

Table 1. The Effect of Seventeen Preemergence Herbicide Treatments on Under-the-Row Weed Control in an Established Vineyard.

	% Total Weed	Weed Height	Weed Control Rating[2]					
Treatment (kg/ha)	Cover	Rating[1]	Giant Foxtail	Annual Grasses[3]	Redroot Pigweed	Ladysthumb Smartweed	Velvetleaf	Plantains[4]
Control	95 a	3.4 a	3.3 gh	2.8 g	7.9 ab	5.5 cd	8.1 ab	8.4 bc
Pendimethalin 2.2	79 bc	2.6 ab	5.8 cde	4.8 de	8.4 a	5.6 cd	5.0 de	8.8 abc
Pendimethalin 4.5	63 bcde	2.5 ab	6.3 bcde	5.5 cde	8.1 ab	7.8 ab	5.8 bcde	8.9 ab
Pendimethalin 9.0	43 defg	3.0 ab	7.6 ab	7.5 ab	8.6 a	8.8 a	4.8 e	9.0 a
Oryzalin 3.4	33 fg	2.5 ab	8.6 a	7.6 ab	8.9 a	8.4 a	6.3 abcde	8.6 abc
Metolachlor 4.5	80 b	2.6 ab	7.0 abc	6.4 bcd	6.0 cd	4.5 d	5.3 de	8.8 abc
Norflurazon 2.2	58 bcde	2.1 bc	7.5 abc	7.5 ab	6.5 bcd	5.3 cd	7.4 abcd	8.8 abc
Norflurazon 4.5	45 defg	2.1 bc	8.5 a	8.5 a	5.3 d	6.3 bc	7.8 abc	9.0 a
Diuron 5.4	29 g	1.3 c	8.6 a	8.5 a	9.0 a	8.6 a	8.6 a	4.5 d
Simazine 5.4	64 bcd	2.6 ab	3.5 fgh	3.0 fg	8.3 ab	9.0 a	6.0 bcde	9.0 a
Pendimethalin 2.2 + Diruon 2.7	61 bcde	2.5 ab	5.0 efg	4.8 de	8.0 ab	6.1 bcd	7.9 ab	8.5 abc
Pendimethalin 4.5 + Diruon 2.7	29 g	2.3 abc	7.4 abc	7.4 ab	8.3 ab	7.6 ab	6.9 abcde	8.8 abc
Oryzalin 2.5 + Diuron 2.7	38 efg	2.8 ab	7.1 abc	6.6 bc	8.5 a	8.1 a	5.8 bcde	8.3 c
Pendimethalin 2.2 + Simazine 2.7	56 cdef	2.9 ab	4.9 efg	4.1 efg	7.8 ab	9.0 a	5.4 cde	9.0 a
Pendimethalin 4.5 + Simazine 2.7	48 defg	2.9 ab	6.9 abcd	5.5 cde	7.8 ab	8.8 a	5.3 de	9.0 a
Oryzalin 2.5 + Simazine 2.7	44 defg	2.4 ab	6.4 bcde	5.3 cde	8.4 a	8.9 a	6.7 abcde	8.9 ab
Diuron 2.7 + Simazine 2.7	46 defg	2.1 bc	5.1 def	4.5 ef	7.5 abc	8.5 a	7.3 abcd	8.9 ab

1. Rating based on a 0-4 scale, 0 = no weeds, 2 = tallest weeds reach the bottom trellis wire (about 0.75 M), 4 = tallest weeds reach the top trellis wire (about 1.7 M).

2. Rating based on a 1-9 scale, 9 = total control, 7 = a few weeds but commercially acceptable, 1 = complete ground cover of weeds.

3. Single rating for all annual grass species.

4. Single rating for all plantain species.

HERBICIDE EVALUATION IN YOUNG GRAPE VINES

W. J. Sanok, J. Smith, and J. Dobson 1/

ABSTRACT

Several herbicides were evaluated for both weed control and phytotoxicity on young grape vines (Vitus vinifera L.). Grapes are frequently planted after potatoes and vegetables on Long Island and weed pressure from ragweed (Ambrosia artimisifolia L.), barnyardgrass [Echinochloa crusgalli (L.) Beauv.], and crabgrass (Digitaria sanguinalis L.) can be rather intense. Other weeds that can be of less importance include lambsquarter (Chenopodium album L.).

In this trial the variety Merlot grafted on SO4 rootstock had been greenhouse grown and transplanted in mid-May. Applications of herbicides were made on June 7, 1984 using a CO2 sprayer, applying 30 gallons per acre. Plot size was 24 feet long which included three plants. Applications were made to a 3-foot band on both sides of the row. The soil is a Riverhead Sandy Loam, having approximately 1% organic matter and treatments were replicated four times. Application was one day after cultivation, therefore it was preemergence to the weed growth. No attempt was made to avoid application of the herbicides to the leaves and stems of the grape plants.

Treatments included pendimethalin at 3.36, 4.48, and 6.72 kg/ha, oryzalin at 4.48 kg/ha, napropamide at 4.48 kg/ha, and simazine at 2.24 kg/ha. These materials were used alone and also the grass killers were used in combination with simazine as a tank mix.

Rainfall following application resulted in 4.8 inches of rain in June, and 7.6 inches in July.

The napropamide treatment resulted in slight phytotoxicity in one replication but was not observed in the three remaining replications. Barnyardgrass and crabgrass were adequately controlled by single treatments of pendimethalin and oryzalin at the rates tested. The combination of oryzalin at 4.48 kg/ha and simazine at 2.24 kg/ha resulted in the best overall weed control, especially in the control of ragweed. The pendimethalin treatments, did not result in weed control of ragweed and combinations of pendimethalin at 3.36 kg/ha, and simazine at 2.24 kg/ha was barely adequate for commercial control.

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RESPONSE OF TREES TO INJECTIONS OF FLURPRIMIDOL AND PACLOBUTRAZOL

J. P. Sterrett and T. J. Tworkoski[1/]

ABSTRACT

Control of vegetative growth without causing injury is a major problem in orchards and under utility lines. Both flurprimidol and paclobutrazol suppress shoot internode elongation by reducing gibberellin biosynthesis. The objective of this research was to determine the growth response of apple seedlings and shade tree saplings to injections of flurprimidol and paclobutrazol.

One-year-old 'Golden Delicious' apple trees were grown hydroponically in a growth chamber and maintained at 25 ± 1 C, 65 ± 10% relative humidity, and 158 μmol s^{-1} M^{-2} par (400 to 700 nm) (16-h photoperiod). Immediately after potting, the trees, except controls, were injected 6 cm above the root/stem transition zone with 2.5 mg of flurprimidol or 0.5 mg of paclobutrazol. Shoot growth inhibition of apple trees commenced about one month after injection of flurprimidol or paclobutrazol.

In a field experiment, 3 to 9-year old saplings were pruned before bud break. Injections of 5 to 40 mg of flurprimidol or paclobutrazol in methanol were made 100 cm below the pruned surface of the main stem at bud break in late April or one month later. Growth of all species was significantly inhibited through June by both compounds and the degree of inhibition was correlated with dose. Shoot growth of American sycamore injected one month after bud break was inhibited by flurprimidol through July 30 but yellow-poplar growth was retarded only until the end of June. Paclobutrazol injections made at bud break or one month after bud break inhibited the growth of red maple, yellow-poplar, white ash, and American sycamore through June, but by August only red maple and white ash were still inhibited. Neither flurprimidol nor paclobutrazol was phytotoxic. The only visible signs of their presence were shortened internodes and dark green foliage.

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EVALUATION OF DICHLOBENIL TO SUPPRESS BUNCHBERRY IN LOWBUSH BLUEBERRY FIELDS

David E. Yarborough[1]

ABSTRACT

Bunchberry (Cornus canadensis) stand has been increasing in lowbush blueberry (Vaccinium angustifolium) fields. Bunchberry is resistant to hexazinone and is spreading in response to the lack of weed competition, especially in blueberry fields that have large inter-clonal spaces. Dichlobenil will control dogwood (Cornus sp.) and is used in both highbush blueberries (V. corymbosum) and cranberries (V. macrocarpon).

Dichlobenil was applied on April 20, 1984 at 0, 2.2, 4.5 and 9 kg/ha ai as a 4% granular formulation on a prune year and a crop year blueberry field. The experimental design was a randomized complete block with 6 replications. Plot size was 1 by 6 m. Bunchberry stems were counted in September from two - $0.1m^2$ subsamples from each plot. Blueberries were harvested in August 1984 from the plots treated in the crop year. Data were analyzed by variance with orthogonal contrasts used to determine trends and level of significance.

A decrease in bunchberry stems was obtained with an increase in dichlobenil rate (Table 1) but even at the 9.0 kg/ha rate bunchberry stems still persisted. Blueberry yield was not affected by the treatments. Because dichlobenil is volatile and can not be incorporated into the soil of lowbush blueerry fields, some of the herbicide may have been volatilized in this experiment. November and March treatments will be evaluated to determine if earlier treatments will increase efficacy.

Table 1. Effect of Dichlobenil on Bunchberry Stems and Blueberry Yield.

Dichlobenil Rate (kg/ha)	Bunchberry Stems/$0.1m^2$ Prune Year	Bunchberry Stems/$0.1m^2$ Crop Year	Blueberry Yield (kg/ha) Crop Year
0	48	18	4453
2.2	62	13	4732
4.5	37	9	4876
9.0	27	5	5222
PR >F	0.0075	0.001	0.6427
Trend[a]	L	L	NS

[a]Orthogonal contrasts used to generate trend analysis.

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TRANSMISSION ROW MANAGEMENT COST EFFECTIVENESS STUDY

C. G. Foreback 1/

C. H. Stevens 2/

ABSTRACT

Niagara Mohawk Power Corporation is conducting a ROW Management Cost Effectiveness Study, totalling approximately 80 acres of test plots. The study is unusual in that it began with a pre-clearing inventory of an undisturbed forest. Initial treatments were applied before, during and after clearing in the spring of 1983. Follow-up maintenance treatments were applied in 1984 and will be applied again in 1988. The study will terminate in 1989.

The study is divided into three areas of investigation as follows:

(1) Comparison of Long-Term Cost Effectiveness of Various ROW Vegetation Management Methods Starting With Initial Clearing

(2) Comparison of Long-Term Cost Effectiveness of Selective vs. Non-Selective Methods and Effects on Development of Woody Shrub Cover

(3) Comparison of Long-Term Cost Effectiveness of Various Herbicides, Application Methods and Cutting Methods

Interim evaluations of plots on northern hardwood woodland sites showed that regrowth and reinvasion of tree species one growing season after clearing averaged 22,855 stems per acre, an average increase of 1,740%. Average stump kill was 83%. Regrowth and reinvasion of woody shrubs averaged 805 per acre, an average increase of 11%.

Interim results on abandoned agricultural lands, where a preponderance of woody shrubs are intermixed with tree saplings and pole timber, showed that regrowth and reinvasion of tree species averaged 3,525 stems per acre, an average increase of 130%. Average stump kill was 95%. Regrowth and reinvasion of woody shrub species averaged 2,950 per acre, an average increase of 180%.

Interim results indicate that on woodland sites, a non-selective follow-up treatment may prove to be more cost effective and practical considering the high density of tree species and low density of shrub species. On abandoned agricultural lands, a selective treatment may prove to be more cost effective considering the ratio of tree to shrub species.

Analysis of 1984 treatment costs and evaluation of effectiveness in 1985 will provide valuable data to prove or disprove the interim indications.

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ENVIRONMENTAL IMPACT OF SPOT TREATMENT ON UTILITY RIGHTS-OF-WAY

Karl H. Deubert[1/]

ABSTRACT

Spot treatment (selective foliar treatment) is used to minimize the possibility of contamination of groundwater as the result of herbicide use in the maintenance of existing utility rights-of-way in parts of New England.

The manner in which the chemical is applied poses problems in the study of the environmental impact of herbicide use. In aerial application, spray reaches the canopy as a mist uniformly distributed over the area, in spot treatment the chemical is primarily applied to individual trees using a hand held nozzle. Therefore, the study had to concentrate on individual trees, i.e., samples from various trees could not be pooled because the amounts of applied chemical vary from tree to tree (size of tree, pressure, human error). The pattern of the spray reaching the target is asymmetrical which makes it difficult to study runoff and foliar deposits. Measuring runoff using 923 sq.cm paper sheets per tree, and studying the fate of foliar deposits taking leaf samples weekly, failed to produce acceptable results because the number of disks per tree and leaves per sample (15-20) were too small for representative data considering the uneven initial distribution of the chemical. For reliable data one would have to cover the whole area under a tree or, in the case of leaf samples, a tree (less than 2 m tall) would be nearly defoliated after two or three samples.

Since conventional sampling methods could not be used, field experiments were done applying chemicals to ground cover and shrub assuming 100% and 10% runoff during application, based on 18.67 L/ha concentrate. Average retention by ground cover and shrub was about 50%. More than 80% of picloram, 2,4-D, and triclopyr remained in the top 10 in. soil layer. In two out of 28 cases, 0.02 and 0.08 ppm of chemicals were found in the 20-30 in. layer.

Comparison of experimental field data with actual field data was favorable.

Under the conditions of this study (top soil 7-10 cm, consisting of 93.3% sand, 6.7% silt and clay, 2.5% organic matter) contamination of groundwater with residues of herbicides is unlikely.

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MULTIFLORA ROSE CONTROL

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ABSTRACT

The control of multiflora rose (Rosa multiflora Thunb) should be of primary importance to land owners. This species has been encroaching on agricultural land for many years not only in the region of Massachusetts where our survey was made, but throughout the state and indeed many of our states in the northeast have a similar problem. A regional survey (questionaire type) to dairy farmers during 1983 revealed the seriousness of the problem. Over 400 hectares (1,096 acres) were estimated as infested land with this species. Interestingly, 81.2% of the land in the survey area was reported to be very seriously infested. Limited research information on the control of multiflora rose is available in Massachusetts. The purpose of the research is to determine the efficacy of various herbicides.

Our 1984 experimental site was located at the St. Josephs Abbey, Spencer, MA. The first experiment consisted of 12 treatments replicated three times in a completely randomized design. All sprayable materials were applied to the foliage to drip with a knapsack sprayer with a wide angle cone nozzle. Granular or pelleted herbicides were applied uniformly by hand as broadcast treatments to the soil. All treatments were applied on June 11, 1984. Visual ratings on the control of multiflora rose were taken on July 12 and August 27, 1984. These plots will be examined in 1985 for regrowth evaluation.

Dicamba in 1.0 and 1.5% solution with X-77(0.5% v/v), glyphosate in 2.0% solution, triclopyr in 0.5 and 0.75% solution, and picloram (10K) at 28.4 and 42.6 gm per 9.29 sqm. provided excellent multiflora rose control (August 27). No differences between low or high rates of these treatments were observed in leaf difoliation or stem-kill. Dicamba (10 G) at 11.2 kg/ha showed poor control under the experimental condition (application date June 11, 1984).

The second experiment consisted of four treatments replicated ten times in a completely randomized design. Dicamba (4SC) at 14.39 gm/3 m canopy diameter (30 ml product/10 ft. canopy diameter) was used as a spot concentrate treatment to the soil near the multiflora rose crown. Dicamba at 6.2% (v/v) was also used in combination with low (15% v/v) and high (50% v/v) volumes of kerosine oil as a basal spray-to-rundown treatment (35 to 45 cm of lower stems). These treatments were applied by a backpack sprayer with a wand nozzle (DB Smith #147 adjustable). Dicamba (10 G) at 11.2 kg/ha was applied uniformly up to drip-line of each canopy. These treatments were applied on April 9, 1984, when multiflora rose was in the pre-bud stage.

Dicamba either alone as a spot concentrate treatment or in combination with kerosine oil (15 or 50% v/v) as a basal treatment provided excellent multiflora rose control including stem kill. However, dicamba (10 G) at 11.2 kg/ha gave 60% of stem-kill inspite of 100% defoliation of multiflora rose.

No regrowth of multiflora rose bushes treated in June 23, 1983 was observed on July 10, 1984. Treatments evaluated were picloram (10K), dicamba, glyphosate, and triclopyr.

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RIGHTS-OF-WAY CLEARING WITH BASAL AND CUT SURFACE TREATMENTS

J. J. de Waal Malefyt and D. D. Macks[1/]

ABSTRACT

The effectiveness of cut surface treatments with an herbicide mixture of picloram and 2,4-D was compared to basal treatments with triclopyr. Treatments were applied to northern hardwoods being cleared along a new electric transmission right-of-way (ROW). Without herbicide treatment, 84% of the cut trees developed root or stump sprouts. Basal and cut surface treatments resulted in 97% and 94% root-kill. Costs for basal were higher than cut surface treatments.

INTRODUCTION

One of the issues concerning new electric transmission facilities in New York State is the cost and effectiveness of herbicide techniques in clearing forests for new ROW. Tree resprouting after cutting and herbicide treatments on some sections of newly cleared ROW has led to much speculation on the cause of this unsatisfactory condition. Was the herbicide ineffective, was it the time of year, or was it the length of time between cutting and treatment?

Two methods of herbicide treatment during initial ROW clearing are utilized in New York State, one of which is where forest-size trees are basally treated with herbicides and cut a week or so later (prebasal or prespray), and the other being an herbicide treatment to the cut surface of the stump (cut surface). The most commonly used herbicide mixture for cut surface treatments has been picloram (4-amino-3,5,6-trichloropicolinic acid) plus 2,4-D [2,4-dichlorophenoxy (acetic acid)]. Triclopyr ([3,5,6-trichloro-2-pyridinyl) oxy] acetic acid), has been the predominant herbicide used in the basal technique.

A 1983 research agreement between the NYS Department of Public Service and Niagara Mohawk Power Corporation fostered several studies to examine the cost and effectiveness of these two ROW clearing techniques. Reported here are some results of the study carried out by the Department of Public Service.

MATERIALS AND METHODS

The study area is located in the Towns of Lee and Western, NY, on a new 345/765 kV powerline ROW cleared in 1982 and 1983. Three replicated treatments were applied in 1983 to trees up to 75 cm in diameter measured 15 cm above ground. In the first treatment, northern hardwoods were basal-sprayed with 61.6% ai triclopyr (butoxyethyl ester) mixed at a rate of 8 lbs. ae in 98 gallons of No. 2 fuel oil. The herbicide mixture was applied under pressure from spray nozzles connected by hose to a spray truck. During bud-break in late April, triclopyr was applied to the exposed roots, root crown, and 45 cm up the trunk of all hardwood trees. The trees were cut 2 weeks later in May.

In the second treatment, 5.4% ai picloram plus 20.9% ai 2,4-D was applied in early to mid-June to the cambium ring of freshly cut hardwood trees. Applicators were allowed to cut up to 10 trees before the herbicide formulation was applied from hand-held spray containers to the stumps.

The third treatment acted as a control as no herbicides were applied to the trees. The untreated trees were cut in early June.

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The basal-sprayed trees were spray-painted to distinguish them from applicator-missed trees and later, numbered tags were placed on all stumps. Trees which received the cut surface treatment were tagged after the herbicide was applied as were stumps missed by the herbicide applicators. Numbered tags were also applied to untreated stumps at the control sites.

Data on stump diameters and presence of stump, and surface-root sprouts were collected during August-October 1983 and September 1984. The number and height of sprouts on the control sites were recorded at the end of the 1983 and 1984 growing seasons.

RESULTS AND DISCUSSION

The results shown in Table 1 indicate that both cut surface treatment with picloram and 2,4-D and basal treatment with triclopyr were very effective on northern hardwood species. Cutting trees only (no herbicide treatment) resulted in sprouting from 83% of the control stumps (Table 2). Basal spraying followed by cutting resulted in only 4%, while cut surface treatment resulted in 6% root and stump sprouting. These results indicate that approximately 15% to 20% of the cut trees died naturally, an additional 75% to 80% were controlled by herbicide treatments, and roughly 5% were missed.

Table 1. Sprout control of northern hardwoods after cutting, cut surface (picloram + 2,4-D) and basal (triclopyr) treatments.

	No Herbicide		Cut Surface		Basal	
Species	No. Stumps	% Root-Kill	No. Stumps	% Root-Kill	No. Stumps	% Root-Kill
Sugar Maple (*Acer saccharum* Marsh.)	32	13%	30	97%	31	94%
Yellow Birch (*Betula lutea* Michx.)	5	100	17	94	37	100
American Beech (*Fagus grandifolia* Ehrh.)	10	10	10	90	9	89
White Ash (*Fraxinus americana* L.)	9	22	18	83	9	100
Black Cherry (*Prunus serotina* Ehrh.)	13	8	15	100	9	89
Paper Birch (*Betula papyrifera* Marsh.)	8	13	-	-	-	-
Quaking Aspen (*Populus tremuloides* Michx.)	-	-	3	100	-	-
Basswood (*Tilia americana* L.)	2	0	-	-	-	-
Red Maple (*Acer rubrum* L.)	1	-	-	-	-	-
Striped Maple (*Acer pensylvanicum* L.)	-	-	-	-	5	100

Nearly all northern hardwood species, such as sugar maple, paper birch, white ash and black cherry commonly produced stump sprouts when not treated with herbicides on the control sites. Cut beech trees produced mostly root-suckers. Yellow birch trees did not produce any sprouts.

Commercial herbicide applicators missed 6% of the target trees on the cut surface sites and 2% on the basal sites (Table 2). The most commonly treated of the non-target plants was striped maple, a low-growing tree. On the basal sites, 5 of 13 (38%) striped maples examined were unnecessarily treated with the herbicide mixture.

Table 2. Effectiveness of cutting, cut surface, and basal treatments on northern hardwoods.

	Number of Treatment Misses	Number of Treated Trees: With Sprouts	Without Sprouts	Total Number
1. Cut, No Herbicide		66 (83%)	14 (17%)	80
2. Cut Surface (picloram + 2,4-D)	6 (6%)	6 (6%)	87 (94%)	99
3. Basal (triclopyr)	2 (2%)	4 (4%)	96 (96%)	102

Of all trees sampled, basswood produced the most and tallest stump sprouts (Table 3). Four months after the June cutting, some untreated basswood sprouts were 183 cm tall and grew to 265 cm in the second growing season. The tallest stump sprouts of common species such as sugar maple, black cherry, and paper birch typically ranged between 60 and 120 cm in height after the first growing season and between 140 and 200 cm during the second growing season. Beech suckers from surface roots within 3 m of the stump were considerably shorter than stump sprouts of other species, but were more numerous and covered a greater area. Overall, the tallest sprouts of all cut hardwood trees sampled averaged 71 cm (1 to 183 cm) in height at the end of the first growing season and 147 cm (31 to 265 cm) in the second growing season. Sprout growth on the control sites was terminated by mid-August 1984 with herbicide treatments in connection with another study.

Table 3. Number and heights of stump sprouts on control plots (no herbicide).

Tree Species	Number of Stumps	Range of Stump Diameter (cm)	Avg. of Tallest Sprouts (cm): 1st Yr.	2nd Yr.	Avg. Number of Sprouts Per Stump
Basswood	2	38-61	165	241	75
Paper Birch	8	5-38	117	198	26
Black Cherry	13	10-41	71	157	6
White Ash	6	3-41	64	183	8
Sugar Maple	34	8-61	64	140	13
Red Maple	1	33	61	193	8
American Beech	9	5-61	41	51	39
Yellow Birch	5	25-74	-	-	0

At the end of the first growing season, an occular estimate of the vegetation cover average for all six sites was less than 5% tree sprouts, 10% pioneering pin cherry (*Prunus pensylvanica* L.), 10% shrubs, mostly *Rubus* spp., 25% herbaceous cover, and 50% exposed soil and litter. During the second growing season, there was a slight increase in pin cherry and *Rubus* spp. cover while herbaceous cover increased to 65% and reduced exposed cover to 20%. If a lower voltage facility were being built on this ROW, the dense population of pin cherry would be a major concern for future vegetation management. Observations from this study and other areas of the ROW cleared since June 1982 show that pin cherry typically reaches 0.5 m in height during the first growing season, and 1.0 to 1.8 m by the end of the second growing season.

Although this study has shown both basal treatment with triclopyr and cut surface with picloram and 2,4-D to be highly effective in preventing hardwood resprouting, the cost difference between the two treatments is quite large. In 1983, contractors bid on clearing one new 125-foot-wide ROW parallel to an existing ROW 35 miles from the study area. Unit price bids for cut surface applications of picloram and 2,4-D averaged $100 per acre, while basal application of triclopyr averaged $450 per acre. The awarded contract costs were approximately one-half of these average bid estimates. The higher cost for basal application reflects the higher cost for materials and labor as it is a two-phase operation.

Both treatments have their advantages and disadvantages. During basal herbicide treatments, small tree stems are more visible and, therefore, fewer misses occur. Missing cut stumps during cut surface treatments can be a problem if applicators are not required to treat each or a few stumps immediately after cutting. Basal applications may not be used when snow or water prevents treatment to the ground line, while the cut surface technique can be used at this time. Conversely, cut surface applications should not be used on species which flush the herbicide off the cut surface during sap flow in the spring and fall, while basal applications can be used during this time. Accessibility to a forested ROW may be more difficult for basal treatment if access roads do not exist. In the final analysis, the vegetation manager will have to evaluate the ROW condition to take advantage of each method.

EFFECTS OF SULFOMETURON METHYL ON UNDERSTORY VEGETATION IN ALLEGHENY HARDWOOD STANDS

Stephen B. Horsley[1]

ABSTRACT

Dense ground covers and understories of certain herbaceous and woody plants interfere with the development of desirable hardwood species of reproduction, such as black cherry (Prunus serotina Ehrh.), red maple (Acer rubrum L.), sugar maple (Acer saccharum Marsh.), and white ash (Fraxinus americana L.) needed to regenerate these forest stands. In northwestern Pennsylvania, many Allegheny hardwood stands contain dense ground covers of hayscented fern (Dennstaedtia punctilobula (Michx.) Moore), New York fern (Thelypteris noveboracensis L.), and short husk grass (Brachyelytrum erectum Schreb.) or understories of striped maple (Acer pensylvanicum L.) and beech (Fagus grandifolia Ehrh.). Substantial reduction in the interfering species is necessary to obtain adequate reproduction of desirable Allegheny hardwood species at the time these stands are ready for harvest. Recently, sulfometuron methyl was evaluated for its ability to control all five interfering plants when applied at several rates (0, 0.105, 0.21, 0.42 kg ai/ha) and dates (May 1, June 1, July 1, August 1, September 1, October 1, November 1) of application. Target species were in pure stands on the Kane Experimental Forest or lands of the Hammermill Paper Company located in northwestern Pennsylvania. The split-plot method was used for field layout. Months of application were split into four rate subplots. Rate subplots were 3.8- by 3.8-m for ferns and grass and 7.6- by 7.6-m for striped maple and beech. Sulfometuron methyl was dissolved in water and applied to plant tissue in 550 L/ha of herbicide solution with a low-pressure sprayer using a double coverage technique. Control of interfering plants was evaluated one year after treatment. Percent ground cover of treated fern and grass plots was estimated ocularly and compared with the untreated control. Control of striped maple and beech was evaluated as the percent reduction in number of stems present in several size classes (>0.3, 0.3 to 1.5, 1.5 to 3.0, 3.0 to 4.5 m) at the beginning of the experiment. Date of application had a substantial affect on fern control, particularly at the 0.105 kg ai/ha rate. About 99% control was obtained at all rates of application between July 1 and October 1. Control was less May 1, June 1, and November 1, depending on the rate of application. Control on these application dates ranged from 10% (0.105 kg ai/ha) to 92% (0.42 kg ai/ha) for May 1, 60% (0.105 kg ai/ha) to 95% (0.42 kg ai/ha) for June 1, and 42% (0.105 kg ai/ha) to 83% (0.42 kg ai/ha) for November 1. Grass control was also affected by rate and date of application. Control at all rates was lowest early in the growing season and highest later in the growing season. There was little grass control with May 1 or June 1 applications (maximum = 28% at 0.42 kg ai/ha). Control with September 1 through November 1 applications ranged from 12% to 35% at 0.105 kg ai/ha, 53% to 68% at 0.21 kg ai/ha, and 80% to 85% at 0.42 kg ai/ha. Neither striped maple nor beech was affected at any rate or date of application.

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FORESTRY WORKERS INVOLVED IN AERIAL APPLICATION OF 2,4-D: EXPOSURE AND URINARY EXCRETION

Robert A. Campbell[1/], Richard Frank[2/] and George J. Sirons[2/]

ABSTRACT

The first purpose of the study was to determine the exposure of workers involved in mixing and loading 2,4-D ester solution into aircraft and guiding spray aircraft throughout two conifer release programs in 1981 and 1982. The 1981 operation involved 109 aircraft loads over 11 days and the 1982 operation involved 135 aircraft loads over 18 days. In order to minimize exposure the workers wore a full line of protective gear (rubber boots, water repellent disposable rain suits, neoprene gloves, hard hats, goggles and respirators). The 2,4-D excretion rates for the worker are given in Table 1. In view of the fact that 2,4-D absorbed into the body is almost totally eliminated in the urine as the unchanged parent material and assuming a half time for excretion of 18 hours, the highest daily excretion of 22.2 ug/kg body weight can be converted to a highest daily exposure of 60 ug/kg body weight. Based on a no observable effect level (NOEL) of 10 mg/kg body weight/day there was a safety factor of 167 for this dose. Since the NOEL is based on repeated dosings the mean excretion rate over the spray operation is probably a more reasonable value to use than the highest daily excretion. For the highest mean excretion there is a safety factor of 421. The presence of 2,4-D in urine samples in the pre-spray period and its slow disappearance during the post spray period prompted further investigation. Swabs of surfaces inside field living quarters revealed residues of 2,4-D from 0.7 to 288 ug/0.1 m^2. Swabs of seats, steering wheels, door handles and brake pedals of vehicles used in spray programs revealed residues of 0.7 to 184 ug/0.1m^2.

The second purpose of the study was to determine the exposure of a bystander to an aerial spray program in the worst case scenario, i.e. being directly sprayed. The bystander, one of the authors, dressed in shorts, T-shirt and sneakers with bare head, arms and legs was sprayed by a helicopter flying at 11 m above the ground emitting 2,4-D at the rate of 1.62 kg ae/ha in a total spray volume of 55L/ha. In order to determine the amount of 2,4-D actually deposited on the bystander, two subjects wearing disposable smocks, pants and hoods were positioned on either side of the bystander during the exposure. These garments were then extracted for 2,4-D. The bystander showered and changed clothes three hours after the event. The results of the bystander exposure are in Table 2.

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Table 1. Worker excretion of 2,4-D

Year	Worker[a]	job[b]	Excretion rate ug/kg/day	
			mean	highest
1981	F1	M + L	3.06	8.10
1981	M1	M + L	0.28	0.51
1981	F2	S + M + L	0.18	0.30
1982	M2	M + L	8.79	22.2
1982	M3	B + M + L	3.90	8.37
1982	M4	B	3.18	7.73

[a] F - female, M - male

[b] M - mixing, L - loading aircraft, S - supervising, B - balloonman

Table 2. Bystander exposure

	whole body basis		bare skin basis
surface area	2.16 m^2		0.76 m^2
deposit	164 mg		15.8 mg
total excretion		716 ug	
absorption	0.44%		4.5%
dose		8.5 ug/kg/day	
safety factor		1176[a]	
excretion half time		16 hours	

[a] based on NOEL of 10 mg/kg body weight/day

DEVELOPMENT OF MECHANIZED SPRAY EQUIPMENT FOR WEED CONTROL IN EASTERN HARDWOOD FORESTS

Stephen B. Horsley, Donald Wills, Robert Johncour, William Shaffer, Douglas Ostergard, and Jeffrey Worrell[1]

Understories of herbaceous and woody plants that interfere with the development of desirable species of forest reproduction are common in the northern hardwood and oak forest types throughout the eastern United States. Lack of mechanized spray equipment for forest use has been a major impediment to control of understory weeds. Recently, several private companies and public agencies have developed five air-blast spray apparatuses for use in the Allegheny hardwood forests in Pennsylvania. The panel will outline the design features and operating characteristics of each piece of equipment and field experiences will be illustrated and discussed.

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AC 252,925[1/]: A New, Multipurpose Herbicide for Vegetation Control

J. B. Dobson*, T. R. Peoples, A. M. VanCantfort, D. VanWinkle[2/]

AC 252,925, 2-,4,5-dihydro-4-methyl-4(1-methylethyl)-5-oxo-1H-imidazol-2-yl).-3-pyridinecarboxylic acid isopropylamine salt, is a new, broad-sprectrum herbicide that is being developed by American Cyanamid Company. In July, 1984, the EPA registered this product for noncrop uses. Research is currently under way to expand the uses of AC 252,925 to manage undesirable vegetation in nurseries, Christmas tree plantations, forest site preparation and conifer release.

The unique properties of AC 252,925, both as a systemic foliar and as a residual herbicide, have been demonstrated in extensive field evaluations conducted in a wide variety of industrial applications, including railroad and highway rights-of-way, tank farms, utility lines, and building sites.

Weeds susceptible to AC 252,925 herbicide include annual and perennial grasses and broadleaves, as well as many difficult to control species, such as Rhus spp., Rubus spp., Campsis radicans and Rosa multiflora. Furthermore, AC 252,925 provides effective control of various hardwood species, including Acer spp., Fraxinus spp., Populus spp., and Prunus spp.

1/ ARSENAL® herbicide

2/ American Cyanamid Company

®Registered trademark of American Cyanamid Company

MODE OF ACTION OF IMAZAPYR (AC 252,925)

Dale Shaner, Paul Anderson, Mary Reider, and Mark Stidham[1/]

ABSTRACT

Imazapyr (AC 252,925) is a member of a new class of herbicides, the imidazolinones, that is being developed by American Cyanamid for total vegetation control. Imazapyr is active on annual and perennial broadleaves and grasses. Research with Johnsongrass (Sorghum halepense) showed that 20% of the imazapyr was absorbed by the foliage by 2 days after application with no subsequent absorption taking place for an additional 5 days. Translocation of imazapyr out of the treated leaf began within 6 hours after application of the herbicide to the leaf surface. Translocation continued at a steady rate for 4 days after application. After 4 days there was no additional translocation of radiolabelled material detected. The radiolabelled material translocated evenly to both the above ground and below ground parts of the plant. Approximately 50% of the absorbed radiolabelled material was translocated out of the treated leaf.

Physiological studies were conducted on corn seedlings. Total neutral sugar content in the treated leaves increased 40% within 24 hours after application of 250 g/ha of imazapyr. Lipid synthesis, and protein synthesis, measured by incorporation of radiolabelled precursors into macromolecules, did not appear to be inhibited in corn root tips 24 hours after being treated with 150 uM of imazapyr. RNA and DNA synthesis were inhibited 15 and 63%, respectively, with the same treatment. DNA synthesis began to be inhibited between 5 and 7 hours after application of the herbicide. This decrease in DNA synthesis coincided with a decrease in growth of corn roots and was probably a secondary response to the herbicide.

Although protein synthesis rates did not appear to be inhibited by imazapyr, there was a 40% decrease in the level of soluble proteins and 36% increase in the free amino acid levels. The effects of imazapyr on the levels of the individual amino acids in corn suspension cultures revealed that while most of the amino acids did increase after application of the herbicide, three amino acids, valine, leucine, and isoleucine, decreased. When these three amino acids were exogenously supplied to corn seedlings, the inhibitory effect of 150 uM of imazapyr on both growth and DNA synthesis was prevented. Examination of the enzymes necessary for the synthesis of valine, leucine and isoleucine showed that imazapyr was a potent inhibitor of acetohydroxyacid synthase, the first enzyme in the pathway leading to these three amino acids. It appears that imazapyr kills plants by inhibiting the biosynthesis of valine, leucine, and isoleucine.

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COVER CROPS IN NURSERY AND CHRISTMAS TREE PLANTATIONS

Larry J. Kuhns[1/]

ABSTRACT

In the last 10 years a number of herbicides have been labelled for use in nursery and Christmas tree plantings that enable growers to obtain almost total weed control. Experience has shown, though, that totally bare ground is not desirable in widely spaced crops that remain in place for many years. Erosion, development of exceptionally difficult weed problems, loss of soil structure, impassable fields for days after rain, and a loss of soil productivity that is hard to define but almost universally recognized are all problems commonly encountered in totally clean areas.

At several locations across the country projects designed to evaluate various herbaceous perennial plants for their potential use as living covers between rows of crop plants have been initiated. The first step to be taken in a project of this type is the selection of the herbaceous plants to be evaluated as covers. The characteristics desired of a cover crop for use between rows of nursery stock and Christmas trees will be presented and the plants we have selected to evaluate will be described (Table 1).

Spring and fall seedings of the cover crops have been made and are being evaluated for the following characteristics: days between seeding and emergence; percent ground cover at selected days after seeding; vigor during different parts of the growing season; growth rate; date of flowering; date of maturity (seed produced); growth habit; rate of lateral spread; weed suppression; ability to withstand traffic; and habitability for vertebrates (mice, voles, rabbits).

Future work on cover crops should focus on two areas; the effect of the covers on the growth of the crops, and the use of growth regulators or sublethal doses of herbicides to control the growth of the covers.

Table 1. Herbaceous plants to be evaluated as cover crops between rows of nursery stock and Christmas trees.

Grasses	# of seeds per pound	Seeding rate lbs./1000 sq.ft.	Seeds per sq.ft.
Hard fescue	625,000	0.500-2.0	312-1,248
Creeping red fescue	546,000	0.500-2.0	273-1,092
Chewings fescue	546,000	0.500-2.0	273-1,092
Sheep fescue	530,000	0.500-2.0	265-1,060
Tall fescue	227,000	0.500-2.0	114 - 454
Perennial ryegrass	227,000	0.500-2.0	114 - 454
Orchardgrass (dwarf)	540,000	0.100-0.4	54 - 216
Canada bluegrass	2,495,000	0.100-0.4	250 -1000
Redtop	4,990,000	0.025-0.1	125 - 500
Timothy	1,134,000	0.100-0.4	113 - 454
Weeping lovegrass	1,500,000	0.025-0.1	38 - 150
Legumes			
Birdsfoot trefoil	400,000	0.125-0.5	50 - 192
White clover	700,000	0.100-0.4	70 - 280

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TOLERANCE OF BEDDING PLANTS TO SELECTED GRASS HERBICIDES

Chiko Haramaki and Larry J. Kuhns [1/]

ABSTRACT

The postemergence grass herbicides, Dowco 453, fluazifop-butyl and sethoxydim gave excellent pre- and postemergence grass control and little or no control of broadleaf weeds. Napropamide gave good to excellent control of grasses and fair control of broadleaf weeds. Oryzalin controlled both grasses and broadleaf weeds. Begonia, calendula, coleus, geranium, portulaca and snapdragon plants showed little or no injury from the postemergence grass herbicides and from napropamide. Begonia and coleus were severely injured by oryzalin. The other bedding plants had little or no injury from oryzalin.

INTRODUCTION

Landscaped areas are often quickly overcome by rapidly growing grass seedlings after the initial herbicide application has either been broken down, has been leached or both. Recent development of postemergence grass herbicides looks promising as a method of controlling these grasses in flower beds (1-6). The purpose of this experiment was determine the tolerance of six bedding plant species to three postemergence grass herbicides and two preemergence herbicides.

MATERIALS AND METHODS

On June 22, 1984 six species of bedding plants were transplanted in a Hagerstown silt loam field which had been plowed and rototilled. Ten plants of each of the species were planted in each plot. The plants were Scarletta begonia (Begonia x semperflorens - cultorum Hort, Scarletta F_1), Orange Coronet calendula (Calendula officinalis L. Orange Coronet), Jade Wizard coleus (Coleus x hybridus Voss. Jade Wizard), Smash Hit Red geranium (Pelargonium x hortorum L. H. Bailey, Smash Hit Red F_1), Sunglo portulaca (Portulaca grandiflora Hook. Sunglo) and Yellow Floral Carpet snapdragon (Antirrhinum majus L. Yellow Floral Carpet F_1). The transplants were irrigated immediately after planting with 3/4 inches of water. On June 27, 1984, the preemergence herbicides, napropamide 2G (2-(a-naphthoxyl)-N, N-diethylpropionamide) and oryzalin, 75W (3,5-dinitro N^4, N^4-dipropylsulfanilamide) were applied. At the time of application the temperatures were: air 72° F, soil surface 80° F, and 2" below 67° F. There was a 3 to 7 mph wind and the sky was partly cloudy. The soil was at field capacity. The field was irrigated with 1/4" of water immediately after treatment. On July 20, 1984, when the grasses were about 4 to 6" tall the postemergence grass herbicides, Dowco 453, 2E (methyl-2(4- (3-chloro-5-trifluoromethyl)-2-pyridinyl) phenoxy) propanoate), plus 1% 'Helena' crop oil concentrate, fluazifop-butyl (PP005) (butyl (R)-2(4((5-(trifluoromethyl)-2-pyridinyl) oxy) phenoxy) propanoate) plus 0.25% X-77 non-ionic spreader and sethoxydim 1.53 E (2-(1-(ethoxyimino) butyl)-5-(2-(ethylthio) propyl)-3-hydroxy-2-cyclohexen-1-one) plus 1% 'Helena' crop oil concentrate. The temperatures were: air 66° F, soil surface 80° F, and 2" below 67° F at the time of application. There was no wind, the sky was clear and sunny and the soil was almost at field capacity. All of the herbicides were applied at the recommended rate and at twice this rate. The treatments were replicated four times as were the control and handweeded plots. Each plots was 140 square feet. The granular herbicide was broadcast by hand and the other herbicides were applied with an AZ CO_2 powered 4 nozzle boom sprayer at 20

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Table 1. Effect of Preemergence and Postemergence Grass Herbicides on Weed Control Ten and Fourteen Weeks After Application, 1984.

Treatment	Rate	Grasses	Broad-Leaf	All Weeds	Weed Height
Dowco 453	1/16 #/A	0.25 a/	5.75	6.00	2.75 b/
Dowco 453	1/8 #/A	0	6.00	6.00	2.00
Fluazifop-butyl	1/4 #/A	0	6.00	6.00	2.25
*Fluazifop-butyl	1/2 #/A	0	5.00	5.00	2.50
*Napropamide	4 #/A	1.00	3.00	4.00	2.00
*Napropamide	8 #/A	0.25	2.25	2.50	0.88
*Oryzalin	2 #/A	0.50	0.50	1.00	1.00
Oryzalin	4 #/A	0.75	0	0.75	1.13
Sethoxydim	1/2 #/A	0	4.25	4.25	2.75
Sethoxydim	1 #/A	0	5.25	5.25	3.00
Control	----	7.00	3.00	10.00	3.00
Handweed	----	Weeding time per plot - 66 minutes			

* - 14 Weeks
a/ 0 = No Weeds
2 = 25% Weed Coverage
4 = 50% Weed Coverage
6 = 75% Weed Coverage
8 = 100% Weed Coverage, Light
10 = 100% Weed Coverage, Heavy
b/ In Feet

PSI with LP8004, 50 mesh nozzle at 32 gallons per acre. The plots were examined periodically for crop tolerance and weed control during the growing season and the final examination was made during the first week in October, 1984.

RESULTS AND DISCUSSION

In the control plots the predominant weeds in descending order of frequency were witchgrass (Panicum capillare L.), yellow woodsorrel (Oxalis stricta L.), redroot pigweed (Amaranthus retroflexus L.), yellow foxtail (Setaria glauca L.), common ragweed (Ambrosia artemisiifolia L.), common purslane (Portulace oleracea L.), Pennsylvania smartweed (Polygonum pensylvanicum L.) and alsike clover (Trifolium hybridum). Additional weeds found in the handweeded plots were smooth groundscherry (Physalis subglabrata Mackenz. and Bush), barnyardgrass (Echinochloa crus-galli (L.) Beauv.), and shepardspurse (Capsella bursa-pastoris (L.) Medik). The time spent weeding the handweeded plots was 66 minutes per plot. Dowco 453 at 1/16 and 1/8 pounds of active ingredient per acre gave excellent control of the grasses, witchgrass and yellow foxtail and little or no control of the broadleaf weeds such as redroot pigweed, yellow woodsorrel, common purslane and common ragweed. Fluazifop-butyl at 1/4 and 1/2 pounds of active ingredient per acre eliminated all grasses and had little or no control of yellow woodsorrel and common purslane. Redroot pigweed was reduced at the higher rate. Sethoxydim at 1/2 and 1 pound of active ingredient per acre eliminated the grasses but gave little or no control of the broadleaf weeds such as redroot pigweed, yellow woodsorrel, common purslane and common ragweed. The postemergence grass herbicides also had preemergence activity and continued to give excellent grass control after 10 weeks. Napropamide at 4 pounds of active

Table 2. Effect of Preemergence and Postemergence Grass Herbicides on Bedding Plant, Ten Weeks and Fourteen Weeks After Treatment, 1984.

Treatment	Rate	Begonia	Calendula	Coleus	Geranium	Portulaca	Snapdragon
Dowco 453	1/16 #/A	1.33[a/]	2.10	1.78	1.18	1.40	0.55
Dowco 453	1/8 #/A	1.28	2.10	1.73	1.65	1.73	0.40
Fluazifop-butyl	1/4 #/A	1.13	2.50	2.30	1.05	1.30	0.28
*Fluazifop-butyl	1/2 #/A	1.10	2.18	2.25	1.15	0.90	0.43
*Napropamide	4 #/A	0.90	1.78	1.95	0.84	0.63	0.55
*Napropamide	8 #/A	1.10	2.18	2.10	1.10	0.80	0.33
*Oryzalin	2 #/A	4.15	2.05	4.08	0.68	1.15	0.48
Oryzalin	4 #/A	4.70	2.00	4.05	0.73	1.23	0.13
Sethoxydim	1/2 #/A	0.98	1.98	2.10	1.18	0.70	0.25
Sethoxydim	1 #/A	1.20	1.98	1.70	0.98	0.98	0.45
Control	---	1.45	1.78	1.78	1.63	1.30	0.35
Handweed	---	1.23	2.58	1.75	0.65	1.18	0.25

* - 14 Weeks
a/ 0 = No Injury
1 = Very Little Injury
2 = Slight Injury
3 = Moderate Injury
4 = Severe Injury
5 = Dead

ingredient per acre gave reasonably good grass control and also reasonably good control of redroot pigweed but not of yellow woodsorrel. At 8 pounds the grass control was excellent and the control of the broadleaf weeds was fair except for yellow woodsorrel. Oryzalin at 2 and 4 pounds of active ingredient per acre gave excellent control of both the grasses and broadleaf weeds.

The begonia plants had excellent vegetative growth and flowering in all plots except when sprayed with oryzalin. The oryzalin treated begonias showed signs of reduced flowering and growth within a week and later the plants were stunted, had leaf necrosis and no flowering. Many of the plants eventually died. Calendula plants grew well regardless of treatment and had good vegetative growth and flowering but towards the end of the growing season many of the plants were infected with leaf spot and gray mold. Coleus plants sprayed with oryzalin were severely injured. The leaves and stems were necrotic, the plants were stunted and many of the plants were dead. The coleus in the other treated and untreated plots had a slight amount of injury from the full sunlight. Some of the leaves showed some marginal and interveinal necrosis and some of the stems also showed some necrosis. Geraniums had good vegetative growth and flowering regardless of the treatment and were not affected by the herbicides although there were isolated plants which showed some leaf necrosis. Portulaca grew well and had good vegetative growth and flowering. There was little or no injury from the herbicide treatments. The snapdragon plants had excellent vegetative growth and flowering. The plants were all dense with dark green foliage and ample flowering. The snapdragons treated with oryzalin initially had reduced flowering but soon were as floriferous as the other plants.

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1984 WEED CONTROL ON FLOWERING ANNUALS

Arthur Bing[1/] and Maria Macksel[2/]

ABSTRACT

DCPA, napropamide, trifluralin and diphenamid controlled grass weeds, but showed a variable effect on annuals used in a landscape planting. DCPA reduced growth of celosia, vinca, impatiens, begonia and coleus. Diphenamid was harmful to celosia, snapdragon, impatiens and coleus. There was delay in flowering in impatiens and very late flowering in vinca treated with DCPA, napropamide and trifluralin.

INTRODUCTION

This is the sixth (1.) of a series of experiments to find safe, effective weed control for transplanted annuals in landscape plantings. There is considerable interest in reducing maintenance costs in the beds of annuals which are grown for the color they give to the landscape.

METHODS AND MATERIALS

Flats of young plants were donated by Ivy Acres Greenhouses. They were planted in double rows on June 7. The centers of the double rows were 34 inches apart. The plants were in staggered rows, with 1 ft lengthwise between plants and 6 in. between the 2 rows. There was a 2 foot space in the row between each plot of 6 plants. There were 3 double rows of shade-tolerant plants and 3 double rows of sun-loving plants. Plants used in this experiment are shown in Table 1.

The treatments were applied on June 12, using a hand shaker for applying granules and a 1.5 gallon hand-pumped sprayer with a flat spray 8003 nozzle for liquids. Each plot was 7 ft wide.

The weed control (Table 3) and plant tolerance were rated on July 16 and again on July 26. The weed control ratings were from 10 for no weeds, to 7 for acceptable control to 1 for full of weeds. All ratings shown in Table 3 are the averages of 4 replicates receiving the same treatment. Plant growth shown in Table 4 was rated from 10 for best anticipated growth, to 7 for acceptable growth, to 3 for a poor plant and 1 for a dead plant. The ratings in Table 4 are the averages of ratings on July 16 and July 26 of 4 replicates with 6 plants each. On August 2, the center 4 plants of each plot were cut off at ground level and weighed. The yield is shown in Table 5.

RESULTS AND DISCUSSION

Weed control ratings were made for general weeds, grasses, non-grasses and individual weeds. Weed pressure was moderate, as shown by a rating of 5 for the control plot (Table 3). Ratings were made for individual weed species, but there was only appreciable pressure from barnyardgrass, (*Echinochloa crus-galli* (L.) Beauv.), large crabgrass, (*Digitaria sanguinalis* (L.) Scop.), field pepperweed (*Lepidium campestre* (L.) R. Br.) and common purslane (*Portulaca oleracea* L.). All herbicides gave good grass control, but field pepperweed was not well controlled.

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The tolerance ratings in Table 4 showed DCPA at 10 and 20 lb ai/A reduced growth of celosia, vinca and impatiens and severely affected begonia and coleus. Napropamide at 4 lb and 8 lb ai/A was not safe on impatiens and coleus, and at 8 lb ai/A injured celosia and begonia. Trifluralin was safe on all plants, showing only slight growth reduction at 4 lb ai/A on impatiens. Diphenamid was very harmful to celosia and coleus at 4 and 8 lb ai/A, injured snapdragon and impatiens at the 8 lb ai/A, but was less injurious to alyssum and zinnia.

Although plant growth may not have been affected, there was considerable delay in flowering of impatiens from DCPA, napropamide, trifuralin and diphenamid and very late flowering of vinca from DCPA, napropamide and trifluralin.

ACKNOWLEDGEMENTS

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Table 1. Herbicides used on annuals in 1984 trials, Riverhead, N.Y.

Common name	Chemical formula
DCPA	dimethyl tetrachloroterephthalate
Diphenamid	N,N-dimethyl-2,2-diphenylacetamide
Napropamide	2-(a-naphthoxy)-N,N-diethylpropionamide
Oryzalin	3,5-dinitro-N^4,N^4-dipropylsulfanilamide
Trifluralin	a,a,a-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine

Table 2. Bedding plants used in 1984 herbicide trials, Riverhead, N.Y.

Common name	
Ageratum	Ageratum houstoniamum Mill - cv Blue Jay
Alyssum	Lobulana maritima L. - cv New Carpet of Snow
Begonia	Begonia semperflorens hort. - cv Pink Tausendschon
Celosia	Celosia L. - cv Geisha mix
Coleus	Coleus blumei Beuth - cv Rainbow mix
Geranium	Pelargonium x hortorum L. H. Bailey - cv Orbit Cherry
Impatiens	Impatiens balsamina L. - cv Novette Red
Marigold	Tagetes patula L. - cv Queen Sophia
Petunia	Petunia x hybrid Hort. Vilm Andr. - cv Coral Cascade
Snapdragon	Antirrhinum majus var. Pixie L. - cv Little Darling
Periwinkle	Vinca L. - cv Little Bright Eye
Zinnia	Zinnia elegans Jacq. cv Cactus flowering mix

Table 3. Control of weeds in a planting of annuals transplanted June 7, treated June 12, observed July 16 and 26, at Riverhead, N.Y. 1984.

Treatment		Control[a]						
Herbicide	Rate lb ai/A	Gen[b]	Grass	Non-Grass	Bygr	Lacg	Fipw	Purs
DCPA 75WP	10	8	9	8	9	9	7	9
	20	8	9	8	9	10	7	10
Napropamide 5G	4	9	9	8	9	9	8	9
	8	9	10	9	10	10	9	10
Trifluralin 5G	4	8	9	8	10	9	7	10
	8	9	9	8	10	10	8	10
Diphenamid 50WP	2	9	10	9	10	10	8	8
	4	9	10	9	10	10	8	9
Handweeded		10	10	10	10	10	10	10
Untreated		5	5	6	5	7	7	7

(a) 10 = no weeds, 7 = acceptable control, 1 = full of weeds

(b) Gen = General, Bygr = Barnyardgrass, Lacg = Crabgrass, Fipw = Pepperweed, field Purs = Purslane

Table 4. Tolerance of annuals to herbicide treatments, transplanted June 7, treated June 12, observed July 16 and 26 at Riverhead, N.Y., 1984.

Treatment		Tolerance[a]											
Herbicide	Rate lb ai/A	Geranium	Petunia	Celosia	Zinnia	Snapdragon	Marigold	Impatiens	Vinca	Begonia	Alyssum	Coleus	Ageratum
DCPA 75WP	10	10	10	7	10	10	10	7	8	6	8	4	10
	20	10	9	7	10	10	10	6	7	4	9	3	8
Napropamide 5G	4	10	10	9	10	10	10	6	8	9	9	7	9
	8	10	10	7	10	10	10	5	9	7	9	5	9
Trifluralin 5G	2	10	10	10	10	10	10	9	9	9	9	8	10
	4	10	10	9	10	10	10	7	9	9	8	8	10
Diphenamid 50WP	4	9	9	5	8	9	10	8	9	9	8	6	10
	8	10	10	4	7	6	9	6	9	8	7	6	10
Untreated		10	10	10	10	10	10	9	10	10	9	8	9
Handweeded		10	10	10	10	10	10	10	10	10	10	10	10

[a] 10 = maximum growth, 7 = acceptable growth, 3 = poor growth and injury symptoms, 1 = dead plant, all averages of 2 observations of 4 replicates of 6 plants each.

Table 5. Growth of annuals treated with herbicides in 1984, planted June 7, treated June 12, and fresh weights taken August 2, Riverhead, N.Y.

Treatment		Fresh weight in pounds[a]										
Herbicide	Rate lb ai/A	Marigold	Geranium	Petunia	Ageratum	Coleus	Snapdragon	Celosia	Alyssum	Begonia	Vinca	Impatiens
DCPA 75WP	10	3.3	1.2	1.3	.44	.06	.44	.04	.22	.31	.11	.19
	20	3.3	0.9	1.1	.52	.13	.33	.04	.26	.17	.11	.13
Napropamide 5G	4	3.5	1.1	1.8	.26	.11	.39	.07	.17	.61	.11	.11
	8	3.7	1.1	1.9	.31	.06	.37	.04	.24	.39	.11	.13
Trifluralin 5G	2	3.5	1.1	1.7	.46	.07	.22	.11	.13	.59	.11	.22
	4	3.7	1.1	1.3	.63	.07	.39	.13	.15	.48	.15	.17
Diphenamid 50WP	4	4.0	1.4	2.0	.59	.13	.48	.04	.15	.44	.14	.17
	8	2.6	1.3	2.6	.57	.04	.28	.07	.19	.42	.07	.13
Handweeded		3.5	1.1	1.6	.46	.17	.35	.17	.19	.59	.15	.22
Untreated		3.1	0.7	1.5	.22	.04	.3	.11	.15	.35	.11	.07

[a] Average of 4 replicates of 4 plants from the center of each treatment plot.

SELECTED GRASS HERBICIDES FOR WOODY ORNAMENTAL LINERS

Chiko Haramaki and Larry J. Kuhns[1/]

ABSTRACT

Postemergence grass herbicides gave good to excellent control of grasses with little or no damage to the ornamental woody liners. Dowco 453 at 1/16 pound AI gave excellent control of witchgrass and poor control of yellow foxtail and broadleaf weeds and at 1/8 pound AI the control of yellow foxtail was good. Fluazifop-butyl at 1/4 and 1/2 pound AI gave good to excellent control of all grasses and no control of broadleaf weeds. Sethoxydim at 1/2 and 1 pound AI per acre gave excellent control of witchgrass and good control of yellow foxtail. Barberry, boxwood, forsythia, holly, juniper, leucothoe, pachysandra, rhododendron and viburnum exhibited little or no injury to the Dowco 453, fluazifop-butyl and sethoxydim treatments. Bearberry exhibited severe injury and deutzia exhibited slight injury in all plots both treated and nontreated. The postemergence grass herbicide sprays did not affect the amount of injury on the woody liners.

INTRODUCTION

There is a need for an effective grass herbicide which can be applied after the grass seedling emerges in beds of ornamental woody liners. After the initial herbicide application has been broken down and leached away, vigorous grasses can easily cover small woody liners if a second preemergence herbicide application was not made in time. Recently a few postemergence grass herbicides have been introduced which have been shown to be safe when sprayed on a number of woody ornamental plants (1-5). The objectives of this experiment were to determine the tolerance of eleven woody species to three postemergence grass herbicides and the weeds controlled.

MATERIALS AND METHODS

The Hagerstown silt loam was disc plowed and rototilled prior to planting of eleven woody ornamental liners on June 27, 1984. The plants were Mentor barberry (*Berberis* x *mentorensis* L. M. Ames), red bearberry (*Arctostaphylos uva-ursi* Spreng.), Korean boxwood (*Buxus microphylla koreana* Nakai), slender deutzia (*Deutzia gracilis* Sieb. and Zucc.) border forsythia (*Forsythia* x *intermedia* Lab.), Japanese holly (*Ilex crenata*, Thunb.) bluerug juniper (*Juniperus horizontalis* 'Wiltonii' Moench.), drooping leucothoe (*Leucothoe fontanesiana* Sleum.), Japanese pachysandra (*Pachysandra terminalis* Sieb. and Zucc.), chionoides rhododendron (*Rhododendron catawbiense chionoides* Michaux.) and doublefile viburnum (*Viburnum plicatum* Thunb.). Six plants of each of the species were planted in each plot except for leucothoe and viburnum. Four to six plants of these two species were planted per plot. Three-fourths of an inch of water was applied immediately after planting. The herbicides were applied on July 13, 1984 when the grasses were 2 to 5 inches tall. The herbicides applied were Dowco 453 2EC (methyl-2(4-((3-chloro- 5-(trifluoromethyl)-2-pyridinyl) phenoxy) propanoate) with 1% 'Helena' crop oil concentrate, fluazifop-butyl (PP005)-1EC (butyl (R)-2(4-((5-(trifluoromethyl) -2-pyridinyl) oxy) phenoxy) propanoate) with 0.25% X-77 non ionic spreader and sethoxydim 1.53 EC (2-(1-(ethoxyimino) butyl)-5-(2-ethylthio) propyl)-3-hydroxy-2-cyclohexen-1-one) with 1% 'Helena' crop oil concentrate. The herbicides were applied at the recommended rate and also at twice this rate, using an AZ CO_2 pressured 4 nozzle

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Table 1. Effect of Postemergence Grass Herbicides on Weed Control Twelve Weeks After Treatment, 1984.

Treatment	Rate	Grasses	Broad-leaf	All Weeds	Weed Height
Dowco 453	1/16 #/A	4.75[a/]	4.75	9.50	4.75[b/]
Dowco 453	1/8 #/A	0.75	6.75	7.25	3.50
Fluazifop-butyl	1/4 #/A	0.25	7.75	8.00	4.00
Fluazifop-butyl	1/2 #/A	0.75	7.25	8.00	3.75
Sethoxydim	1/2 #/A	0.50	8.25	8.75	4.00
Sethoxydim	1 #/A	0.25	8.00	8.25	4.00
Control	---	7.25	2.75	10.00	4.00
Handweed	---	Weeding time per plot - 78 minutes			

a/ 0 = No Weeds
2 = 25% Weed Coverage
4 = 50% Weed Coverage
6 = 75% Weed Coverage
8 = 100% Weed Coverage, Light
10 = 100% Weed Coverage, Heavy
b/ In Feet.

boom sprayer at 20 psi at the rate of 32 gallons per acre. LP8004 nozzles with 50 mesh screens were used. At the time of spraying the temperatures were: air 76° F, soil surface 86° F and 2" below 74° F. The soil moisture was at field capacity. There was a 2 to 6 mph wind and the sky was clear and sunny. All of the treatments were replicated four times. The plots were 227 1/2 square feet. The plots were examined periodically during the season for crop tolerance and weeds controlled. The final examination was made during the first week in October, 1984.

The predominant weeds in the control plots were in decreasing order of frequency witchgrass (Panicum capillare L.), yellow foxtail (Setaria glauca L.) Beauv.), redroot pigweed (Amaranthus retroflexus L.), yellow woodsorrel (Oxalis stricta L.), Canada thistle (Cirsium arvense (L.) Scop.), common lambsquarter (Chenopodium album L.), giant foxtail (Setaria faberi Herrm.) and Virginia copperleaf (Acalypha virginica L.). Additional weeds found in the handweeded plots were tumble pigweed (Amaranthus albus L.), common dandelion (Taraxacum officinale. Weber in Wiggers), quackgrass (Agropyron repens (L.) Beauv.), bitter nightshade (Solanum dulcamara L.), broadleaf plantain (Plantago major L.), and mayweed chamomile (Anthemis cotula L.). The average total hand weeding time per plot was 78 minutes. Dowco 453 at 1/16 pounds of active ingredient per acre gave excellent control of witchgrass and poor control of yellow foxtail and of broadleaf weeds such as redroot pigweed, Canada thistle and yellow woodsorrel. At 1/8 pounds per acre of Dowco 453 the control of witchgrass was excellent and the control of yellow foxtail was good. The broad leaf weeds such as redroot pigweed yellow woodsorrel and Canada thistle were not reduced. Fluazifop-butyl at 1/4 and 1/2 pounds of active ingredient per acre gave good to excellent control of all grasses but no control of broadleaf weeds such as tumble pigweed, redroot pigweed, yellow woodsorrel and common lambsquarter. Sethoxydim at 1/2 and 1 pounds of active ingredient per acre gave excellent control of witchgrass and good control of yellow foxtail but little or no control of broadleaf weeds such as redroot pigweed, Canada thistle, yellow woodsorrel, common lambsquarter and hairy galinsoga (Galinsoga ciliata Raf.) Blake). The postemergence grass herbicides also had good to excellent preemergence activity on grasses.

Table 2. Effect of Postemergence Grass Herbicides on Woody Liners Twelve Weeks After Treatment, 1984.

Treatment	Rate	Barberry	Bearberry	Boxwood	Deutzia	Forsythia	Holly
Dowco 453	1/16 #/A	0.25[a/]	3.54	0	1.50	0.08	0.08
Dowco 453	1/8 #/A	0.42	3.79	0.08	1.50	0.38	0.08
Fluazifop-butyl	1/4 #/A	0.41	4.71	0.04	1.50	0.46	0
Fluazifop-butyl	1/2 #/A	0.46	4.25	0.04	1.67	0.42	0.21
Sethoxydim	1/2 #/A	0.21	4.21	0.17	1.50	0.25	0.08
Sethoxydim	1 #/A	0.67	3.92	0.21	1.97	0.42	0.04
Control	---	0.21	4.42	0.04	1.54	0.21	0.21
Handweed	---	0.42	3.38	0.13	1.59	0.08	0.04

a/ 0 = No Injury
1 = Very Little Injury
2 = Slight Injury
3 = Moderate Injury
4 = Severe Injury
5 = Dead.

Barberry, boxwood, forsythia, holly, juniper, leucothoe, pachysandra, rhododendron and viburnum exhibited little or no injury to the Dowco 453, fluazifop-butyl and sethoxydim treatments. Bearberry exhibited severe injury in all treatments including the handweeded and control plots. The leaves had necrotic spots as well as red and yellow coloration, also there were many dead plants. There was little difference between treatments in the amount of injury. There was a slight amount of injury on most of the deutzia plants, regardless of herbicide treatment or nontreatment. There were one or two leaves on most plants which had some necrosis or chlorotic margins. The sprays of the postemergence grass herbicides did not affect the amount of injury.

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Table 3. Effect of Postemergence Grass Herbicides on Woody Liners Twelve Weeks After Treatment, 1984.

Treatment	Rate	Juniper	Leucothoe	Pachysandra	Rhododendron	Viburnum
Dowco 453	1/16 #/A	0.29[a/]	0.28	0.04	0.77	0.38
Dowco 453	1/8 #/A	0.29	0.94	0	0.59	0.74
Fluazifop-butyl	1/4 #/A	0.13	1.07	0.13	0.42	0.75
Fluazifop-butyl	1/2 #/A	0.33	1.27	0.04	1.08	0.58
Sethoxydim	1/2 #/A	0.33	0.53	0	1.37	0.56
Sethoxydim	1 #/A	0.54	0.56	0.08	0.76	0.63
Control	---	0.21	0.67	0	0.63	0.24
Handweed	---	0.25	0.98	0	0.88	0.38

a/ 0 = No Injury
5 = Dead

EVALUATION OF POSTEMERGENCE GRASS HERBICIDES IN CONIFER SEEDBEDS AND CHRISTMAS TREES

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ABSTRACT

Fluazifop-p-butyl, sethoxydim, haloxyfop, DPX-Y6202 and SC-1084 were applied postemergence on seedbeds of Norway spruce, Eastern hemlock, Fraser fir, white pine and Douglas-fir, and on transplanted balsam fir. Fluazifop-butyl, sethoxydim, haloxyfop and SC-1084, tank-mixed with simazine, also were applied during 1983-84 on transplanted white pine, Fraser fir and Douglas-fir. Crabgrasses (Digitaria sanguinalis (L.)Scop.) and D. ischaemum (Schreb.)Muhl.) and common rye (Secale cereale) were better controlled than mixed perennial grasses, but in all instances, conifers suffered no injury from the postemergence grass herbicides. Glyphosate at 0.56 lb ae/A alone and at 0.28 lb ae/A with the surfactant Frigate at 0.5% (v/v) controlled rye in April without injury to dormant balsam fir.

INTRODUCTION

The new postemergence grass herbicides offer opportunities for controlling grasses in conifers but information is needed on their selectivity at different stages of conifer growth. Annual grasses are serious problems in conifer seedbeds and perennial grasses are serious competitors in conifers grown in Christmas tree plantings. Prior results in conifers showed that tank mixes of grass herbicides with simazine [2-chloro-4,6-bis(ethylamino)-s-triazine] could control perennial grasses and provide residual control of other weeds (1,2). Rye has potential as a winter cover crop in ornamental nurseries and Christmas tree plantings, but selective controls for rye are needed to reduce its competitive effects in the spring. In preliminary trials certain postemergence grass herbicides and low rates of glyphosate [N-(phosphonomethyl)glycine] were effective in controlling rye in dormant conifers.

In this work we report the results obtained with postemergence grass herbicides in conifer seedbeds and Christmas tree plantings during 1983 and 1984

MATERIALS AND METHODS

Experiments were conducted at three locations during 1983 and 1984. The postemergence grass herbicides evaluated were fluazifop-butyl [(butyl-2-[4-[[5-trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid], PP005 (fluazifop-p-butyl, the active isomer of fluazifop-butyl), sethoxydim [2-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclo-hexen-1-one], haloxyfop [2-[4-[[3-chloro-5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]-propanoic acid], DPX-Y6202 [2-[4-[(6-chloro-2-quinoxalinyl)oxy]phenoxy]propionic acid, ethyl ester], and SC-1084 (Stauffer Chemical Co.). Crop oil concentrate or X-77 surfactant was added to these herbicides at 1% (v/v) or 0.25% (v/v). Other herbicides applied in one of the tests were glyphosate alone or with the surfactants X-77 or Frigate at 0.5% (v/v), simazine and atrazine [2-chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine].

The herbicides were applied with hand-held booms with one, three, or four nozzles calibrated to deliver 30 gal/A. At each location treatments were arranged in randomized complete blocks with three or four replicates.

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Test A was conducted at the Connecticut State Forest Nursery at Voluntown, CT on a sandy loam soil with 5% organic matter. Seeds of Norway spruce (Picea abies (L.)Karst), hemlock (Tsuga canadensis), white pine (Pinus strobus L.), Fraser fir (Abies fraseri (Pursh.)Poir.), and Douglas-fir (Pseudotsuga menziesii (Mirb.)Franco.) were drilled in individual 4 by 300 ft beds in November 1983 and grown under plastic shade netting after germination in early May 1984. Oxyfluorfen [2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene] or prometryn [2,4-bis(isopropylamino)-6-(methylthio)-s-triazine] was applied in mid June to control broadleaf weeds, as in normal practice. The experimental herbicides were applied on June 21, 1984 when the conifer seedlings were 1 to 2 in tall and crabgrasses were 2 to 4 in tall. Plot sizes were 4 by 9 ft. All plots were handweeded following evaluation of crabgrass control on July 23. Injury to the conifers was evaluated on July 23 and September 18. Irrigation was delayed until the day following treatment but was supplied as needed during the season as in normal seedling production.

Test B was conducted at a commercial Christmas tree plantation in South Windsor, CT in silt loam soil with 4.7% organic matter. A cover crop of rye was broadcast before planting four and five-year-old balsam fir (Abies balsamea (L.)Mill.) at 5 by 6 ft spacings in September 1983. The herbicides were applied in 3-ft swaths over the trees and the rye on April 23, 1984, when the rye was 15 to 22 in tall. Plot sizes were 3 plants long (15 ft). The balsam fir was dormant at treatment. Rain started to fall about 1 h after the final herbicide application. Plant injury and control of rye were evaluated on May 17 and June 17 and leader growth of the fir was measured in August.

Test C was conducted at the Valley Laboratory in Windsor, CT on a fine sandy loam soil with 3% organic matter. Four-year-old (2-2) white pine, Fraser fir and Douglas-fir were planted March 30 to April 7, 1983 in an established grass sod composed of a mixture of quackgrass (Agropyron repens (L.)Beauv.), timothy (Phleum pratense L.), orchardgrass (Dactylis glomerata L.), and sweet vernalgrass (Anthoxanthum odoratum L.). Conifers were spaced 3-ft apart in rows 6-ft apart.

The herbicides were applied in a 4.5 ft swath over the trees. Plots were 18-ft long and three rows wide, with six trees of each of the three conifer species. Postemergence grass herbicides were tank-mixed with simazine and applied from May 15 to June 1, 1983, and reapplied on the same plots on May 15, 1984. These herbicides without simazine added were reapplied on August 1, 1984. The standard treatments of simazine alone and simazine plus atrazine were applied once each year in May. No rain fell within several hours after any application in this test.

Treatments were scheduled at times when two or more of the conifers were actively growing. The Douglas-fir and pine were actively growing in May and early June, but Fraser fir buds were not yet open. On August 1, 1984, Douglas-fir were actively growing but the pines and Fraser fir had completed most of their season's growth. On May 15, 1983, quackgrass and timothy were 6 to 10 in tall, but on May 18, 1984 quackgrass was 10 to 20 in tall and timothy was 10 to 12 in tall.

Vegetation between the rows of trees was mowed in June and July each year. Percentage grass cover and percentage control of grasses and other weeds and conifer injury were evaluated periodically over the 2 years. Growth of the conifers was measured in August of 1984.

RESULTS AND DISCUSSION

Test A, conifer seedbeds. Untreated plots had an estimated 70% stand of crabgrass in July. Crabgrass control was essentially complete with all herbicides tested: PP005 at 0.188 and 0.375 lb/A plus X-77 gave 99 and 100% control, respectively; sethoxydim at 0.25 and 0.5 lb/A plus crop oil gave 99 and 100% control; haloxyfop at 0.125 and 0.25 lb/A plus crop oil gave 100% control; DPX-Y6202 at 0.125 and 0.25 lb/A plus X-77 gave 99 and 100%

control; and SC-1084 at 0.25 and 0.5 lb/A plus crop oil gave 99 and 100% control. No injury was detected with any of these treatments in hemlock, Fraser fir, Norway spruce, white pine or Douglas-fir.

Test B - rye in balsam fir. Applications to control rye on April 23 were only partially effective in 3 weeks (Table 1). Eighty-five percent or better control of rye in

Table 1. Control of rye and growth of balsam fir in 1984.

Herbicide	lb/A ai or ae	Spray additive 1/	Hours-minutes between application and rainfall 2/	% Control rye 5/17	% Control rye 6/17	1984 Leader growth cm
untreated				0	0	15.7
fluazifop-butyl, 4E	0.5	X-77	1:47	52	80	19.6
PP005 1E	0.25	X-77	1:59	62	76	16.4
	0.5	X-77	1:53	68	94	19.1
sethoxydim 1.53E	0.5	CO	2:12	57	76	17.2
DPX-Y6202 0.8E	0.0625	X-77	1:40	41	66	22.4
	0.125	X-77	1:34	52	87	16.2
	0.25	X-77	1:28	56	96	16.3
haloxyfop 2E	0.25	CO	1:11	57	98	17.3
	0.5	CO	1:05	61	100	17.2
SC-1084 4E	0.5	CO	1:21	34	49	15.9
	0.75	CO	1:16	46	59	24.2
glyphosate 3L	0.28 ae	none	2:38	25	21	23.1
	0.56 ae	none	2:32	61	86	17.7
	0.28 ae	X-77	2:12	28	32	19.7
	0.28 ae	Frigate	2:24	57	80	17.5
	0.56 ae	Frigate	2:18	66	92	18.7
LSD p = .05				10	10	NS
p = .01				13	14	NS

1/ X-77 was added at 0.25% (v/v); CO was Agway Booster+E at 1% (v/v); Frigate was added at 0.5% (v/v).

2/ Time elapsed between completion of spraying and the start of rainfall on April 23.

8 weeks was obtained with PP005 at 0.5 lb/A, DPX-Y6202 at 0.125 or 0.25 lb/A, haloxyfop at 0.25 or 0.5 lb/A, glyphosate alone at 0.56 lb ae/A, and glyphosate at 0.28 lb ae/A plus Frigate, despite rainfall occurring 1 to 2½ hours after application. SC-1084 at 0.5 or 0.75 lb/A was less effective than the other grass herbicides. Glyphosate activity on rye was enhanced with the surfactant Frigate, but not X-77. None of the treatments caused any detectable injury to the balsam fir or significantly affected growth.

Test C - conifers in sod. Timing of the treatments in the 2-year trial may have been too late for optimal control of perennial grasses. The tank mixes of simazine with sethoxydim, fluazifop-butyl, haloxyfop or SC-1084 in May of 1983 and 1984 gave initial control and suppression of perennial grass mixtures, but grass populations recovered with time (Table 2). Following treatment the populations of grasses shifted from timothy and

Table 2. Effects of herbicides on mixed perennial grasses following one application in 1983 and one or two applications in 1984.

Herbicide	lb/A ai	Application dates '83	Application dates '84	1983 %Control grasses July 6	1983 %Control grasses Oct 28	% Grass cover May 15 '84	1984 %Control grasses June 18	1984 %Control grasses Aug 1	1984 %Control grasses Aug 24	% Grass cover Oct 5
simazine+ atrazine	2+2	5/18	5/11	81	70	77	67	48	43	60
simazine	4	5/18	5/11	33	27	87	30	40	33	85
sethoxydim+ simazine+CO	0.5+3	5/18	5/15, 8/1*	86	83	58	68	37	75	52
	0.75+3	5/18	5/15, 8/1*	86	62	85	73	40	75	55
fluazifop-butyl+ simazine+CO	0.5+3	5/18	5/15, 8/1*	81	57	77	70	58	83	9
	0.75+3	5/18	5/15, 8/1*	86	72	63	77	57	78	13
haloxyfop+ simazine+CO	0.25+3	6/1	5/15, 8/1*	30	55	62	78	58	88	1
	0.5+3	6/1	5/15, 8/1*	56	67	58	80	67	89	0
	0.75+3	6/1	5/15, 8/1*	56	73	57	78	72	95	0
SC-1084+ simazine+CO	0.75+3	5/25	5/15, 8/1*	60	57	78	73	73	83	0

*The second application on 8/1/84 did not include simazine.

CO = Crop oil concentrate (Agway Booster+E) at 1% (v/v).

sweet vernalgrass to quackgrass and orchardgrass, which were more resistant to the herbicides. However, the August 1, 1984 applications of fluazifop-butyl, haloxyfop and SC-1084 were very effective in controlling the quackgrass that survived earlier treatments. None of the treatments had any detectable effect on the white pine, Douglas-fir or Fraser fir over the 2-year period, nor on perennial broadleaf weeds that were present.

The utility of postemergence grass herbicides in controlling perennial grass mixtures in Christmas tree plantations requires further investigation, but the tolerance of conifers at varied times and stages of growth appears excellent.

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SULFOMETURON, CHLORSULFURON, METSULFURON METHYL, AND UC77892 ON CHRISTMAS TREES

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ABSTRACT

Sulfometuron 75% water dispersible granule (WDG) , chlorsulfuron (75% WDG), metsulfuron methyl (60% WDG), and UC77892 (80% WP) were applied as directed sprays to the base of established confifers. The length of time the plants were in the field and their approximate size at the time of application follows: Douglas fir-1 year, 12-18 in.; Fraser fir-2 years, 12-18 in.; Scotch pine-4 years, 36-48 in; white pine-4 years, 36-48 in.; and Colorado spruce-6 years, 48-60 in. The rates of application are presented in Table 1. All treatments were applied on June 1 with a CO_2 pressurized test plot sprayer through an OC04 nozzle at 30 psi in the equivalent of 45 gal. of water per acre. The spray was directed at the base of each side of the trees. The size of the conifer, its conformity, and weed density determined how much spray contacted the foliage of the conifers. Plot size was 3 ft. by 25 ft. and each plot contained 3-5 conifers. Each treatment was replicated twice in each tree species.

The test plots contained primarily broadleaved weeds with some grasses scattered throughout. The only herbicide used in the area in prior years was simazine, so perennial weeds dominated. The most common weeds in the plots were dewberry (Rubus spp.), goldenrod (Solidago spp.), wild carrot (Daucus carota L.), oxeye daisy (Chrysanthemum leucanthemum L.), wild strawberry (Fragaria spp.), barnyardgrass [Echinochloa crus-galli (L.) Beauv], common ragweed (Ambrosia artemisiifolia L.), quackgrass [Agropyron repens (L.) Beauv.], broadleaf plantain (Plantago major L.), buckhorn plantain (Plantago lanceolata L.), hemp dogbane (Apocynum cannabinum L.), and common yarrow (Achillea millefolium L.).

Only sulfometuron provided adequate weed control. Its early control was very good and its long term control of difficult to control species was excellent. The few weeds present in the plots 21 weeks after application were primarily stunted grasses. Chlorsulfuron and metsulfuron methyl provided limited control of broadleaved weeds early, but the grasses were released and filled in the open areas by the end of the growing season. Almost no control was provided by UC77892. The weed species present and stage of growth at the time of application made this area a severe test for selective herbicides.

The UC77892 did not cause any injury to any of the conifers. Metsulfuron methyl caused severe stunting and chlorosis or necrosis of new growth on all conifer species. Chlorsulfuron caused even more severe injury than metsulfuron methyl. The symptom development was similar, but progressed to death of more of the trees.

The injury caused by sulfometuron varied with species. Douglas fir, Fraser fir, and lorado spruce were stunted and chlorotic, with severity being rate dependent. Scotch white pines were not severely injured. Initially, bud break was delayed, the needles slow to develop, and there was some discoloration of needles contacted by the spray. end of the growing season there was some stunting of the growth on lower limbs, development on the stunted branches was satisfactory.

iury caused by the herbicides varied greatly within treatments. This have been due to plant size and the amount of chemical contacting the

r sulfometuron on pines and the UC77892, all other treatments were too onsider further use in plantings of the species tested.

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esearch Asst., and Prof., Dept. of Horticulture, The Pennsylvania State sity Park, PA 16802.

Table 1. The injury ratings of conifers receiving a directed spray of four herbicides, and the weed control provided by them.

Treatment[1/]	Doug Fir[2/]		Fraser Fir[2/]		Scotch Pine[2/]		White Pine[2/]		Colo. spruce[2/]		Weed Control[3/]	
	July 5	Oct.26	July 5	Oct.26	July 5	Oct.26	July 5	Oct.26	July 5	Oct.26	July 5	Oct.26
Control	0	3.5	0	0	0	0	0	0	0	0	0	0
Sulfometuron (2 oz./acre)	2	5	6.5	6.5	4	1	2.5	1	2.5	6	7.7	8.1
Sulfometuron (4 oz./acre)	6	6.3	7	5	2.5	1	4	1.5	1	5	8.1	9.3
Sulfometuron (8 oz./acre)	5.8	9	8.5	8.8	2.5	1	2.5	1.5	4.5	5	8.6	9.8
UC77892 (4 lbs.ai/acre)	0	0	0	0	0	0	0	0	0	0	0	1.7
UC77892 (7 lbs.ai/acre)	0	0	0	0	0	0	0	0	0	0	0	1.8
UC77892 (10 lbs.ai/acre)	0	0	0	0	0	0	0	0	0	0	0.4	2.5
Metsulfuron methyl (3.2 oz./acre)	8	7.5	7.5	8	8	9	7	7	7	8.3	6.2	3.3
Chlorsulfuron (3 oz./acre)	9	10	9	9.3	8	7	8	8.3	9.3	9	4.9	3.7

[1/] of UC77892 is presented in lbs.a.i./acre; all others are in oz. of product.

[2/] on a scale of 0-10 with 0=no injury, 3=commercially unacceptable, and 10=dead.

[3/] on a scale of 0-10 with 0=no control and 10=total control. The data represents averages in all of the plots.

EVALUATION OF SULFOMETURON METHYL FOR WEED CONTROL IN CHRISTMAS TREE PLANTINGS

J. F. Ahrens 1/

ABSTRACT

Sulfometuron methyl was applied in April and June 1984 at rates of 0.094, 0.1875 and 0.375 lb/A alone or at 0.094 lb/A in combination with simazine at 2 lb/A over balsam fir planted in September 1983, and over white pine and Colorado spruce planted in April 1983. The surfactant X-77 was added to all but one sulfometuron spray at 0.25% (v/v). The standard applications of simazine plus oryzalin at 2+3 lb/A and simazine plus atrazine at 2+2 or 3+3 lb/A caused no injury to white pine, Colorado spruce or dormant balsam fir, but atrazine plus simazine injured the lower foliage of actively growing balsam fir. Although sulfometuron methyl gave preemergence and postemergence control of several annual and perennial weeds, all rates injured the three conifer species when applied before or after bud break. Eliminating the surfactant did not reduce injury to balsam fir.

INTRODUCTION

Sulfometuron methyl [methyl-2-[[[[(4,6-dimethyl-2-pyrimidinyl)amino]carbonyl]amino]-sulfonyl]benzoic acid] is registered for control of weeds in plantings of Virginia pine and loblolly pine, two species grown as Christmas trees in the southern U.S., for the control of herbaceous perennial weeds such as yellow nutsedge (Cyperus esculentus L.) and goldenrod (Solidago spp.). The current standard preemergence herbicides for Christmas tree plantings in the northeast such as simazine [2-chloro-4,6-bis(ethylamino)-s-triazine], oryzalin (3,5-dinitro-N^4,N^4-dipropylsulfanilamide) and atrazine [2-chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine] fail to control many of the established herbaceous perennials and woody plants (1,2). Atrazine also has been found injurious when applied on new growth of balsam fir (3). The purpose of this work was to evaluate the selectivity of sulfometuron methyl in Christmas tree plantings in Connecticut.

MATERIALS AND METHODS

Three replicated experiments were conducted during 1984 in a commercial Christmas tree plantation in South Windsor, Connecticut. The balsam fir (Abies balsamea (L.)Mill.) planting was on a silt loam soil with a 4.7% organic matter. The 5-and 6-yr (wilding+2) plants were set into field rows at 5 by 6 ft spacings in September 1983. Rye (Secale cereale) was broadcast before planting to provide a winter soil cover and protection from windburn.

The white pine (Pinus strobus L.) and Colorado spruce (Picea pungens Engelmann) were planted in April 1983 as 4-yr (2-2) plants at 5 by 6 ft spacings in a silt loam soil with 3.3% organic matter. Fescue grasses were seeded between rows after planting to support traffic and provide erosion control. These center strips of sod were periodically mowed. Simazine plus oryzalin at 2+3 lb/A was applied in 3-ft bands over the rows of the spruce and pine after planting, as in normal commercial practice.

On April 10 and 11 and on June 1, 1984, the experimental herbicide treatments were applied in 3-ft bands over the three conifer species, using a single even-spray nozzle (8004-E Spraying Systems Co.) on a hand-held boom calibrated to deliver 30 gal/A. Sulfometuron methyl was applied at 0.094, 0.1875 and 0.375 lb/A alone or at 0.094 lb/A in combination with simazine at 2 lb/A. The surfactant X-77 was added to all but one sulfometuron spray at 0.25% (v/v). Standard treatments included simazine plus oryzalin at

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2+3 lb/A and simazine plus atrazine at 2+2 and 2+3 lb/A. Plot lengths were 3 or 4 plants (15 or 20 ft) in balsam fir, 2 plants (10 ft) in Colorado spruce, and 3 plants (15 ft) in white pine. Within each conifer species the treatments were arranged in randomized complete block designs with 4 or 5 replicates. All conifers were dormant on April 10 and 14, but on June 1, the balsam fir and Colorado spruce had 2 to 3 in of new growth and the white pines had 3 to 8 in of new growth.

On April 10, the rye cover crop in the balsam fir was 6 to 10 in tall with 3 to 4 leaves. Percentage control of rye was evaluated on May 19. The June 1 applications were made after mowing the rye and removing it from the plot area. Percentage control of weeds was evaluated on October 3.

Weeds present in the Colorado spruce and white pine plots were recorded at each treatment date and percentage weed cover and the weeds present were evaluated again in September.

Conifer injury ratings were made in late June and in the fall on a scale of 0-10, with 0 as no injury and 10 as complete plant kill. Percentage survival and height growth of surviving plants were recorded in August.

Over 2 in of rain fell 1 week after the April 10 applications. May was very wet with a total of 12.7 in of rainfall. At the time of the June 1 application, the soil was saturated and over 1 in of rain fell within 24 hours after application. Rainfall in June was only about 2/3 normal (2.7 in), however, rainfall in July was above normal (4.2 in), and rainfall in August (1.2 in) and September (1.1 in) was about one third normal.

RESULTS AND DISCUSSION

Vegetation control. Whereas simazine+oryzalin, or simazine+atrazine in April gave only 26 and 55% control of rye, respectively, sulfometuron methyl at 0.094 lb/A gave about 80% control (Table 1). The sulfometuron methyl-treated rye was severely stunted and did not mature.

Untreated plots in the balsam fir were 100% covered with weeds in October. The predominant weeds included fall panicum (*Panicum dichotomiflorum* Michx.), giant foxtail (*Setaria faberi* Herrm.), horseweed (*Conyza canadensis* (L.)Conq.), yellow nutsedge and common ragweed (*Ambrosia artemisiifolia* L.). Princep plus oryzalin at 2+3 lb/A applied after rye removal in June gave better weed control (78%) than when applied on growing rye in April (59%). Yellow nutsedge, fall panicum and horseweed were predominant in simazine plus oryzalin plots. Similarly, simazine plus atrazine at 2+2 lb/A gave better control with the June 1 application (93%) than with the April application (78%). Fall panicum invaded plots treated with simazine plus atrazine in April.

Sulfometuron methyl at 0.094 lb/A or higher gave over 90% control of the above weeds for the season, whether applied in April or June. Seedling horseweed and St. Johnswort (*Hypericum perforatum* L.) were found in sulfometuron methyl plots in October.

Untreated plots in the Colorado spruce and white pine had an estimated 92% weed cover on September 15. The predominant weeds were horseweed, tall fescue (*Festuca arundinacea*), fall panicum, large crabgrass (*Digitaria sanguinalis* (L.)Scop.), common ragweed, quackgrass (*Agropyron repens*(L.)Beauv.), common dandelion (*Taraxacum officinale* Weber), brambles (*Rubus* spp.) and yellow nutsedge. The perennials and brambles were present in most plots before treatment. Simazine+oryzalin failed to control the perennial weeds or brambles and simazine+atrazine failed to control brambles and tall fescue.

Sulfometuron methyl was more effective on June 1 than on April 10 (93 vs. 61% control at 0.094 lb/A), and gave postemergence as well as preemergence control of most weeds. Sulfometuron methyl at 0.094 lb/A in April controlled or suppressed tall fescue, quackgrass,

yellow nutsedge and brambles, but allowed late season invasion of fall panicum and crabgrasses. The tank mix of sulfometuron methyl plus simazine at 0.094+2 lb/A in April gave longer control of weeds than sulfometuron methyl alone. June applications of sulfometuron methyl also suppressed Virginia creeper (Parthenocissus quinquefolia (L.)Planch.).

Although slopes were gentle (2 to 3%), the untreated fescue sod growing adjacent to, but downslope of, sulfometuron methyl plots frequently was suppressed or killed, indicating lateral movement of the herbicide.

Plant injury. The heavy rainfall in 1984 stressed the conifers and resulted in poorer than normal growth in all conifers, and poorer than normal survival in balsam fir. Therefore, greater than normal herbicide injury could be expected. Simazine+oryzalin at any date, and simazine+atrazine in April caused no detectable conifer injury but applications of atrazine+simazine at 2+2 or 3+3 lb/A on tender new growth of balsam fir on June 1 injured lower foliage (Table 2). Needles were moderately discolored and necrotic early but plants appeared healthy later in the season even though lower foliage was sparse.

Sulfometuron methyl applied in April delayed bud break, discolored plants, and suppressed growth of all conifers, and at 0.1875 or 0.375 lb/A increased mortality of fall planted balsam fir. Applications on June 1 during active conifer growth, affected terminal growth of white pine less than April applications but also resulted in crooked terminal leaders and off-color plants. These symptoms are reflected in the moderate injury ratings in Table 2. In balsam fir and Colorado spruce new growth of sulfometuron methyl-treated plants appeared juvenile, with shorter than normal needles. Eliminating the surfactant from the June 1 applications did not reduce injury to balsam fir.

Despite the advantages that sulfometuron methyl offers in the control of perennial weeds, brambles, and Virginia creeper, these experiments indicate that tolerance of balsam fir, white pine and Colorado spruce is inadequate for commercial use of sulfometuron methyl in young Christmas tree plantings in Connecticut.

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Table 1. Percent Control of Rye in May and Weeds in the Fall

		Balsam fir		Colorado spruce & white pine
Herbicide	lb/A, ai	Rye 1/ May 19	All weeds 2/ Oct 3	All weeds 3/ Sept 25
untreated		0	0	0
Applications on April 10 and 11, 1984				
simazine WP+ oryzalin WP	2+3	26	59	60
simazine WP+ atrazine WP	2+2	55	78	-
sulfometuron DF+ X-77	0.094	83	91	61
	0.1875	83	93	84
	0.375	85	96	96
sulfometuron+ simazine	0.094+2	81	94	82
	0.1875+2	81	96	85
Applications on June 1, 1984				
simazine WP+ oryzalin WP	2+3	-	78	49
simazine WP+ atrazine WP	2+2	-	93	70
	3+3	-	94	76
sulfometuron DF+ X-77	0.094	-	98	93
	0.1875	-	100	98
sulfometuron DF (no surfactant)	0.094	-	94	-
sulfometuron DF+ simazine	0.094+2	-	99	96

1/ Rye was mowed between rows on May 23 and the remaining rye plants were cut off before applying herbicides on June 1.

2/ Untreated plots had 100% weed cover on October 3, primarily of annual weeds.

3/ Untreated plots had an estimated 92% weed cover on September 25, composed of annuals and perennials such as quackgrass, tall fescue, brambles, yellow nutsedge, fall panicum, large crabgrass and horseweed.

Table 2. Effects of herbicides on dormant and actively growing conifers.

		Balsam fir			White pine		Colorado spruce	
Herbicide	lb/A, ai	Injury (0-10)	Height growth (cm)	% Mortality	Injury (0-10)	Height growth (cm)	Injury (0-10)	Height growth (cm)
untreated		-	-	-	0	26.9	0	13.6
Applications on dormant plants - April 10 and 11, 1984								
simazine WP+ oryzalin WP	2+3	0	15.7	7.7	0	22.9	0	18.5
simazine WP+ atrazine WP	2+2	0	16.8	0	-	-	-	-
sulfometuron DF+ X-77	0.094	4.5	8.5	7.1	3.2	15.9	4.0	4.5
	0.1875	7.3	6.3	15.4	3.6	14.5	3.8	5.4
	0.375	7.1	5.1	23.1	4.6	11.5	5.5	2.5
sulfometuron DF+ simazine+X-77	0.094+2	3.3	12.1	15.4	2.8	18.3	3.5	6.3
	0.1875+2	5.5	7.9	30.8	3.8	13.8	4.0	4.2
Applications on actively growing plants - June 1, 1984								
simazine WP+ oryzalin WP	2+3	0	17.0	0	0	31.9	0	12.3
simazine WP+ atrazine WP	2+2	1.0	17.8	0	0	27.6	0	16.8
	3+3	2.5	15.5	0	0	29.6	0	11.5
sulfometuron DF+ X-77	0.094	3.8	9.9	0	3.4	21.9	1.3	13.4
	0.1875	6.5	13.9	57.1	4.6	15.9	3.0	3.9
sulfometuron DF (no surfactant)	0.094	3.5	13.2	7.7	-	-	-	-
sulfometuron DF+ simazine WP+ X-77	0.094+2	4.8	10.8	23.1	3.4	27.3	3.3	6.7
LSD p = .05			5.6			7.8		7.5
.01			7.5			10.4		10.0

WEED CONTROL IN NURSERY AND CHRISTMAS TREE TRANSPLANT BEDS

W. Bennett and H.P. Wood[1/]

ABSTRACT

Weed control is an important part of transplant bed management in nurseries and Christmas Tree Plantations. Herbicides and herbicide combinations including oxyfluorfen .56 kg/ha, simazine 1.1 kg/ha + oryzalin 2.2 kg/ha, simazine 1.1 kg/ha + napropamide 2.2 kg/ha, and simazine 1.1 kg/ha + oxydiazon 2.2 kg/ha gave excellent control of annual weeds in conifer transplant beds during 1982 and 1983. Japanese yew, white spruce, Douglas fir, and Norway spruce transplants were treated with the above herbicides in June 1982 and 1983. No injury was observed in any of the treatments. Predominant weed species in control plots included large crabgrass, horseweed, purslane, common lambsquarters, carpetweed and redroot pigweed.

INTRODUCTION

Weed control in transplant beds is necessary to ensure high quality planting stock. Rate of survival and subsequent growth in the field are important in profitable production of these crops. The objective of this study was to determine the efficacy of several herbicide combinations and individual herbicides previously reported effective in liner or transplant beds. (1) Seedlings and rooted cuttings were planted in April and May 1982 at approximately 10.16 cm x 15.24 cm spacing. Herbicide treatments were applied to weed free soil in the transplant beds in early June 1982 and repeated in June 1983. Weed control evaluations were made in July, August, and September of 1982 and 1983. All herbicide treatment resulted in satisfactory annual weed control under the conditions in this study.

MATERIALS AND METHODS

Field trials were conducted in five locations in Western Massachusetts during 1982 and 1983. Two ornamental nurseries and three Christmas tree plantations were selected which had transplant beds available. Conifer seedlings or transplants included Japanese yew (*Taxus cuspidata*), white spruce (*Picea glauca*), Douglas fir (*Pseudotsuga menzeisii glauca*), and Norway spruce (*Picea abies*). Planting was done by the commercial firms in April and May 1982. Plant spacing in all cases was 10.16 cm x 15.24 cm. Trial plots were 1.3 m by 1.6 m and were replicated twice at each location. Herbicides were applied on June 9 and 10, 1982 and repeated on the same plots on June 16, 1983. Liquid applications were made with a tank sprayer at a volume of 374 L/ha and granular applications were made with a hand held shaker applicator. Plots were hand weeded as necessary prior to application of the herbicides.

The treatments were oxyfluorfen [2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene] .56 kg/ha, simazine [2-chloro-4,6-bis(ethylamino)-s-triazine] 1.1 kg/ha + oryzalin (3,5-dinitro-N^4,N^4-dipropylsulfanilamide) 2.2 kg/ha, simazine 1.1 kg/ha + napropamide [N,N-diethyl-2-(1-naphthalenyloxy)-propionamide] 2.2 kg/ha, simazine 1.1 kg/ha + oxadiazon [tert-butyl-4-(2,4-dichloro-5-isopropoxyphenyl)-Δ^2-1,3,4-oxadiazolon-5-one] 2.2 kg/ha.

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The predominant weed species in the control plots were large crabgrass (Digitaria sanguinalis (L.) Scop.), horseweed (Conyza canadensis (L.) Cronq.), purslane (Portulaca oleracae L.), common lambsquarters (Chenopodium alba L.), redroot pigweed (Amaranthus retroflexus L.), and carpetweed (Mallugo verticillata L.). Visual evaluations were made at monthly intervals during July, August and September of 1982 and 1983. Weed control ratings were based on a scale of 0 to 10 with 0 representing no weed control and 10 representing complete control of weeds.

Table 1: Average weed control ratings in nursery and Christmas tree transplant beds in 1982 and 1983.

Treatments	Rates (kg/ha)	Weed Control Rating[1/]	
		Broad Leaf Weeds	Grasses
Check		6.2	6.8
simazine 80%W + oryzalin 75%W	1.1 + 2.2	8.3	8.6
simazine 4%G + napropamide 10%	1.1 + 2.2	8.2	8.7
simazine 4%G + oxadiazon 2%G	1.1 + 2.2	8.3	8.5
oxyfluorfen 2%E (1.6%E used in 1983)	.56	8.2	8.3

[1/] Rating system based on) = no weed control, 10 = complete weed control, 7 and above = acceptable control.

RESULTS AND DISCUSSION

Table 1 shows average weed control ratings over the two year period. All treatments resulted in commercially acceptable weed control under the conditions of these trials. Oxyfluorfen and combinations of simazine plus oryzalin, napropamide, or oxadiazon resulted in greater than acceptable control. Treatments applied in June 1982 and 1983 provided excellent control during the entire growing season. It can be concluded from these trials that several herbicides and herbicide combinations can provide excellent weed control in conifer transplant beds. Choices should be made on the basis of preference as to formulations, application method and cost rather than the slight differences in efficacy in these trials.

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PHYTOTOXICITY OF SELECTED INDUSTRIAL USE HERBICIDES IN ROOT ZONES OF ORNAMENTAL PLANTS

J.F. Ahrens [1/]

ABSTRACT

Simazine at 4.8 lb/A, diuron at 4.8 lb/A, sulfometuron methyl at 0.1875, 0.375 and 0.5625 lb/A, metsulfuron methyl at 0.06 and 0.12 lb/A, AC-252,214 at 0.5 and 1.0 lb/A, and combinations of sulfometuron methyl at 0.1875 lb/A with simazine or diuron at 4.8 lb/A were applied in shielded sprays along rows of established Japanese yew (Taxus cuspidata), Andorra juniper (Juniperus horizontalis plumosa), white pine (Pinus strobus L.) and forsythia (Forsythia intermedia 'Lynwood Gold'). Simazine caused moderate early injury only to forsythia; diuron injured pines moderately, and other plants slightly; and sulfometuron methyl, metsulfuron methyl and AC-252,214 injured all species slightly to severely, often causing growth regulator-type symptoms. Forsythia and white pine were injured most by the latter three herbicides.

INTRODUCTION

Herbicides applied to control weeds on industrial sites sometimes cause extensive off-site damage to woody ornamental plantings, either from runoff or from the growth of ornamental plant roots into treated areas. Therefore, it is desirable to assess the phytotoxicity of industrial use herbicides that are applied in the root zones of ornamental plants. The purpose of this work was to evaluate injury to selected woody ornamental plants from root zone applications of candidate industrial use herbicides in comparison with maintenance rates of older materials such as diuron]3-(3,4-dichlophenyl)-1,1-dimethylurea] and simazine [2-chloro-4,6-bis(ethylamino)-s-triazine].

MATERIALS AND METHODS

Japanese yew, Andorra juniper, white pine and forsythia were planted into Windsor loamy coarse sand with 2.2% organic matter and a pH of 5.5 in Windsor, CT during August 1981. Three to five plants of each species were planted into two-row plots 6 ft wide and 12 ft long. Plants were spaced 1-ft apart in rows 3-ft apart. Three and 4-ft borders separated the plots on the sides and ends, respectively. The plants were well established in early May of 1984.

The herbicides were applied on freshly tilled soil on May 16, 1984, using a knapsack sprayer with a Cooper Pegler shield equipped with a single flood nozzle, calibrated to deliver 30 gal/A in a 15-in swath. A pass was made along both sides of each row with care to avoid spraying foliage of the woody plants. Treatments were replicated four times in randomized complete blocks. In order to prevent treatments from affecting plants in adjacent plots by root uptake, a chisel running 18 to 24 in deep was used to cut roots in the borders between plots and a hand spade was used to cut roots in the alleys between ends of plots.

Weeds between plants in the untreated row middles were removed by hand at the start and weeds in the untreated plots were removed on July 24. At that time weeds occupied 100% of the area of untreated plots. Weeds present and % area covered by weeds were evaluated in the treated plots in September.

On July 9, Aug 6 and Sept 21, 1984 plant injury was rated on a 0 to 10 scale, with 0 being no injury and 10 complete kill. Types of plant injury were noted. Injury ratings

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of 1 to 2 were considered slight; ratings of 3 to 5 were considered moderate; and ratings of 6 or over were considered severe.

Rainfall was normal during the first 2 weeks following herbicide application (1.8 in) but record rainfall (9.2 in) occurred in the next two weeks. Rainfall was about three quarters normal in June (2.7 in), about normal in July, and about one third normal in August (1.2 in) and September (1.1 in) 1984.

The herbicide treatments included sulfometuron methyl (methyl-2[[[(4,6-dimethyl-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]benzoic acid) at 0.1875, 0.375 and 0.5625 lb ai/A, AC-252,214 (2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid] at 0.5 and 1 lb ai/A, diuron at 4.8 lb/A, DPX-T6376 or metsulfuron methyl [methyl-2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino]sulfonyl]-benzoic acid] at 0.06 and 0.12 ai/A, simazine at 4.8 lb ai/A and combinations of simazine+ sulfometuron methyl and diuron+sulfometuron methyl at 4.8+0.1875 lb ai/A.

RESULTS AND DISCUSSION

Ratings of ornamental plant injury, types of symptoms observed, and percent area covered by weeds in September are given in Table 1. Simazine at 4.8 lb ai/A caused moderate interveinal chlorosis on lower leaves of forsythia in July, but by September the forsythia were growing vigorously and were as large as control plants. Simazine caused no detectable injury to the other ornamentals. Weeds invading simazine plots in September included crabgrasses (*Digitaria* spp.), quackgrass (*Agropyron repens* (L.)Beauv.), red sorrel (*Rumex acetosella* L.), and sedges (*Cyperus* spp.).

Diuron at 4.8 lb ai/A caused less chlorotic injury to forsythia than simazine, but caused slight injury to yews and juniper, and moderate chlorosis and severe necrosis on some of the pines. On forsythia chlorosis occurred along veins with diuron and between veins with simazine. The few weeds in diuron plots in September included wild carrot (*Daucus carota* L.), common dandelion (*Taraxacum officinale* Weber) and yellow toadflax (*Linaria vulgaris* Mill.).

Injury to the ornamental plants from sulfometuron methyl, metsulfuron methyl and AC-252,214 might be described as growth regulator-type symptoms. Sulfometuron methyl injured all the ornamentals. Injury increased with dosage. At 0.1875 lb/A, growth suppression was evident in all species, but it was slight in juniper, yew, and white pine, and severe in forsythia until September when the forsythia showed signs of improved growth. At 0.5625 lb/A a few forsythia were killed. At all rates about 70% of the white pine terminal leaders were crooked. At 0.5625 lb/A pine needles were twisted and slightly chlorotic. At 0.375 and 0.5625 lb/A yews and juniper were chlorotic early but yews recovered later in the season. Combinations of sulfometuron methyl at 0.1875 lb/A with simazine or diuron at 4.8 lb/A injured the ornamental plants to about the same degree as sulfometuron alone. Crabgrass was the only weed present in plots treated with sulfometuron methyl in September.

Metsulfuron methyl caused injury symptoms on forsythia and yew similar to those from sulfometuron methyl, but caused less injury to juniper. At 0.06 lb/A, 25% of the pines had crooked terminal leaders and at 0.12 lb/A, 44% of the pines had crooked terminal leaders and the trees showed chlorosis, kill of some terminal buds and fasicle bud development along terminal leaders. Weeds invading the plots included crabgrass, sedges, yellow toadflax and common milkweed (*Ascelpias syriaca* L.).

AC-252,214 at 0.5 lb/A caused severe growth suppression and branch tip chlorosis in forsythia, little or no injury to taxus and juniper, and slight twisting of terminal leaders of white pine. Axillary bud formation below suppressed terminals of forsythia was increased. At 1.0 lb/A injury was moderate to severe in all but juniper. Symptoms on

pine were similar to those from metsulfuron methyl in that needles were shortened, 44% of terminal leaders were crooked, some terminal buds were killed, and fasicle bud development along terminals was stimulated. Weeds that invaded plots receiving 1.0 lb/A were horseweed (Conyza canadensis (L.)Cronq.), and common milkweed. Crabgrass also was present in plots receiving 0.5 lb/A.

The effects of metsulfuron methyl in stimulating development of fasicle buds in white pine appears related to terminal bud injury such as occurs with manual shearing, but with AC-252,214 fasicle bud development occurred on some terminal leaders without evidence of injury to terminal buds or growth suppression.

Further testing will be required to assess long term effects of these herbicides on ornamental plants, but the information obtained in this test should be helpful in diagnosing suspected problems on plants adjacent to industrial sites.

Table 1. Injury ratings and symptoms on ornamentals and % weed cover in September following root zone applications of herbicides on May 10, 1984.

Herbicide	Rate, lb ai/A	Injury 1/ and Symptoms 2/ white pine	forsythia	yew	juniper	% Weed cover
untreated		0	0	0	0	- 3/
simazine, WP	4.8	0	0.8 ic,r	0	0	6
diuron, WP	4.8	3.3 c,n	0.5 vc,r	0.8 c,r	1.0 c,r	3
sulfometuron, methyl, DF	0.1875	3.0 a	4.3 s,r,t	0.5	1.0 s,r	25
	0.375	3.8 a	6.9 s,n,r,t	3.0 c,s	3.8 c,s,r	5
	0.5625	4.3 a,s	7.6 s,n,t	3.5 c,s	5.0 c,s	4
sulfometuron+ simazine	0.1875+4.8	2.8 a	4.0 ic,s,t,r	1.0 s	0.8 s,r	2
sulfometuron+ diuron	0.1875+4.8	3.3 a,c,s,n	4.3 vc,s,t,r	1.5 c,s	1.5 n,s,r	1
metsulfuron, methyl,DF	0.06	2.3 a	2.0 s,t,r	0.5 c,s,r	0	11
	0.12	5.5 a,c,s,f,t	5.0 c,s,r,t	3.3 c,s,r	1.3 c,s,r	16
AC-252,214	0.5	1.3 a,f	7.0 c,s,t,x	0	0	18
	1.0	3.8 a,b,c,f,n,t	7.3 c,s,t	2.5 c,s,t	0.8 s,r	9

1/ 0 = no injury, 10 = complete plant kill.

2/ s = growth suppression; c = general chlorosis; v = chlorosis along veins; ic = interveinal chlorosis; n = necrotic leaves or needles; r = recovery at end of season; t = terminal bud kill; f = increased fasicle bud development on terminals; b = shortened needles; a = crooked terminal leaders; x = increased axillary bud development

3/ Untreated plots were 100% weed infested when handweeded on July 24.

A HAND ROLLER HERBICIDE WIPER FOR LAWNS AND GARDENS

W. V. Welker, Jr.[1]

ABSTRACT

Herbicides applied as a spray in the proximity of ornamental plants can be hazardous due to possible herbicide drift. This hand roller herbicide wiper was developed to place herbicides on weeds, while eliminating the danger of drift. It can be used to apply herbicides to control weeds in brick walks, sidewalks, driveways, lawns and adjacent to flowers and ornamentals. With a protective shield, it can be used to apply herbicides to weeds beneath ornamentals. The wiper consists of a long-handled paint roller that has been modified to increase the capacity of the roller to carry a greater amount of solution along with a dispensing device. Two layers of one-half inch sponge rubber are wrapped around the paint roller (the sponge rubber used is high-density foam padding used beneath carpeting). The ends of the sponge are cemented together with contact cement. The foam rubber is covered with a protective cloth, such as denim. The herbicide is dispensed through a manifold that is fed through a trigger mechanism from a reservoir. The manifold consists of a one-half inch piece of PVC pipe that is mounted above the roller on the roller support arm. The ends of the PVC pipe are capped and the herbicide is fed into the center of the pipe. Small holes are drilled into the PVC pipe using a number 56 (.046 inch) drill bit. Five holes would be used to dispense the herbicide onto a 12-inch roller to give good coverage. A plastic tube attached to the handle is used to transport the herbicide from a reservoir through a trigger activated valve to the PVC manifold. The reservoir can be attached to the handle or carried on your back. An air valve in the reservoir provides an open gravity-fed system, and avoids the need for pressurizing. Excellent control of broadleaf weeds in lawns was achieved using 2,4-D. Both paraquat and glyphosate were applied to weeds adjacent to ornamentals and controlled weeds with no evidence of herbicide drift.

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THE EFFECT OF GROWTH RETARDANTS ON FOUR LAWN GRASSES

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ABSTRACT

Growth retardants applied alone and in combination to four grasses suppressed grass height and seedhead expression for periods ranging from six to twelve weeks depending on the chemical and rate used. The longest and most effective suppression of grass height was obtained with combinations of amidochlor + paclobutrazole while combinations of mefluidide + paclobutrazole were nearly as effective with less turf injury visible. Amidochlor alone provided 6 weeks of suppression and mefluidide alone provided five to six weeks of growth suppression. Mefluidide was more effective in controlling seedhead expression than amidochlor and the addition of paclobutrazole to either chemical did not improve seedhead control. The addition of a wetting agent to mefluidide treatments did not greatly affect growth, nor did it enhance or suppress turf injury. Three new compounds, ACP 1900, S-1240 and S-380 provided no effective control of grass growth. Grasses which were the tallest at 8 weeks consequently had greatest turf injury rating late in the test due to scalping and summer heat stress. Red fescue appeared the least tolerant of these grasses to treatment and injury levels during the test were low but noticeable for all treatments at all rates.

INTRODUCTION

Plant growth retardants offer a potential means for fossil fuel conservation and a possible reduction in mowing costs. Despite these estimated benefits, growth retardant use often results in unacceptable injury levels. Chemicals for growth retardation have been the subject of numerous investigations at several sites (1,2,3,4). While a majority of the work has been done on Kentucky bluegrass (*Poa pratensis* L.) turf, investigators have begun to apply these compounds to monostands of other grasses, notably tall fescue, *Festuca arundinacea* Schreb. (2,4) and polystands of bluegrass, red fescue, *Festuca rubra* L. or perennial ryegrass, *Lolium perenne* L. The objectives of this study were to compare one time applications of growth retardant chemicals, alone and in combination for their ability to suppress grass growth and seedhead development. Chemicals were also evaluated for their effects on turf quality. All chemicals were applied to four grasses: Kentucky bluegrass (KBG), red fescue (RF), perennial ryegrass (PRG) and tall fescue (TF).

MATERIALS AND METHODS

Nine materials were applied alone or in combination to four separate turf areas. Plots four by four feet were established on uniform stands of Kentucky bluegrass cvs 'Glade' and 'A-34', red fescue cv 'Jamestown', perennial ryegrass cvs 'Yorktown II' and 'Manhattan' and tall fescue located at the Turf Research Farm of the University of Rhode Island.

Plant growth retardants were applied on May 4+5, 1984 with a CO_2 pressurized backpack sprayer delivering 50 gpa at 21 psi. All treatments were replicated three times in each grass species. The granular materials S-1240 and S-380 were applied by hand to moist turf in all areas and the materials paclobutrazole, flurprimidol and amidochlor were applied byspray and followed by irrigation to 0.25". The application of mefluidide, maleic hydrazide and ACP 1900 were followed by at least 24 hours without water. The rates for each compound may be found in Table 1. Two fungicides, (anilazine and iprodione) were applied to lessen disease impact in the study. All areas were trim mowed on May 11, one week after treatment to a 2" height and mowing was resumed on June 28, two months after treatment. Data for turf injury was taken periodically

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throughout the test. Grass height data and seedhead stand estimates commenced one month after treatment and was recorded weekly up to 8 weeks.

RESULTS AND DISCUSSION

Of the nine chemicals tested, the use of six of them resulted in a marked suppression of grass height for six to eight weeks after treatment (Table 1). The use of these same six chemicals resulted in a suppression of seedhead number and a shortening of seedhead stalk length. These same chemicals also caused some reduction in turfgrass quality which was most noticeable on red fescue turf early in the period of growth retardation. All four grasses had some treatments with turf injury scores approaching the controls 8 to 12 weeks after treatment. This is attributed to a combination of summer heat stress and recovery for the severe mowing (scalping) of June 28.

Height Suppression:

Mefluidide or amidochlor provide approximately 5-6 weeks of grass height suppression. By the end of the seventh week grass treated with the low rate of either mefluidide or amidochlor had reached heights greater than 50% of controls in all grasses. The suppression of grass height by amidochlor and mefluidide was similar, differences were slight, and rarely exceeded 0.5 inches. The inclusion of paclobutrazole or flurprimidol to mefluidide treatments greatly extended the period of height suppression. At 7 weeks after treatment, grass height was still noticeably shorter than controls. Higher rates of paclobutrazole provided greater height suppression. Either of these combinations provided greater height suppression to all grasses, but especially to KBG. The addition of Citowett Plus to mefluidide did not enhance the degree of height suppression nor did it prolong the time of retardation. The addition of paclobutrazole to amidochlor also extended the period of retardation. The lowest rate provided growth control equivalent to that of high rates of amidochlor alone to KBG but provided greater levels of suppression in other grasses. Of the rates tested, the optimum rate appears to be 1.25 + 0.5 lb/A for this combination for all grasses but especially for KBG. Maleic hydrazide also suppressed grass height in all grasses, and appears to be as effective as newer chemicals in this test.

The chemical ACP -1900 at all rates and S-1240 and S-280 provided no suppression of grass height at any date. Grass treated with S-380 was higher on all sample dates than controls for all grasses. RF, TF and PRG treated with S-1240 were taller than controls at all dates and only KDB showed height reduction. None of these compounds offer adequate suppression of grass height.

Turfgrass Injury:

None of the chemicals tested demonstrated objectionable turf injury to any grass in the first four weeks following treatment (Table 2). During that period, the greatest injury was seen in plots receiving high rates of amidochlor + paclobutrazole. During the second four weeks following treatment, some objectionable injury levels were recorded for high rates of amidochlor in RF, PRG and TF turf and for all rates of the amidochlor + paclobutrazole combination in all grasses. Higher rates of this combination also resulted in higher degrees of injury. During the first eight weeks, injury from mefluidide was less than 2.0 for all grasses. The combination of mefluidide + high rates of paclobutrazole or flurprimidol did result in objectionable injury only to KGB. The addition of Citowett Plus to mefluidide did not affect turf injury. All grasses were mown 8 weeks after treatment. Mowing improved the appearance of KBG and TF plots treated with mefluidide + paclobutrazole or flurprimidol. For these combinations, RF and PR remained relatively unchanged. Mowing also slightly improved the appearance of RF treated with amidochlor alone and all grasses treated with the amidochlor + paclobutrazole combination at any rate. However, injury levels were still unacceptable.

In all other cases, the resumption of mowing greatly exacerbated turf injury ratings. The less the level of suppression evident at 8 weeks, the greater the turf injury rating following mowing; this was probably due to scalping. Thus, the compounds ACP 1900 at all rates, S-1240 and S-380 had injury levels equivalent to or greater than untreated check plots. Injury from mefluidide had not been objectionable in any grass until mowing was resumed. At this point, all grasses treated with mefluidide at any rate showed some objectionable injury but this, too, was due to scalping. Levels of injury associated with maleic hydrazide use increased over time and were most objectionable for tall fescue. Following mowing, it appears that KBG was injured to a greater extent than other grasses while they were less objectionable following mowing for PR and TF.

Seedhead Suppression:

Mefluidide at the 0.25 lb/A rate provided the excellent control of seedhead expression in all grasses (Table 3). Control of seedheads by mefluidide at the 0.125 rate was excellent for RF and TF but this treatment was not as effective on KBG cr PRG. The addition of Citowett Plus to mefluidide improved seedhead suppression in most grasses. The effect of Citowett Plus was more prounounced at the low rate of mefluidide in KBG and RF areas. Amidochlor was nearly as effective as mefluidide for all grasses except RF. The inclusion of paclobutrazole to either mefluidide or amidochlor did not enhance seedhead control. Maleic hydrazide provided excellent seedhead control in this test.

Late season color changes were evident in Kentucky bluegrass. Grass appeared darker green for July through September after mowing was resumed. The color change was most prounounced for high levels of mefluidide or amidochlor in combination with paclobutrazole. Maleic hydrazide, ACP 1900, S-1240 and S-380 did not act to improve grass color.

In conclusion, mefluidide alone and in combination offered the best simultaneous control of grass height and seedhead expression for 6 weeks. The addition of paclobutrazole or flurprimidol to mefluidide greatly extended the length of time retardation occurred. Amidochlor at the 2.0 lb/A rate or higher provided 6 weeks of growth suppression with good control of seedheads. Longer height suppression was obtained with the addition of paclobutrazole. This combination appears nearly as effective as mefluidide and paclobutrazole but its use resulted in greater levels of turf injury at 4 weeks.

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Table 1. Grass height of four grasses as affected by growth retardants applied May 4 + 5, 1984, and measured on five dates.[a)]

Chemical	lb/A	Kentucky Bluegrass				Red Fescue				Perennial Ryegrass				Tall Fescue			
		5/25	6/11	6/22	% new growth 6/22	5/25	6/11	6/22	% new growth 6/22	5/25	6/11	6/22	% new growth 6/22	5/25	6/11	6/22	% new growth 6/22
ACP 1900	0.01	4.4	7.8	11.3	100	2.6	4.8	5.7	100	2.6	4.6	4.5	100	3.1	5.2	6.6	100
ACP 1900	0.02	3.7	8.0	10.8	100	2.8	5.0	5.9	100	2.4	4.3	4.2	100	2.7	4.3	5.1	100
ACP 1900	0.04	3.9	8.8	11.3	100	2.5	5.3	5.8	100	2.2	4.2	4.1	100	2.5	4.2	5.5	100
ACP 1900	0.08	3.7	8.5	11.7	100	2.1	3.9	4.3	93	2.0	3.5	3.6	70	--	--	--	--
mefluidide	0.125	2.4	4.2	5.3	100	2.2	3.5	3.5	93	2.7	4.2	4.2	77	3.5	4.4	5.0	100
mefluidide (.5% Citowett Plus)	0.125	2.2	4.4	5.6	100	2.1	3.6	3.8	82	2.4	4.1	3.9	93	--	--	--	--
mefluidide	0.25	2.1	3.9	4.9	95	2.0	2.9	3.5	73	2.5	3.6	3.9	100	3.2	3.3	4.0	100
mefluidide (.5% Citowett Plus)	0.25	2.0	3.5	4.6	100	2.0	3.3	3.5	83	2.4	3.9	3.6	93	--	--	--	--
mefluidide + paclobutrazole	0.125 + 0.125	2.1	2.3	3.0	63	2.0	2.8	3.1	67	2.1	3.7	3.4	70	--	--	--	--
mefluifide + paclobutrazole	0.125 + 0.25	2.1	2.0	2.3	22	2.0	2.3	2.5	40	2.2	2.9	3.2	55	2.9	3.1	3.6	93
mefluidide + flurprimidol	0.125 + 0.5	2.1	2.1	2.5	32	2.0	2.8	3.1	53	2.2	3.1	3.3	80	2.9	3.2	3.6	77
maleic hydrazide	3.0	2.4	2.9	4.0	72	2.3	2.7	3.1	67	2.2	2.6	2.8	82	3.0	3.2	3.7	83
amidochlor	1.5	2.1	4.1	4.9	93	2.1	2.6	3.1	63	2.2	3.6	3.6	100	--	--	--	--
amidochlor	2.0	2.1	3.9	5.0	100	2.1	2.6	3.1	42	2.2	2.7	3.0	57	2.6	2.9	3.3	70
amidochlor	2.5	2.1	3.8	4.6	92	2.0	2.4	2.9	48	2.0	2.4	2.7	87	2.7	3.0	3.4	67
amidochlor	3.0	2.0	3.5	4.2	80	2.1	2.2	2.5	25	2.0	2.2	3.0	57	2.8	2.7	3.3	58
amidochlor + paclobutrazole	1.0 + 0.4	2.0	2.0	4.2	8	2.0	2.2	2.3	8	2.0	2.4	2.9	68	--	--	--	--
amidochlor + paclobutrazole	1.25 + 0.5	2.0	2.0	2.1	2	2.1	2.1	2.2	18	2.0	2.2	2.7	35	2.4	2.5	2.7	73
amidochlor + paclobutrazole	1.5 + 0.6	2.0	2.0	2.0	0	2.1	2.2	2.2	8	2.0	2.2	2.7	27	2.4	2.6	2.7	70
amidochlor + paclobutrazole	2.0 + 0.8	2.0	2.0	2.1	0	2.0	2.1	2.1	0	2.1	2.2	2.3	6	2.5	2.4	2.5	100
S-1240	126.0	3.6	6.2	7.6	100	3.5	5.5	6.9	100	4.2	6.8	6.7	100	4.6	6.4	8.0	100
S-380	121.0	5.1	10.7	14.7	100	4.0	6.8	7.8	100	4.5	6.9	7.0	100	--	--	--	--
check	--	4.1	7.3	9.7	100	2.9	4.1	5.0	100	3.2	4.9	5.0	100	4.1	5.5	6.3	100
check	--	4.1	8.0	10.3	100	3.1	4.9	5.1	100	3.1	5.0	5.2	100	--	--	--	--

a) grass height measured in inches above the sod surface, values are means of three replicates.
b) turf trim mowed to 2 inches on May 11 and mowed again on June 28, 1984.
c) that portion of the grass actively growing.

Table 2: Turfgrass injury associated with growth retardants applied May 4 + 5, 1984 to four grasses.

Chemical	lb/A	Kentucky Bluegrass			Red Fescue			Perennial Ryegrass			Tall Fescue		
		0-4[a]	4-8	8-12[b]	0-4	4-8	8-12	0-4	4-8	8-12	0-4	4-8	8-12
ACP 1900	0.01	0[c]	0	4.4	0.2	0.3	3.8	0.3	0.2	2.7	0.1	0.2	1.1
ACP 1900	0.02	0	0	4.6	0.3	0.2	3.6	0.2	0.7	3.1	0.2	0.3	0.9
ACP 1900	0.04	0	0	4.4	0.4	0.3	2.7	0.1	0.4	2.6	1.0	0.2	0.8
ACP 1900	0.08	0	0	4.7	0.6	0.6	2.7	0.6	0.3	1.7	--	--	--
mefluidide	0.125	0.4	0.2	2.6	1.1	1.1	2.7	0.2	0.8	2.3	0.1	0.7	1.7
mefluidide (.5% Citowett Plus)	0.125	0.7	0.1	2.6	1.3	0.9	1.7	0.4	0.5	2.6	--	--	--
mefluidide	0.25	0.7	0.5	2.4	1.4	1.3	2.0	0.5	0.8	2.2	0.5	1.9	1.7
mefluidide (.5% Citowett Plus)	0.25	1.2	0.8	2.7	1.9	1.3	1.5	1.2	1.0	2.2	--	--	--
mefluidide + paclobutrazole	0.125 + 0.125	0.7	1.1	1.0	1.3	1.3	1.5	0.4	0.8	1.9	--	--	--
mefluidide + paclobutrazole	0.125 + 0.25	1.0	2.3	0.7	1.2	1.6	1.6	0.7	1.4	1.7	0.4	1.9	1.3
mefluidide + flurprimidol	0.125 + 0.5	1.1	2.6	0.7	0.8	1.5	1.6	0.6	1.0	2.0	0.4	2.4	1.2
maleic hydrazide	3.0	0.7	1.3	3.4	1.3	2.5	2.7	1.7	2.6	1.6	1.5	3.3	2.0
amidochlor	1.5	0.5	0.3	3.1	1.4	1.9	2.1	0.4	0.5	1.0	--	--	--
amidochlor	2.0	0.8	0.6	2.6	1.4	2.1	1.7	0.9	1.7	1.1	0.2	2.2	2.8
amidochlor	2.5	0.6	0.7	2.8	1.1	2.1	2.1	1.0	2.1	0.8	0.5	2.6	2.1
amidochlor	3.0	0.9	0.9	2.1	1.8	3.4	2.7	1.3	2.5	1.1	0.5	2.8	1.5
amidochlor + paclobutrazole	1.0 + 0.4	1.0	3.1	1.6	1.4	2.8	1.0	0.7	2.1	0.8	--	--	--
amidochlor + paclobutrazole	1.25 + 0.5	1.1	4.1	2.3	1.4	2.9	1.5	1.0	3.3	0.5	0.5	3.2	1.7
amidochlor + paclobutrazole	1.5 + 0.6	1.5	3.7	3.3	1.6	3.7	1.6	1.0	3.6	1.1	0.7	3.0	1.7
amidochlor + paclobutrazole	2.0 + 0.8	1.7	4.4	3.8	1.1	4.1	2.3	1.0	4.2	1.2	0.7	4.1	2.5
S-1240	126.0	0	0	3.2	0	0.2	3.4	0	0.4	5.6	0	0.2	1.4
S-380	121.0	0	0	4.5	0	0.1	3.8	0	0.3	3.6	--	--	--
check	--	0	0	4.4	0.4	0.8	3.3	0.1	0.4	3.2	0	0.3	1.2
check	--	0	0	4.3	0.3	0.3	3.4	0.1	0.7	3.4	--	--	--
mown area	--	0.1	0.4	1.1	--	0.8	1.4	--	--	--	--	0.8	--

a) weeks after treatment
b) turf trim mowed to 2 inches on May 11 and mowed again on June 28, 1984.
c) turf injury measured as visual estimates on a scale of 1-10, where 10 = brown turf, values are means of three replicates, reporting the greatest injury in a 4 week period.

Table 3. Visual estimates of grass seedheads in four grasses treated with growth retardants on May 4+5, 1984.

Chemical	lb/A	KBG[a] 6/22	Red Fescue 6/4	Red Fescue 6/22	PRG[b] 6/22	Tall Fescue 6/4	Tall Fescue 6/22
ACP 1900	0.01	10.0[c]	6.3	9.0	8.2	0.4	0.9
ACP 1900	0.02	10.0	6.0	7.0	4.8	0.1	0.1
ACP 1900	0.04	9.3	3.0	7.2	1.0	0.1	0.1
ACP 1900	0.08	9.5	1.0	5.0	0.6	--	--
mefluidide	0.125	2.6	0.6	1.5	3.0	1.1	1.7
mefluidide (.5% Citowett Plus)	0.125	0.5	0.2	0.3	3.0	--	--
mefluidide	0.25	0.2	0.1	0.1	1.8	0.1	0.1
mefluidide (.5% Citowett Plus)	0.25	0.1	0.1	0.1	1.0	--	--
mefluidide + paclobutrazole	0.125 + 0.125	2.3	0.1	0.6	2.9	--	--
mefluidide + paclobutrazole	0.125 + 0.25	2.0	0.3	1.3	2.5	0.2	1.5
mefluidide + flurprimidol	0.125 + 0.5	2.8	0.2	1.3	2.7	0.7	2.4
maleic hydrazide	3.0	0.0	0.1	0.0	0.1	0.1	0.1
amidochlor	1.5	1.2	1.4	3.2	0.8	--	--
amidochlor	2.0	0.2	0.8	2.7	0.4	0.4	1.1
amidochlor	2.5	0.2	0.7	2.7	0.2	0.2	0.3
amidochlor	3.0	0.0	0.2	1.3	0.1	0.3	0.1
amidochlor + paclobutrazole	1.0 + 0.4	1.5	0.8	2.1	0.6	--	--
amidochlor + paclobutrazole	1.25 + 0.5	0.3	0.8	2.2	0.4	0.8	2.4
amidochlor + paclobutrazole	1.5 + 0.6	0.1	0.6	2.0	0.2	0.3	0.5
amidochlor + paclobutrazole	2.0 + 0.8	0.1	0.3	2.2	0.2	0.2	1.7
S-1240	126.0	9.8	6.5	9.5	10.0	8.3	9.3
S-380	121.0	9.5	6.8	10.0	10.0	--	--
check[d]	--	9.8	4.5	8.3	9.8	6.5	8.8
check	--	10.0	5.3	9.0	9.3	--	--

a) Kentucky bluegrass, stand seeded to 80% A-34 and 20% Glade.
b) Perennial ryegrass.
c) Visual estimate of seedheads on a scale of 1-10 when 10 = 100% emergence.
d) Actual seedhead numbers per plot on June 22 were: KBG 15, RF 102, PRG 92, TF 20.

DURATION OF TURFGRASS GROWTH SUPPRESSION WITH GROWTH RETARDANTS

Prasanta C. Bhowmik[1/]

ABSTRACT

Various growth retardants including five experimental compounds were evaluated in field experiments at the Turf Research Center, University of Massachusetts. The objectives were (i) to determine the effectiveness of growth retardants (ii) to establish the optimum rate of application, and (iii) to determine the duration of growth suppression. All treatments were applied in 675 L/ha at 152 KPa to 'Baron' Kentucky bluegrass (Poa pratensis L.) turf which was mowed twice after 100% greenup. Mowing height was maintained at 3.8 cm throughout the summer. Injury to the turf (0 to 100%), turf quality (1 to 9; 6 being commercially acceptable), vertical height, and above ground growth (clipping weight) were determined every two weeks for 10 weeks.

ACP 1900 (American Cyanamid) at 40 gm/ha provided 20 to 46% top growth reduction up to 4 weeks and stimulated growth thereafter. Seedhead suppression (50%) due to these treatments was not adequate. DPX 6367 (Dupont) at 26.25 gm/ha gave 60 to 80% seedhead suppression and 43 to 74% top growth reduction up to 4 weeks. Amidochlor (Mon 4621) at 2.8 kg/ha reduced the top growth by 63 to 90% for 6 weeks, while Mon 4624 (a combination of amidochlor and PP 333) at 2.4 kg/ha provided the best growth reduction (40 to 91%) up to 8 weeks. Both of these treatments showed excellent seedhead suppression (90% or better) of Kentucky bluegrass. Turf quality was good with no objectionable injury.

Mefluidide at 0.43 kg/ha also provided excellent top growth reduction (60 to 88%) up to 4 weeks and only 13% 6 weeks after the application. Seedhead suppression was excellent with the mefluidide treatment. Turf quality was good with slight injury to the turf. The combination of flurprimidol and mefluidide at 1.4 + 0.07 kg/ha gave excellent seedhead suppression, while the flurprimidol treatment (1.4 kg/ha) alone failed to provide acceptable seedhead suppression (only 62%). Top growth reductions (54 to 88%) due to these treatments was observed during the 6 to 8 week period after the application. The combination of flurprimidol and mefluidide exhibited more injury (30%) to the turf than that of the flurprimidole treatment alone.

Mon 4624 (amidochlor plus PP 333) at 2.4 kg/ha provided the best growth reduction for the maximum period (8 wk). In contrast, all other treatments exhibited growth reduction up to 4 to 6 weeks.

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SPRING GROWTH PERIOD FOR EFFECTIVE APPLICATION OF GROWTH RETARDANTS ON TURF

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

ABSTRACT

Timely application of growth regulators is essential for adequate suppression of vegetative growth and seedheads in turfgrass. Personnel responsible for treating grasses along highway rights-of-way are particularly interested in knowing how many weeks they have to spray. In order to more clearly define the effective period of application in Rhode Island, three chemicals were applied to three stands of mixed turf species at weekly intervals from April 3 through May 9, 1984. Mefluidide (0.56 kg ai/ha), MH (4.48 kg ai/ha) and amidochlor (MON4621; 2.8 kg ai/ha) were applied in 700 l/ha water. Treatments were replicated four times in a randomized complete block design. Of the three turf stands treated, two were predominantly composed of 'Exeter' colonial bentgrass and 'Pennlawn' red fescue, while the third was a mixture of 'Manhattan' perennial ryegrass and 'Pennlawn' red fescue. Red fescue and colonial bentgrass were largely dormant at the first treatment date while perennial ryegrass was just emerging from dormancy. Height of vegetative growth was measured periodically between May 11 and July 19. Half of each plot was clipped at 9 cm. six weeks after the last treatment. The remaining half was clipped ten weeks after the last treatment. Prior to the second clipping, seedheads were cut from 929 cm^2 sample and counted by species.

All treatments resulted in significant reduction in seedheads at all application dates at each location. Mefluidide provided the best control of red fescue seedheads with complete suppression in the ryegrass-fescue stand when applied April 10, 17 and 26. Most seedheads in amidochlor-treated plots were stunted. MH applied at the first two dates resulted in poor control of fescue and bentgrass seedheads. There were no differences between treatments in ryegrass seedhead suppression.

Mefluidide and amidochlor resulted in good control of vegetative growth at all application dates. MH was less effective when applied at the two earliest dates (April 3 and April 10).

Some turfgrass discoloration was observed with all growth regulators. The discoloration appeared to be caused by a combination of chemical injury, and leaf diseases.

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MEFLUIDIDE TIMING FOR *POA ANNUA* L. SEEDHEAD SUPPRESSION

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ABSTRACT

Mefluidide is used to suppress the unsightly seedheads of *Poa annua* L. (annual bluegrass) which develop profusely in the spring in turfgrass areas. Tests were initiated in a lawn and golf course fairway in 1984 to determine optimum rates and timing (see Table 1). Materials were applied to replicated plots as sprays using 75 gallons of water per acre. No rain followed treatment for at least 20 hours. The lawn was mowed at a 2-inch height weekly while the fairway was mowed at a .75-inch height two or three times weekly. Visual estimates of *Poa annua* injury and seedhead stand were recorded weekly. Untreated turf had less than 10 seedheads/sq ft by April 10. There were 89,188 and 365 by April 16, April 26 and May 2, respectively. The number of seedheads peaked, up to 686/sq ft, on May 16 and decreased to less than 100 after June 5. Seedheads were objectionable in appearance from May 9 to June 5 (4-week period). This occurred when the number of opened seedheads exceeded about 140/sq ft and reached the mowing height.

The results in Table 1 indicate that April 26 was the optimum application date for the .125 lb ai/Acre rate of mefluidide to reduce the *Poa annua* seedhead stand to a level where it was not objectionable. Treatments applied furthest from April 26 were the least effective. Adding an adjuvant (Citowett Plus) to the .063 and .125 lb rates extended the optimum date to include April 17 along with April 26. Possibly earlier dates using an adjuvant would also be successful. The .063 lb rate of mefluidide, without adjuvant, did not satisfactorily suppress seedheads, however two applications (3-week interval) was successful when the initial date was April 26. Two applications of mefluidide at .125 lb rate extened the initial optimum application date to include April 10 along with April 17 and 26. On April 26 there were up to 188 seedheads/sq ft and they were not opened and were less than .75 inches in length. Since treatments on April 26 were successful one might assume that suppression can be attained at this stage of development.

Some mefluidide treatments, especially those at the .125 lb rate, caused temporary (1-2 weeks) objectionalbe *Poa annua* injury 3 to 5 weeks after application. However, this could be less objectionable than that of having the seedheads. There was an increase in *Poa annua* injury with adjuvant use, but it was not objectionable at the mefluidide .063 lb rate. Two applications may increase the potential for injury.

Amidochlor and MH, two other plant growth regulators, were evaluated in these tests, but were only applied on April 17. MH at the 2 lb rate appeared promising while Amidochlor at the 2 lb rate was ineffective.

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Table 1. Effect of plant growth regulators (PGR), rates and dates of application on *Poa annua* L. (annual bluegrass) seedhead stand and injury in two test areas in 1984.

TREATMENT			ANNUAL BLUEGRASS SEEDHEAD STAND [a]													ANNUAL BLUEGRASS INJURY [b]					
			Grass Lawn Area							Golf Course Fairway						Lawn			Fairway		
			May					June		May					June						
Regulator	lb ai/A	Date	2	9	16	23	30	5	12	2	10	16	23	30	5	0-3 wks	4-6 wks	7-9 wks	0-3 wks	4-6 wks	7-9 wks
mefluidide	.063	April 10	5	6	10	10	9	5	7	5	6	8	9	9	10	.7	.7	.0	1.4	.2	.2
		April 17	2	1	5	8	9	6	7	8	9	9	8	8	8	.8	.8	.0	.4	.0	.0
		April 26	6	7	5	7	8	4	4	5	7	6	6	4	5	.7	.8	.0	1.3	.0	.0
mefluidide	.063 [c]	April 17	2	1	1	1	3	3	6	1	2	1	1	3	3	1.7	1.1	.0	1.1	.4	.0
		April 26	4	1	1	1	1	2	2	6	5	3	2	4	5	1.8	1.7	.0	1.4	.0	.0
mefluidide	.063	April 3, April 26	-	-	-	-	-	-	-	3	5	4	6	5	8	-	-	-	.2	.1	.0
		April 10, May 2	7	6	9	9	9	8	7	6	8	7	7	5	8	.5	.8	.0	.5	.0	.0
		April 17, May 10	2	2	2	6	2	1	2	5	7	7	8	3	5	.5	1.4	.0	.1	.5	.0
		April 26, May 17	6	5	3	5	4	2	2	3	6	4	3	1	1	1.1	2.9	.0	.8	1.3	.0
mefluidide	.125	March 27	2	5	8	9	9	7	7	-	-	-	-	-	-	.0	1.7	.3	-	-	-
		April 3	5	7	9	9	9	8	9	4	7	8	9	7	9	.4	.9	.1	1.3	.8	.0
		April 10	2	2	7	9	9	7	8	2	5	4	5	6	5	1.2	.8	.0	2.2	.6	.3
		April 17	1	1	2	7	9	6	5	3	6	5	5	5	5	1.8	1.1	.0	.9	.3	.2
		April 26	3	2	2	3	4	5	5	5	3	2	1	2	4	2.2	2.0	.0	2.1	.5	.0
		May 2	6	7	9	9	8	3	4	5	6	6	4	2	3	1.6	.4	.0	.6	.3	.0
		May 10	7	9	9	10	9	3	3	-	-	-	-	-	-	2.2	.8	.0	-	-	-
mefluidide	.125 [c]	April 17	1	1	1	1	1	2	1	1	2	1	1	3	4	1.7	1.7	.0	1.8	.8	.0
		April 26	3	1	1	1	1	4	2	3	2	1	1	1	3	2.6	2.7	.0	3.2	.2	.0
mefluidide	.125	April 10, May 2	3	1	3	4	4	4	3	2	3	1	1	4	2	1.2	1.8	.0	1.6	2.0	.1
		April 17 May 10	1	1	1	1	1	4	1	3	5	2	3	1	2	1.2	2.5	.6	.6	1.5	.0
		April 26, May 17	5	2	1	2	2	1	1	5	6	1	1	1	1	1.7	3.5	.0	2.0	3.1	.0
MH	2.0	April 17	4	2	1	1	3	5	6	8	8	4	4	3	5	.4	1.3	.0	.4	1.1	.0
amidochlor	2.0	April 17	6	10	10	10	10	7	9	8	10	10	10	10	10	.8	.6	.4	.4	.1	.0
CHECK	-	-	9	10	10	10	9	5	8	9	9	9	10	7	5	.0	.0	.0	.0	.0	.0
Area seedheads/sq ft			149	455	605	518	329	100	55	365	613	686	536	293	194	-	-	-	-	-	-

a Seedhead stand scale 0 to 10 with 10 being the most, 6 would be objectionable from May 9 to June 5.
b Turf injury scale 0 to 10 with 10 being brown, 2.0 could be objectionable.
c Citowett Plus added to spray at .5% V/V.

CRABGRASS CONTROL IN LAWN TURF WITH UC 77892 AND FENOXYPROP-ETHYL

Prasanta C. Bhowmik[1/]

ABSTRACT

Field experiments were conducted to evaluate pre- and postemergence activity of UC 77892 (Union Carbide) and postemergence activity of fenoxyprop-ethyl (American Hoechst) on the control of smooth crabgrass [*Digitaria ischaemum* (Schreb.) Muhl.] in Kentucky bluegrass (*Poa pratensis* L.) lawn. Performance of these herbicides was based upon injury to the turf, effectiveness in crabgrass control, and the duration of crabgrass control. An excellent control (acceptable) of crabgrass was considered 90% and above. UC 77892 at rates of 6.2 to 7.8 kg/ha, when applied either in preemergence or in early postemergence (2-3 leaf stage) to crabgrass, provided good crabgrass control over the entire season. The early postemergence application of the 4F and 80WP formulations of UC 77892 at 6.2 to 7.8 kg/ha showed excellent activity in controlling crabgrass (July 26 rating). August rating demonstrated poor to fair control of crabgrass. The formulations (5G and 5GF) of UC 77892 showed poor control of crabgrass when applied in postemergence. Although these treatments, when applied in preemergence, provided excellent crabgrass control (July 26). In general, UC 77892 did not provide excellent season-long crabgrass control under Massachusetts conditions.

Fenoxyprop-ethyl at 0.09, 0.13, and 0.20 kg/ha, when applied to the 2 to 4 leaf stage of crabgrass (June 14), provided excellent control (July 26). However on August 24, crabgrass control ranged from 38 to 53%. Fenoxyprop-ethyl at 0.13, 0.20, and 0.28 kg/ha applied in postemergence when the crabgrasses were in the 4 leaf to 3 tiller stage (July 5) and at 0.20, 0.28, and 0.39 kg/ha applied in postemergence when the crabgrass were in the 1 to 5 tiller stage (July 19), provided excellent crabgrass control (August 24 rating). Discoloration of the treated turf was noted especially from the July 5 and July 19 application. The addition of DCPA at 11.8 kg/ha to the treatment of fenoxyprop-ethyl at 0.13 kg/ha exhibited added advantage in crabgrass control, especially later in the season.

Further research should be directed to finetune the formulation and rate of UC 77892 as a preemergence treatment for crabgrass control. Fenoxyprop-ethyl appears to be a promising postemergence crabgrass herbicide for use in lawn turf. More research information on the tolerance of various cool-season turfgrasses to fenoxyprop-ethyl is needed.

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Preemergence Control of Crabgrass in Turf with Pendimethalin

R. M. Herrick and R. D. Ilnicki[1]

ABSTRACT

Three formulations of pendimethalin were evaluated in turfgrass under greenhouse and field conditions for preemergence control of smooth crabgrass (Digitaria ischaemon (Schreb.) Muhl.) and hairy crabgrass (Digitaria sanguinalis (L.) Scop.). Turfgrasses evaluated included Kentucky bluegrass (Poa pratensis L. cv. Merion), red fescue (Festuca rubra L.), and perennial ryegrass (Lolium perenne L.). Pendimethalin 4EC, 10G, and 2.5G applied at 1.5 or 3.0 kg ai/ha provided excellent control (97-100%) of crabgrass in both the greenhouse and field studies without injury to the turfgrasses. In comparison, bensulide 4EC applied at 7.5 or 12.0 kg ai/ha provided commercially acceptable control (≥ 80%) only at the latter rate. Bensulide injured Kentucky bluegrass in the greenhouse study, but did not injure turfgrasses in the field study.

INTRODUCTION

Crabgrass can be one of the most difficult weed species to control in turfgrass areas (1). Preemergence herbicides are commonly used to achieve control of this troublesome weed. Pendimethalin (N-(1-ethylpropyl)-3,4dimethyl-2,5-dinitrobenzenamine) is a dinitroaniline herbicide that has shown preemergence activity against crabgrass (2,3,4). Therefore, the objective of this study was to evaluate the efficacy of three formulations of pendimethalin against both smooth and hairy crabgrass.

MATERIALS AND METHODS

Greenhouse Studies

Kentucky bluegrass, red fescue, and perennial ryegrass were seeded in sterilized soil in 10.2 cm plastic pots. After allowing 2 weeks of growth, the turfgrasses were mowed at a height of 3.8 to 5.1 cm. for 8 weeks before treatment. After treatment, the turfgrasses were maintained at the aforementioned height until the study was terminated.

Seeds of smooth and hairy crabgrass were placed in the upper 1.25 cm. of sandy loam soil contained in 10.2 cm. plastic pots. Each pot contained one species. The cups were lightly watered immediately before treatment and well watered immediately after treatment. They were then held in the greenhouse under high intensity discharge lights (14 hour light period) for 8 weeks. Weed control and turfgrass phytotoxicity data were recorded on a weekly basis. Pendimethalin 4EC, 10G, and 2.5G formulations were applied at 1.5 or 3.0 kg a.i./ha while bensulide 4EC was applied at 7.5 or 12.0 kg a.i./ha. Granular formulations were applied by hand while EC formulations were applied as aqueous sprays at 374 l/ha with a laboratory belt sprayer. Each treatment was replicated six times.

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Field Studies

Small plot field studies were conducted at the Agricultural Research Center, American Cyanamid Co., Princeton, New Jersey by utilizing established turfgrass. The turf was a uniform stand of Kentucky bluegrass and red fescue and was maintained at a height of 3.8 to 5.1 cm. throughout the study. Each plot was 3m x 9m and was replicated three times. Pendimethalin 4EC, 10G, and 2.5G formulations were applied at 1.5 or 3.0 kg a.i./ha while bensulide 4EC was applied at 7.5 or 12.0 kg a.i./ha. Granular formulations were applied by hand while EC formulations were applied as aqueous sprays at 374 l/ha with a CO_2 powered hand-held sprayer. Weed control and turfgrass phytotoxicity were recorded on a weekly basis for 13 weeks.

RESULTS AND DISCUSSION

Under greenhouse conditions, pendimethalin 4EC, 10G, and 2.5G formulations applied at 1.5 or 3.0 kg a.i./ha provided excellent control (97-100%) of both smooth and hairy crabgrass (Table I). Injury to the turfgrasses was not evident from any pendimethalin treatment. In comparison, bensulide 4EC applied at 7.5 or 12.0 kg a.i./ha provided commercially acceptable control ($\geq$ 80%) only at the 12.0 kg a.i./ha rate (Table I). Applications of bensulide at both rates injured turfgrasses, the injury being characterized by browning of the upper portions of the leaf blades.

Small plot field studies showed that the three pendimethalin formulations evaluated provided excellent control (97-100%) of smooth crabgrass when applied at 1.5 or 3.0 kg a.i./ha (Table II). As was observed in the greenhouse studies, bensulide provided commercially acceptable control only at the 12.0 kg a.i./ha rate (Table II). Injury to the turfgrasses in the field was not evident from any treatment evaluated.

Results of this study show that pendimethalin formulated as either 4EC, 10G, or 2.5G formulations provides excellent preemergence control of crabgrass without injury to turfgrass.

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TABLE I: Smooth and hairy crabgrass control in turfgrass with preemergence applications of pendimethalin under greenhouse conditions.

Herbicide	Formulation	Rate (kg ai/ha)	Smooth Crabgrass Control			Hairy Crabgrass Control		
			KB[1]	RF[2]	PR[3]	KB[1]	RF[2]	PR[3]
pendimethalin	4EC	1.5	100	100	100	100	100	100
pendimethalin	4EC	3.0	100	100	100	100	100	100
pendimethalin	10G	1.5	99	99	99	97	100	100
pendimethalin	10G	3.0	100	100	100	100	100	100
pendimethalin	2.5G	1.5	99	99	99	98	99	99
pendimethalin	2.5G	3.0	100	100	100	100	100	100
bensulide	4EC	7.5	75	70	78	78	78	74
bensulide	4EC	12.0	85	90	90	90	94	90
untreated	-	-	0	0	0	0	0	0

1 Kentucky bluegrass (Poa pratensis L.) cv. Merion.

2 Red fescue (Festuca rubra L.).

3 Perennial ryegrass (Lolium perenne L.).

TABLE II: Smooth crabgrass control in turfgrass with preemergence applications of pendimethalin under field conditions.

Herbicide	Formulation	Rate (kg ai/ha)	Smooth Crabgrass Control	
			Site #1[1]	Site #2[2]
			% Control	
pendimethalin	4EC	1.5	100	100
pendimethalin	4EC	3.0	100	100
pendimethalin	10G	1.5	97	100
pendimethalin	10G	3.0	100	100
pendimethalin	2.5G	1.5	98	99
pendimethalin	2.5G	3.0	100	100
bensulide	4EC	7.5	78	78
bensulide	4EC	12.0	90	94
untreated	-	-	0	0

1 Test site contained a mixture of Kentucky bluegrass and red fescue.

2 Ibid.

CRABGRASS CONTROL IN TURFGRASS WITH HERBICIDES

John A. Jagschitz[1]

ABSTRACT

Trials were initiated in 1984 to evaluate pre- and postemergence herbicides applied at various dates and rates for the control of smooth crabgrass (Digitaria ischaemum (Schreb.)Muhl.) and to determine the tolerance of Kentucky bluegrass (Poa pratensis L.), red fescue (Festuca rubra L.) and perennial ryegrass (Lolium perenne L.). Preemergent March applications of DCPA, oxadiazon, pendimethalin and prodiamine provided excellent crabgrass control. Benefin, bensulide, napropamide, siduron, tridiphane and UC-77892 provided good to excellent control when applied in April, at higher than standard rates and/or with a second application. Tridiphane provided early postemergence control of crabgrass while single applications of HOE-A25-01 and two applications of MSMA materials gave good to excellent control of more mature crabgrass. Results with SC-1084 were variable with the potential for Kentucky bluegrass injury. Bensulide and chloramben were safe to use on red fescue, Kentucky bluegrass and perennial ryegrass while prodiamine at rates of 1 lb or more may injure all three grasses. Kentucky bluegrass may be injured by ethofumesate, HOE-A25-01 and napropamide while red fescue may be injured by benefin, DCPA, MSMA, oxadiazon or tridiphane. The 3 lb rate of pendimethalin injured perennial ryegrass.

INTRODUCTION

Crabgrass is a troublesome weed in turfgrass areas and both pre- and postemergence herbicides are used to provide control (2,4). There is a need to find herbicides which provide more effective control, have longer residual activity and cause less turfgrass injury. Herbicide application date, rate and application frequency have an influence on effectiveness (1,3,4). Some newer herbicides have shown promising results in turfgrass areas (1,2,). Seventeen trials were initiated in 1984 in lawn turf to evaluate standard and newer pre- and postemergence herbicides applied at various rates and dates and to determine the tolerance of various lawn grasses to some of these herbicides.

MATERIALS AND METHODS

Three preemergence and five postemergence crabgrass trials along with nine grass tolerance studies were initiated on lawn turf (1.5 inch height) at the Turf Research Farm at the University of RI in 1984. The herbicides, formulations, rates, dates of treatment, number of applications and grass species involved are shown in Tables, 1, 2 and 3. Plots were 16 to 20 sq ft in size and replicated three or four times except for two replications in the August 9 Kentucky bluegrass tolerance trial. Granular materials were applied by hand while others were applied as sprays using 150 gallons of water per acre (gpa) except for: Table 2 - 50 gpa (not tridiphane) on June 5 and July 2 and for SC-1084 and HOE-A25-01 on June 19 in Kentucky bluegrass; and Table 3 - 50 gpa on May 8 and 44 gpa on May 25 except for tridiphane and MSMA at 130 gpa. Preemergent type herbicides received rainfall or irrigation within three days following application while postemergent type herbicides received no appreciable rainfall for at least 22 hours. Rainfall from March 16 to the end of July was about 31 inches (13 inches above normal), with about 2/3 of the rain occurring in May, June and July. Irrigation in August and September was provided when needed to avert drought stress. Crop oil (1% V/V) was added to sprays of SC-1084 on May 25, June 5

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and July 2. The time between applications in Table 2 ranged from 7 to 16 days while in Table 3 from 7 to 20 days. Crabgrass germination started in early May and continued through July with most occurring in June. Percent crabgrass control was based on comparisons between crabgrass cover in treated plots to that of untreated plots. Crabgrass cover at the time of control is shown in the Tables. Turf injury was evaluated periodically through September on a visual scale of 0 to 10 with 10 being brown. A reading of 2.0 or higher was considered objectionable.

RESULTS AND DISCUSSION

Preemergent Trials

The results for crabgrass control are listed in Table 1. The date of application of some herbicides had an effect upon efficacy. Herbicides which provided excellent control (90-100%) without objectionable turf (2.0 or greater) when applied as a single application

Table 1. Effect of herbicides on preemergence control of crabgrass when applied in 1984 at varying dates in three lawn areas - red fescue (RF), kentucky bluegrass (KB) and RF + KB mixture.

Preemergence Treatments			Percent Crabgrass Control (Aug 6-8)***					
			Application Date - Grass					
Herbicide	Formulation	Rate lb ai/A	Mar 16	Apr 12	Apr 25-27 KB	Apr 25-27 RF	Mar 16 May 17	Apr 12 Jun 14
benefin	2.5% G	2	55	56	74	79	-	-
benefin	2.5% G	4	73	79	92	91	-	-
benefin	2.5% G	2 — 2	-	-	-	-	78	74
bensulide	4 EC	7.5	-	78	68	87	-	-
bensulide	4 EC	10.0	70	87	80	99	-	-
bensulide	4 EC	7.5-3.8	-	-	-	-	-	89
bensulide	4 EC	10.0-5	-	-	-	-	96	-
DCPA	75% WP	7.5	-	98	-	-	-	-
*DCPA	75% WP	10.5	95	96	99	98	-	-
DCPA	75% WP	7.5-3.8	-	-	-	-	-	98
DCPA	75% WP	10.5-5.3	-	-	-	-	98	-
napropamide	50% WP	2	83	81	55	74	-	-
napropamide	50% WP	3	82	93	-	88	-	-
*napropamide	50% WP	2 — 1	-	-	-	-	-	95
oxadiazon	2% G	2	-	86	71	90	-	-
oxadiazon	2% G	3	96	93	94	96	-	-
oxadiazon	2% G	2 — 1	-	-	-	-	-	96
oxadiazon	2% G	2 — 2	-	-	-	-	96	-
pendimethalin	1.7% G	1.5	-	-	99	93	-	-
pendimethalin	4 EC	2.0	97	99	98	97	-	-
pendimethalin	4 EC	3.0	99	99	-	-	-	-
pendimethalin	4 EC	2.0 — 1	-	-	-	-	97	99
prodiamine	50% WP	.5	98	95	97	-	-	-
prodiamine	50% WP	1.0	99	100	99	100	-	-
prodiamine	50% WP	2.0	100*	100*	99	99*	-	-
prodiamine	50% WP	1.0 — 1	-	-	-	-	100*	100
siduron	50% WP	12	32	36	66	87	-	-
siduron	50% WP	12 — 6	-	-	-	-	47	54
UC-77892	4 FLOW	6	77	80	67	-	-	-
UC-77892	4 FLOW	6 — 3	-	-	-	-	99	89
tridiphane	2 EC	1.5	-	-	84	71	-	-
tridiphane**	2 EC	1.0 — 1	-	-	99	99*	-	-

* Some objectionable grass injury

** Second application on June 20

***Percent crabgrass cover in check plots was 52% in RF + KB lawn, 63% in RF lawn and 86% in KB lawn

as early as March were as follows: DCPA at 10.5 lb/A rate, oxadiazon at 3 lbs, penimethalin at 2 lbs and prodiamine at .5 lb . Prodiamine at rates of 2 lbs caused objectionable grass injury. Bensulide at 10 lbs provided fair control (70-79%) when applied in March and good (80-89%) to excellent control from April applications. A 5 lb bensulide application nine weeks following the March 10 lb treatment gave excellent control. Napropamide (2 lb) results were variable while the 3 lb rate provided good to excellent control. The single 6 lb rate of UC-77892 was not adequate but a second application of 3 lbs improved control to good or excellent. Results with benefin at the standard 2 lb rate were no better than fair while the 4 lb rate applied in late April gave excellent control. Earlier applications or splitting the 4 lb rate only gave fair results. Siduron at the 12 lb rate provided poor control except when applied in late April in the red fescue turf where control was good. A 6 lb follow up application after the March or early April treatment did not provide seasonal control. Tridiphane, only used in the late April studies, gave fair to good control at the 1.5 lb rate and excellent control with two applications at the 1 lb rate. The repeat application was safe in Kentucky bluegrass but caused injury to red fescue.

Postemergent Trials

The control of crabgrass from postemergence herbicides are shown in Table 2. In the June 5 trial crabgrass was in the 1 to 5 leaf stage and new germination occurred later in June. Of the five herbicides evaluated only tridiphane provided satisfactory results.

Table 2. Postemergence control of crabgrass from herbicides applied on various dates in five separate lawn areas containing Kentucky bluegrass (KB), red fescue (RF) and/or perennial ryegrass (PR) in 1984.

POSTEMERGENCE TREATMENT				Percent Crabgrass Control Application Date - Grass				
Herbicide	Formulation	Rate lb ai/A	No. Appl.	Jun 5 KB+PR	Jul 2 RF	Jul 19-20 KB	Jul 19-20 KB+PR	Aug 9 RF+PR
tridiphane	2 EC	.5	1	57	27	2	-	-
tridiphane	2 EC	.5	2	92	69	31	30*	-
tridiphane	2 EC	1.0	1	75	68*	20	16	44
tridiphane	2 EC	1.0	2	98	96*	42	53*	-
tridiphane	2 EC	1.5	1	87	74*	9	15	-
tridiphane	2 EC	2.0	1	-	-	-	-	71
tridiphane	2 EC	2.0	2	-	-	-	-	93
tridiphane	2 EC	3.0	1	-	-	-	-	79
HOE-A25-01	.42 EC	.08	1	13	90	80	79	-
HOE-A25-01	.42 EC	.08	2	-	94	72	70	-
HOE-A25-01	.42 EC	.12	1	27	99	75	86	-
HOE-A25-01	.42 EC	.12	2	-	-	88	-	-
HOE-A25-01	.42 EC	.18	1	42	99	89	90	91
HOE-A25-01	.42 EC	.18	2	-	-	-	-	97
HOE-A25-01	.42 EC	.25	1	-	98	92	-	91
HOE-A25-01	.42 EC	.35	1	-	92	95	-	95
SC-1084	4 EC	.075	1	25	29	-	-	-
SC-1084	4 EC	.125	1	31	31	23	-	-
SC-1084	4 EC	.125	2	-	77	91	-	-
SC-1084	4 EC	.175	1	-	44	45	-	64
SC-1084	4 EC	.175	2	-	-	100*	-	77
MSMA	6 LIQ.	1.0	2	-	-	90	77	-
MSMA	6 LIQ.	1.5	1	56	64	-	-	-
MSMA	6 LIQ.	1.5	2	66	84*	97	94	-
MSMA	6 LIQ.	2.0	2	-	-	-	-	99*
2,4-D+mecoprop+ dicamba+MSMA	LIQ.	.48+.48+ .12+1.8	1	37	26	-	-	-
(as above)	LIQ.	"	2	-	84*	97	-	-
% Crabgrass Cover in Checks and Date of Control				69% 8/6	64% 8/8	95% 9/10	60% 9/12	53% 9/10

* Injury of 2 to 3.7 on a scale of 0 to 10 (10 = brown), 2.0 may be objectionable.

Probably this was because it had both pre- and postemergence activity. A single tridiphane rate of 1.5 lbs gave good control while two applications (16 day interval) at the .5 or 1 lb rate provided excellent control. About 2% of the crabgrass plants had started to tiller in the July 2 trial while most plants were tillering in the July 19-20 trials. Some crabgrass plants in the August 9 trial were developing seedheads. Excellent results were provided by single treatments of HOE-A25-01 at the .08 lb rate in early July and at rates from .18 to .25 lbs in late July and early August. Two applications (7-15 day interval) of MSMA (1.5 or 2 lb rate) and MSMA+2,4-D+mecoprop+dicamba (1.8+.48+.48+.12 lb rate) gave good to excellent control, but there was a potential for objectionable injury to red fescue turf. Results with SC-1084 and tridiphane were variable. With SC-1084 there was a potential for Kentucky bluegrass injury and with tridiphane for red fescue injury. It appears that higher rates and/or repeat applications of tridiphane are needed to control crabgrass as it matures.

Grass Tolerance

Results are presented in Table 3. Bensulide and chloramben caused no objectionable

Table 3. Turfgrass injury from herbicides applied on various dates to eight separate lawn areas containing Kentucky bluegrass (KB), red fescue (RF) and perennial ryegrass (PR) in 1984.

	Treatment			Maximum Turfgrass Injury* Application Date - Grass								
				May 8-9			May 25		KB**		Jul 19	Aug 9
Herbicide	Formulation	Rate lb ai/A	No. Appl	RF	KB	PR	AM	BA	TD	A+G	RF	KB (AM)
benefin	2.5% G	2.5	1	2.7	.3	-	-	-	-	-	-	-
bensulide	4 EC	10.0	1	.8	1.1	-	-	-	-	-	-	-
chloramben	75% DS	2.7	1	.8	.5	1.1	-	-	-	-	-	-
DCPA	75% WP	10.5	1	4.7	.1	-	-	-	-	-	-	-
ethofumesate	4 FLOW	2.0	1	1.0	2.1	.6	-	-	-	-	-	-
ethofumesate	4 FLOW	4.0	1	2.8	3.0	.5	-	-	-	-	-	-
napropamide	50% WP	2.0	1	1.0	2.1	.4	-	-	-	-	-	-
oxadiazon	2% G	3.0	1	2.2	.4	1.2	-	-	-	-	-	-
pendimethalin	4 EC	3.0	1	1.2	.5	3.0	-	-	-	-	-	-
prodiamine	50% WP	1.0	1	2.6	2.2	-	-	-	-	-	-	-
prodiamine	50% WP	2.0	1	4.2	2.1	2.9	-	-	-	-	-	-
tridiphane	2 EC	.5	-	-	-	-	-	-	-	-	1.5	-
tridiphane	2 EC	1.0	1	-	-	-	-	-	-	-	1.7	.4
tridiphane	2 EC	1.0	2	-	-	-	-	-	-	-	2.6	-
tridiphane	2 EC	1.5	1	2.2	.3	1.1	.9	.7	.3	.3	2.4	-
tridiphane	2 EC	2.0	2	-	-	-	-	-	-	-	-	1.5
tridiphane	2 EC	3.0	1	2.5	.4	-	-	-	-	-	-	.3
HOE-A25-01	.42 EC	.08	1	1.4	.5	-	-	-	-	-	.1	-
HOE-A25-01	.42 EC	.08	2	-	-	-	-	-	-	-	.3	-
HOE-A25-01	.42 EC	.12	1	.3	.2	.7	2.1	3.0	3.8	2.7	.4	-
HOE-A25-01	.42 EC	.18	1	-	-	-	-	-	-	-	.5	2.5
HOE-A25-01	.42 EC	.25	1	1.1	2.3	-	-	-	-	-	-	2.0
HOE-A25-01	.42 EC	.35	1	-	-	-	-	-	-	-	-	3.5
SC-1084	4 EC	.125	1	-	-	-	2.3	2.6	3.4	2.2	-	-
SC-1084	4 EC	.175	1	-	-	-	-	-	-	-	-	4.3
SC-1084	4 EC	.175	2	-	-	-	-	-	-	-	-	7.2
MSMA	6 LIQ	1.0	2	-	-	-	-	-	-	-	1.8	-
MSMA	6 LIQ	1.5	2	-	-	-	-	-	-	-	3.2	-
MSMA	6 LIQ	1.8	1	-	-	-	.2	.4	.1	.4	-	-
MSMA	6 LIQ	1.8	2	-	-	-	.6	1.2	.6	1.6	-	-
MSMA	6 LIQ	2.0	2	-	-	-	-	-	-	-	-	.3
2,4-D+mecoprop+ dicamba+MSMA	LIQ	.48+.48+ .12+1.8	1	-	-	-	.0	.4	.7	.6	-	-
(as above)	LIQ	"	2	-	-	-	1.1	2.3	1.1	2.2	-	-

* Turf injury scale 0 to 10, 10 = brown. 2.0 could be objectionable.

** Kentucky bluegrass: AM = America, BA = Baron, TD = Touchdown and A+G = A-34 + Glade.

injury when applied in May to 'Jamestown' red fescue (RF), 'A-34' and 'Glade' Kentucky bluegrass (KB) and 'Yorktown II' perennial ryegrass (PR). Benefin (2.5 lb) and DCPA (10.5 lb) injured RF but were safe on KB. Oxadiazon (3 lb) injured RF but not KB or PR. Pendimethalin (3 lb) was safe on RF and KB but injured PR. Napropamide (2 lb) and ethofumesate (2 lb) injured KB but was safe on RF and PR. Prodiamine (1 lb) injured RF and KB while the 2 lb rate injured PR.

Data from several trials with postemergence - type herbicides indicate that tridiphane (1.5 lb) was safe on Kentucky bluegrass and perennial ryegrass but injured red fescue. HOE-A25-01 at rates up to .25 lbs were safe on red fescue. Injury to some Kentucky bluegrass varieties occurred at rates from .12 to .25 lbs. Perennial ryegrass was not injured by HOE-A25-01 at the .12 lb rate used. SC-1084 at the .125 lb rate injured the four varieties of Kentucky bluegrass. MSMA (2 applications at 1.8 lb rate) did not injure the four Kentucky bluegrass varieties while two applications at the 1.5 lb rate injured red fescue. Two applications of the combination of MSMA+2,4-D+mecoprop+dicamba (1.8+.48+.48+.12 lbs) injured two of the four Kentucky bluegrass varieties.

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PRE- AND POSTEMERGENCE CRABGRASS CONTROL IN 1983 AND 1984.

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ABSTRACT

Two experiments (one pre- and one postemergence) were conducted in both 1983 and 1984 to evaluate experimental herbicides for the control of smooth crabgrass in cool season turfgrasses.

In 1983, the preemergence experiment was conducted on separate blocks of turf (one fine fescue and the other predominantly Kentucky bluegrass). On the fine fescue block, acceptable control (at least 85%) was attained by applying DCPA (all rates and formulations), bensulide 4E and 2.2S at 11.2 kg ai/ha, bensulide 7G at 11.2 and 14 kg ai/ha, bensulide plus devrinol at both rates, bensulide plus oxadiazon, all rates of oxadiazon and pendimethalin applied alone, and benefin. Sequential applications of DCPA 75W caused severe injury to fine fescue. Severe injury also occurred when UC77892 80W was applied. On the bluegrass block, DCPA (all rates and formulations), bensulide 4E and 2.2S at 11.2 kg ai/ha, bensulide 76 at both rates, UC77892 at the high rate, bensulide plus devrinol (granular forms), bensulide plus oxadiazon, all rates of oxadiazon and pendimethalin applied alone, and benefin provided acceptable control. Sequential application of DCPA did not injure bluegrass nor did UC77892. The poor control found for the Ando formulations (peltech oxadiazon) was probably due to the use of 50-mesh screens which may have trapped some material resulting in an underdosage.

The postemergence test was initiated to compare crabgrass control from experimental compounds (fenoxaprop-ethyl, SC-1084, and UC-82042) with that from CAMA. Only CAMA provided acceptable control, but it caused unacceptable injury to a predominantly fine fescue turf. At the time of application, all turf in the test was under moisture stress which affected the efficacy of fenoxaprop-ethyl. SC-1084 appeared to have potential as a rate effect was found and the turf was not injured. UC-82042 appeared to have little postemergence activity.

In 1984, the preemergence experiment was again conducted on separate blocks of turf. However, prior to application, both sites were verticut in two directions and over seeded with crabgrass from two sources (Rhode Island and Mississippi). On the fine fescue block, DCPA, both rates of bensulide 2.2S and the high rate of 4E, the 6.2 and 6.7 kg ai/ha rates of UC77892 4F, oxadiazon at 2.8 kg ai/ha, benefin, S-1280 and S-1319, pendimethalin, bensulide plus devrinol, and bensulide plus oxadiazon provided acceptable control. The powder and flowable formulations of UC77892 caused severe injury to the fine fescue as did the bensulide plus EPTC treatment. On the bluegrass block, acceptable control was provided by DCPA, bensulide 7G at 11.2 kg ai/ha, UC77892 4F at 6.7 kg ai/ha, benefin, S-1280 and S-1319, pendimethalin, and bensulide plus oxadiazon. The most consistent preemergence control in both test blocks in 1984 was found for DCPA and pendimethalin (S-1280 and S-1319). Bensulide plus EPTC caused severe injury to bluegrass.

The postemergence test in 1984 was conducted on a mixed turf stand containing predominantly fine fescue. Soil moisture was adequate and all rates of fenoxaprop-ethyl provided excellent control from a single application. MSMA was imporved by a sequential treatment, but did not acceptably control crabgrass. SC-1084 provided increased control at the higher rate without injury, but further testing is needed to establish a more efficacious rate. The broadleaf herbicide plus MSMA did not adequately control crabgrass from a single application.

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Table 1. Preemergence control of smooth crabgrass and injury ratings for Kentucky bluegrass (KBG) and fine fescue (FF). Ratings for injury were taken on June 13, and for control on September 15, 1983. Date of application was April 27, 1983.

Treatment	Rate (kg ai/ha)	Crabgrass Control		Injury[a]	
		KBG	FF	KBG	FF
DCPA 75W	11.8	97	99	0	65
DCPA 75W	11.8 + 11.8 (45 days)	98	99	0	50
DCPA 75W	11.8 + 8.4 (45 days)	95	99	0	68
DCPA 75W	11.8 + 6.3 (45 days)	94	99	0	58
DCPA 75W	11.8 + 11.8 (60 days)	98	97	0	60
DCPA 75W	11.8 + 8.4 (60 days)	97	99	0	55
DCPA 75W	11.8 + 16.8 (90 days)	98	99	0	68
DCPA 75W	16.8	97	99	0	63
Ando-A 20%	1.7	20	40	0	0
Ando-A 20%	2.2	38	82	0	0
Ando-B 10%	2.2	38	82	0	5
Ando-B 10%	3.4	65	80	0	5
Peltech 20%	2.2	60	60	0	0
Bensulide 4E	11.2	92	90	0	0
Bensulide 2.2S	11.2	95	99	0	0
UC77892 80W	4.5	68	74	0	35
UC77892 80W	5.6	78	94	0	53
UC77892 80W	6.7	85	82	0	70
Benefin 17.6% F	1.7	20	32	0	0
Benefin 17.6% F	2.2	38	82	0	0
DCPA 5G	11.8	94	97	0	0
Bensulide 7G	11.2	99	98	0	0
Bensulide 7G	14.0	95	95	0	0
Bensulide 7G + Devrinol 5G	5.6 + 1.7	95	95	0	20
Bensulide 7G + Devrinol 5G	5.6 + 2.2	80	95	0	20
Bensulide + Oxadiazon	6.7 + 1.7	97	97	0	0
Oxadiazon 2G	1.7	93	95	0	0
Oxadiazon 2G	2.2	85	90	0	0
Oxadiazon 2G	2.8	90	90	0	0
Pendimethalin (S-353)	1.7	90	87	0	0
Pendimethalin (S-353)	2.2	94	96	0	0
UC77892-B 5G	11.2	82	67	0	0
UC77892-B 5G	13.4	75	82	0	0
Benefin 2.5G	2.2	90	95	0	0
Benefin 2.5G	2.2 + 2.2 (45 days)	85	85	0	0

[a]Injury refers to discoloration and/or thinning, 10 = completely brown, 0 = no injury.

Table 2. The postemergence control of smooth crabgrass resulting from application of four herbicides to a mixed turfgrass sward on July 12, 1983. Injury was rated on July 28 and control was rated on August 22, 1983.

Treatment	Rate (kg ai/ha)	Crabgrass Control (%)	Injury[a]
Fenoxaprop-ethyl 1E	0.17	9	0
Fenoxaprop-ethyl 1E	0.28	28	0
Fenoxaprop-ethyl 1E	0.39	10	0
CAMA	5.5	85	5
SC-1084 4E	0.14	10	0
SC-1084	0.28	77	0
UC-82042 4E	4.5	7	0
UC-82042 4E	9.0	5	0
Check	0.0	0	0

[a]Injury rated on 1 to 9 scale with 9 = green and 1 = brown.

Table 3. Preemergence control of smooth crabgrass and injury ratings for Kentucky bluegrass (KBG) and fine fescue (FF). Ratings for control were taken August 17, and injury ratings were made June 22, 1984. Application date was May 2, 1984.

Treatment	Rate (kg ai/ha)	Crabgrass Control KBG	Crabgrass Control FF	Injury[a] KBG	Injury[a] FF
DCPA 75W	11.8	95	98	0	2
DCPA 5G	11.8	94	92	0	0
Bensulide 4E	8.4	15	35	0	0
Bensulide 4E	11.2	18	43	0	0
Bensulide 2S	8.4	60	88	0	0
Bensulide 2S	11.2	70	94	0	0
Bensulide 7G	8.4	60	75	0	0
Bensulide 7G	11.2	88	85	0	0
UC 77892 80W	6.2	55	70	1	3
UC 77892 4F	5.6	78	80	2	6
UC 77892 4F	6.2	72	92	2	4
UC 77892 4F	6.7	88	94	2	8
UC 77892 5G	5.6	58	50	0	1
UC 77892 5G	6.2	65	55	0	2
UC 77892 5G	6.7	70	65	0	3
UC 77892 5GF	5.6	55	25	0	0
UC 77892 5GF	6.2	70	48	0	0
UC 77892 5GF	6.7	45	65	0	0
UC 82042 4E	6.7	10	40	0	1
UC 82042 4E	9.0	18	50	0	2
UC 82042 4E	13.4	10	68	0	2
UC 82042 10G	6.7	30	62	0	2
UC 82042 10G	9.0	35	60	2	3
UC 82042 10G	13.4	48	65	4	4
Oxadiazon 2G	1.7	50	55	0	0
Oxadiazon 2G	2.2	65	75	0	0
Oxadiazon 2G	2.8	78	85	0	0
Benefin 2.5G	2.2	85	85	0	0
S-1280 G	1.7	92	95	0	0
S-1280 G	3.4	99	98	0	0
S-1319 GF	1.7	98	98	0	0
Devrinol 5G	1.7	60	62	0	0
Devrinol 5G	2.2	55	80	0	0
Devrinol 50W	1.7	15	45	0	0
Pendimethalin 60DG	1.7	88	98	0	0
Pendimethalin 60DG	2.7	95	98	0	0
Bensulide 7G + Devrinol 5G	5.6 + 1.1	70	88	0	0
Bensulide 7G + EPTC 10G	11.2 + 4.5	58	72	4	6
Bensulide + Oxadiazon	6.7 + 1.7	85	92	0	0
Bensulide 4E + Devrinol 50W	5.6 + 1.1	20	60	0	0

[a]Injury rated on scale of 1 to 9, with 1 = green and 9 = brown.

Table 4. The postemergence control of smooth crabgrass resulting from application of four herbicides to a mixed turfgrass sward on July 24, 1984.

Treatment	Rate (kg ai/ha)	Crabgrass Control (%)
Fenoxaprop-ethyl 0.42E	0.17	90
Fenoxaprop-ethyl 0.42E	0.28	93
Fenoxaprop-ethyl 0.42E	0.34	95
MSMA 6S	2.2	63
MSMA 6S	2.2 + 2.2 (2 wks)	72
S-1084 4E	0.28	20
S-1084 4E	0.39	52
2,4-D + MCPP + Dicamba + MSMA	0.5 + 0.5 + 0.1 + 1.3	26
Check	0.0	0

CRABGRASS CONTROL IN TURF WITH FENOXAPROP-ETHYL, MSMA, TRIDIPHANE AND UC 77892

Peter H. Dernoeden and Jack D. Fry

ABSTRACT

Effective, preemergence control of crabgrass (Digitaria ischaemum (Schreb.) Muhl.) was provided by sequential applications of UC 77892 80W (5.5 + 2.5 and 6.0 + 3.0 lb ai/A), UC 77892 4F (6.0 + 3.0 lb ai/A), UC AXF 1291 2.2G (4.5 + 2.5 lb ai/A) and oxadiazon 2G (3.0 lb ai/A). Tridiphane (1.0, 2.0 and 1.0 + 1.0 lb ai/A), single applications of UC 77892 (5.0 lb ai/A) and early postemergence applications of UC 77892 (5.0 and 6.0 lb ai/A) failed to provide a satisfactory level of crabgrass control. Fenoxaprop-ethyl applied postemergently on July 2 (0.18 and 0.25 lb ai/A) and July 13, 1984 (0.25 and 0.40 lb ai/A) gave excellent crabgrass control. MSMA (2.0 lb ai/A) and tridiphane (1.0 lb ai/A) provided unsatisfactory levels of postemergence crabgrass control. Fenoxaprop-ethyl applied May 17, 1984 at 0.25 lb ai/A to 'America' Kentucky bluegrass (Poa pratensis L.), and applied June 14, 1984 at 0.36 lb ai/A to 'America' and a blend of 'Merion', 'Sydsport' and 'Vantage' Kentucky bluegrass, elicited an objectionable level of discoloration. Test results indicate that a single, well-timed application of fenoxaprop-ethyl in early to mid-July will eliminate crabgrass as a weed problem for the remainder of the growing season. The effectiveness of fenoxaprop-ethyl in late summer appears to be related to how environmental conditions affect the vigor of crabgrass.

INTRODUCTION

Despite the availability of safe and effective, preemergence crabgrass herbicides, chemical companies are continuing to develop new and improved preemergence herbicides. Postemergence control of crabgrass with the methanearsonates, however, often provides erratic results and invariably will elicit unacceptable levels of discoloration when applied during hot, summer months. Fenoxaprop-ethyl (ethyl 2-[4-[(6-chloro-2-benzoxazolyl)oxy]phenoxy]propanoate) is a promising new postemergence crabgrass herbicide, which has been reported to elicit an objectionable level of discoloration in Kentucky bluegrass (Poa pratensis L.) (2). Therefore, the objectives of this investigation were as follows: (a) to evaluate the preemergence and early postemergence crabgrass control efficacy of several experimental herbicides; (b) to determine if a single, early summer application of fenoxaprop-ethyl would eliminate crabgrass as a problem for the remainder of the season; and (c) to evaluate the safety of fenoxaprop-ethyl usage in Kentucky bluegrass.

MATERIALS AND METHODS

Preemergence Test. The herbicides evaluated included several experimental chemicals whose chemistry was undisclosed, i.e. UC 77892, UC 82042, UC AXF 1290 and UC AXF 1291. Also evaluated were DCPA (dimethyl tetrachloroterephthalate), bensulide (O, O-diisopropyl phosphorodithioate-S-ester with N-(2-mercaptoethyl)benzenesulfonamide), oxadiazon (2-tert-butyl-4-(2,4-dichloro-5-isopropoxyphenyl)-Δ^2-1,3,4-oxadiazolin-5-one, and tridiphane (2-(3,5-dichlorophenyl)-2-(2,2,2-trichloroethyl)oxirane). These

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herbicides were evaluated in College Park and Silver Spring, MD. At College Park the turf was a 95% mix of unknown cultivars of perennial ryegrass (Lolium perenne L.) and 5% Kentucky bluegrass (Poa pratensis L.) grown on a silt loam soil with a pH of 5.7 and 3.8% organic matter (OM). Herbicides were applied once or sequentially in 50 gpa on April 19 and May 22, 1984. Rain occurred within 75 and 28 hours of each, respective application. Plot size was 5 by 5 feet and plots were arranged in a randomized complete block (RCB) with four replications. At Silver Spring the turf was 'Citation' perennial ryegrass grown on a Chillum silt loam with a pH of 5.2 and 2.4% OM. Herbicides were applied once or sequentially in 50 gpa on April 10 and May 23, 1984. Early postemergence treatments were applied on May 23, 1984. The areas were irrigated 48 and 5 hr of each, respective application date. Plot size was 5 by 5 feet, and plots were arranged in an RCB with three replications. Smooth crabgrass seedlings were observed at both sites during the first week of May.

Postemergence Test. The herbicides evaluated were fenoxaprop-ethyl, MSMA (monosodium methanearsonate), and tridiphane. The turf was 'Citation' perennial ryegrass grown on a Chillum silt loam with a pH of 5.2 and 2.4% OM. Herbicides were applied on three dates, i.e. June 13, July 2 and July 16 in 50 gpa. On July 13, crabgrass (mostly smooth and some hairy) was in the 1 to 3 leaf stage and was below the turf canopy. On July 2, crabgrass was above the canopy and in the 2 to 4 leaf stage, and on July 16 the crabgrass was in the 4 leaf to 2 tiller stage. No rain occurred within 48 hr of the first two applications, but rain fell 7 hr following application on July 16. Turf was irrigated only to prevent drought stress during the test period. Plot size was 5 by 5 feet, and plots were arranged in an RCB with four replications.

Fenoxyaprop-ethyl Phytotoxicity Test. Fenoxaprop-ethyl was applied to a blend of Merion, Sydsport and Vantage, and a monostand of America Kentucky bluegrass grown on a Chillum silt loam with a pH of 6.5 and 2.0% OM. The herbicide was applied to separate plots on May 17 and June 14, 1984 in 50 gpa. Plot size was 5 by 5 feet, and plots were arranged in a completely randomized design with three replications. Both bluegrass stands were three years old and were irrigated on June 13 to avoid drought stress. Mowing of the test areas was avoided in the 48 hr period prior to and following application of the herbicides.

Percent plot area colonized by crabgrass was visually estimated on a 0 to 100% scale where 0= no crabgrass and 100 = entire plots area colonized. Percent control was calculated by comparing the mean percent cover of crabgrass in the untreated controls with the amount in treated areas. An acceptable level of control was considered to be greater than 90%. Phytotoxicity was visually estimated on a 0 to 5 scale where 0 = green, healthy turf; 2.5 = unacceptable level of discoloration for golf course turf and 5 = entire plot area brown. Selected data were subjected to the analysis of variance and significantly different means were separated using the Bayes LSD.

RESULTS AND DISCUSSION

Preemergence Test. In College Park, the only treatments providing an acceptable level of preemergence crabgrass control were UC 77892 4F (6.0 lb/A), oxadiazon, bensulide, UC 77892 80W (5.5 + 2.5 lb/A) and UC AXF 1291 2.2G (4.5 + 2.5 lb/A) (Table 1). In Silver Spring, oxadiazon, UC 77892 80W (5.5 + 2.5 and 6.0 + 3.0 lb/A), and UC 77892 4F (6.0 + 3.0 lb/A) provided an acceptable level of control. Hence, the only treatments tested at both sites, and providing greater than 90% control, were UC 77892 80W (5.5 + 2.5 lb/A) and oxadiazon (3.0 lb/A). Of the early postemergence treatments in Silver Spring, best control

(89%) was provided by UC 82042 10G (12 lb/A). Both rates of UC 82042, however, reduced density of the perennial ryegrass stand to an unacceptable level. Tridiphane provided some preemergence crabgrass control (49%), but treated turf developed a yellow color within 3 weeks of application. About one month after application, the yellowing continued to persist where tridiphane had been applied at the 2.0 lb/A rate. UC 77892 80W and 4F (6.0 lb/A) caused some slight yellowing of the turf within three weeks of application at College Park. Conversely, UC AXF 1291 enhanced turf color.

Postemergence Test. Herbicides were applied on three occasions to determine the optimum time to control crabgrass. An important parameter was to begin applications following the spring period after most of the crabgrass seed would have germinated. The ultimate goal was to determine if a single, summer, postemergence application would eliminate crabgrass as a problem for the remainder of the growing season. At the rates evaluated, data (Table 2) show that none of the MSMA or tridiphane treatments provided an acceptable level of control. The July 2 and July 16 applications of fenoxaprop-ethyl, however, were extremely effective in eliminating crabgrass for the remainder of the growing season. When fenoxaprop-ethyl was applied on June 13, the 0.18 lb/A rate effectively controlled the existing crabgrass, although crabgrass plants were below the perennial ryegrass canopy. On August 24, we observed that crabgrass in the plots treated June 13 with fenoxaprop-ethyl (0.18 lb/A) generally possessed 3 to 5 tillers; whereas, crabgrass plants in the untreated plots were in the 8 to 10 tiller stage. Hence, crabgrass developing in the 0.18 lb/A treated plots germinated following June 13. MSMA and tridiphane, however, did not effectively control crabgrass in plots treated on June 13. Tridiphane provided best control (75%) when applied on July 16; whereas, there was no difference in level of control (42-44%) provided by MSMA when applied on either July 2 or July 16.

Fenoxaprop-ethyl was also applied to an adjacent perennial ryegrass test area (RCB, 4 replications) on August 7. At that time, crabgrass was in the 3 to 5 tiller stage. Crabgrass coverage was rated on September 11, 1984 and the 0.25 lb/A rate provides 93% control, and the 0.50 lb/A rate provided 97% control. In past studies (3), however, late July applications of fenoxaprop-ethyl failed to provide satisfactory crabgrass control. Late season failures were attributed to drought hardening of crabgrass, which reduced herbicide effectiveness, particularly against mature crabgrass with 3 or more tillers (3). In 1984, however, environmental conditions in Maryland were less stressful, i.e. there was a generally lower daytime temperatures and above average rainfall in July and August. Hence, it appears that environmental conditions, as they effect the vigor of crabgrass, will influence the performance of fenoxaprop-ethyl in late summer.

Phytotoxicity Tests. Discoloration elicited by fenoxaprop-ethyl in Kentucky bluegrass has been described as slight (1) to objectionable (2). In Maryland, when fenoxaprop-ethyl (0.15 and 0.25 lb/A) was applied to three Kentucky bluegrass (Sydsport, Vantage and Pennstar) cultivars following periods of heat and drought stress on July 12, 1982, no conspicuous discoloration was observed (4). Hence, the objective of this test was to re-assess the safety of this herbicide on Kentucky bluegrass in Maryland.

When fenoxaprop-ethyl was applied on May 17, the 0.25 lb/A rate caused an unacceptable browning of the 'America' monostand, but not the Kentucky bluegrass blend (Table 3). In the 'America' monostand there was tip yellowing at the two higher rates. Furthermore, older leaves, and culms and inflorescences were brown and turf growth was stunted. Discoloration and

stunting dissipated by mid-June. About 10 days following the second application of fenoxaprop-ethyl to previously untreated plots, discoloration became evident in both the 'America' and the blend. On June 26 (Table 3), the discoloration elicited by the 0.36 lb/A rate was judged unacceptable in both turfs. Fenoxaprop-ethyl caused a tip purpling followed by tip yellowing. Leaves exposed to the herbicide eventually began to senesce early, developing a brown, necrotic color. New leaves, developing after the herbicide was applied, appeared unaffected. Stunting of turf persisted 3 to 4 weeks, depending on dosage, and then dissipated. After dissipation, turf in treated plots appeared to grow more rapidly than turf in adjacent, untreated areas. By July 25, discoloration and stunting were no longer evident. Hence, discoloration of Kentucky bluegrass appears to associated more with May and June applications of the herbicide when Kentucky bluegrass is growing vigorously, rather than in July when environmental stress reduces turf vigor. Our observations to date have indicated that the early season discoloration of Kentucky bluegrass elicited by fenoxaprop-ethyl is not as objectionable as that induced by sequential applications of MSMA at standard rates.

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Table 1. Effectiveness of various herbicides for smooth crabgrass control at two locations. Plots were evaluated for crabgrass cover at both sites on September 11, 1984.

Treatment	Rate	Crabgrass Control[a] College Park[b]	Silver Spring[c]
	(lb ai/A)	%	
UC77892 80W	5.0	45	30
UC77892 80W	6.0	85	26
UC77892 80W	5.5 + 2.5	94	96
UC77892 80W	6.0 + 3.0	*	95
UC77892 4F	5.0	81	72
UC77892 4F	6.0	95	79
UC77892 4F	5.5 + 2.5	88	82
UC77892 4F	6.0 + 3.0	*	97
UC AXF 1290 5.5G	5.5	79	*
UC AXF 1290 5.5G	5.5 + 2.5	75	*
UC AXF 1291 2.2G	4.5	60	*
UC AXF 1291 2.2G	4.5 + 2.5	95	*
Tridiphane 2 EC	1.0	48	*
Tridiphane 2 EC	2.0	49	*
Tridiphane 2 EC	1.0 + 1.0	49	*
DCPA 75W	10.5	89	79
Oxadiazon 2G	3.0	95	92
Bensulide 4EC	7.6	96	88
Early Postemergence Treatments			
UC77892 80W	5.0	*	55
UC77892 80W	6.0	*	75
UC77892 4F	5.0	*	76
UC77892 4F	6.0	*	79
UC82042 10G	6.0	*	71
UC82042 10G	12.0	*	89

a/ Control was calculated based on percent of the control.
b/ In College Park, the initial and sequential application of herbicides were April 19, and May 22, 1984, respectively.
c/ In Silver Spring, the initial and sequential application were April 10 and May 23, 1984, respectively. Early postemergence treatments were also applied May 23.
* Treatment not evaluated.

Table 2. Timing postemergence control of crabgrass with various rates of fenoxaprop-ethyl, tridiphane and MSMA.

Treatment	Rate	Date applied	Crabgrass[a/] Cover	Control
	(lb ai/A)	(date)	%	
Fenoxaprop-ethyl 50 gr/L	0.12	June 13	49cd[b]	37
Fenoxaprop-ethyl 50 gr/L	0.18	June 13	30ef	62
Fenoxaprop-ethyl 50 gr/L	0.18	July 2	7gh	91
Fenoxaprop-ethyl 50 gr/L	0.25	July 2	1h	98
Fenoxaprop-ethyl 50 gr/L	0.25	July 16	1h	99
Fenoxaprop-ethyl 50 gr/L	0.40	July 16	0h	100
MSMA 6L	1.0	June 13	64bc	18
MSMA 6L	2.0	June 13	72ab	7
MSMA 6L	2.0	July 2	44de	44
MSMA 6L	2.0	July 16	45de	42
Tridiphane 4 EC	1.0	June 13	45de	42
Tridiphane 4 EC	1.0	July 2	71ab	8
Tridiphane 4 EC	1.0	July 16	20fg	75
Untreated	-	-	78a	-

a/ Crabgrass cover was visually rated on September 11, 1984.

b/ Means the column followed by the same letter are not significantly different different at the p=0.05 level according to the Bayes LSD.

Table 3. Evaluation of the safety of fenoxaprop-ethyl applied to a mature monostand of America or a mature blend of Merion, Sydsport and Vantage Kentucky bluegrass.

Treatment	Rate	Discoloration Study I[a] America	Study I[a] Blend	Study II[b] America	Study II[b] Blend
	(lb ai/A)	(0-5 Scale)			
Fenoxaprop-ethyl 50 gr/L	0.12	1.5b[c]	0.0a	2.2ab	2.2ab
Fenoxaprop-ethyl 50 gr/L	0.18	2.0ab	0.7a	2.0ab	2.0ab
Fenoxaprop-ethyl 50 gr/L	0.25	3.0a	1.0a	*	*
Fenoxaprop-ethyl 50 gr/L	0.36	*	*	2.8a	2.7a
Untreated	-	0.0c	0.3a	0.0c	0.8b

a/ Herbicide was applied on May 17 and plots were rated June 8, 1984 in Study I .
b/ Herbicide was applied on June 14 and plots were rated on June 29, 1984 in Study II.
c/ Means in column followed by the same letter are not significantly different at the p=0.05 level according to Bayes LSD.
* Treatment not evaluated.

PROGRESS REPORT ON CONTROLLING MUGWORT IN TURFGRASS

Arthur Bing[1/]

ABSTRACT

Preliminary trials indicated that repeat treatments of 2,4-D + dichlorprop or 2,4-D plus MCPP plus dicamba were effective in reducing an infestation of mugwort (*Artemesia vulgaris* L.) in turfgrass. In September 1983, an area in St. Charles Cemetery, Pinelawn, N.Y., heavily infested with mugwort, was laid out in 10 x 10 ft plots with each treatment replicated 3 times. The mugwort population in each plot was rated as a % of area covered on September 14, 1983. The first treatments were made on September 23, 1983. Plots receiving a second treatment were sprayed May 18, 1984, a third treatment was made on July 20, 1984 and a fourth treatment October 4, 1984. Herbicides used are shown in Table 1.

Table 1. Herbicides used on mugwort in turfgrass, Pinelawn, N.Y., 1983-84.

Herbicide			
Common name	Formulation	lb/gal	Chemical name
2,4-D	Weedome DP	1	butoxyester 2,4 dichlorophenoxy acetic acid
+ dichlorprop		1	butoxy ester 2-(2,4-dichlorophenoxy) proprionic acid
2,4-D	Trimec	2.06	dimethylamine 2,4 dichlorophenoxy acetic acid
+ MCPP		1.08	dimethylamine 2-(methyl-chlorophenoxy) proprionic acid
+ dicamba		0.21	dimethylamine 3,6 dichloro-o-anisic acid
2,4-D	Growell	0.576	dimethylamine 2,4 dichlorophenoxy acetic acid
+ MCPP		0.26	dimethylamine 2-(methyl-chlorophenoxy) proprionic acid
+ dicamba		0.06	dimethylamine 3,6 dichloro-o-anisic acid
triclopyr	Garlon 4	4.0	(3,5,6-trichloro-2-pyridinyloxyacetic acid
2,4-D	Estron 99	3.8	butoxyethyl ester 2,4 dichlorophenoxy acetic acid
2,4-D	Dow 123	2	butoxyethyl ester 2,4 dichlorophenoxy acetic
+ triclopyr		1	

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Mugwort ratings on October 25, 1984 compared to the pretreatment ratings of September 14, 1983 are shown in Table 2. The triclopyr + 2,4-D treatments were only fairly effective after 1 application and were not repeated. Repeat applications of 2,4-D + dichlorprop were very effective, practically eliminating the mugwort, as shown by a rating of 2% after 3 applications and 0 after 4 applications. The 2,4-D plus MCPP plus dicamba combinations were slightly less effective reducing the population to 0.7 and 1.7% after 4 treatments. The conclusion is that 2,4-D plus dichlorprop or 2,4-D plus MCPP plus dicamba can eliminate mugwort if the infested area is retreated at the recommended turfgrass rates everytime the mugwort recovers. It may take 4 or more treatments over a period of more than 1 year.

Table 2. The effect of herbicides on mugwort in turfgrass, Pinelawn, N.Y., 1984.

Treatment			% mugwort stand[a]	
Herbicide	Rate lb ai/A	No. of Treatments[b]	9/14/83	10/25/84
2,4-D + dichlorprop	1 + 1	1	50	18
(Weedone DP)		3	67	2
		4	43	0
2,4-D + MCPP	1+0.54+0.11	1	43	10
+ dicamba		3	53	1.3
(Trimec)		4	47	0.7
2,4-D + MCPP	0.78+0.35+0.08	1	37	11
+ dicamba		3	42	5.3
(Growell)		4	57	1.7
triclopyr + 2,4-D	1/4 + 1	1	43	11
(Garlon 4 + Eston 99)	1/8 + 1	1	50	28
2,4-D + triclopyr	0.75+0.38	1	53	16
(Dow 123)	1.0+0.50	1	70	7
Untreated			30	25

(a) Average of 3 10 x 10 ft. randomized plots.

(b) Treatments made 9/23/83, 5/11/84, 7/20/84 and 10/4/84.

CONTROL OF ANNUAL LESPEDEZA, OXALIS AND OTHER BROADLEAF WEEDS IN TURF

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ABSTRACT

Herbicides including MCPA, 2,4-D, bromoxynil, 2,4-D + MCPP and 2,4-D + MCPP + dicamba did not deleteriously affect the density of a fall, 1981 seeded blend of Kentucky bluegrasses (Poa pratensis L.) when applied at normal use rates in April, 1982. The propylenediamine salt of 2,4-D (0.9 lb ai/A) effectively controlled white clover (Trifolium repens L.) in 1983, but not in 1984 when a higher rate (1.5 lb ai/A) was evaluated. Mixing 2,4-D with either MCPP; dicamba, dichlorprop or triclopyr was extremely effective in controlling white clover and dandelion (Taraxacum officinale Weber). Bromoxynil (0.5 lb ai/A), however, did not effectively control dandelion. Oxalis (Oxalis stricta L.) was effectively controlled by various formulations of 2,4-D + MCPP + dicamba, 2,4-D + MCPP, and 2,4-DP, but not bromoxynil. Annual Lespedeza (Lespedeza striata (Thunberg) H. & A.) was most effectively controlled with a low volatile ester formulation of 2,4-D + MCPP + dicamba. Common blue violet (Viola papilionacea Pursh.) was not controlled with 2,4-DP, 2,4-DP + mefluidide or 2,4-D + MCPP + dicamba + either triclopyr or mefluidide.

INTRODUCTION

Herbicide evaluations were performed at various sites in Maryland between 1982 and 1984 to compare the effectiveness of new herbicides and new herbicide formulations with standard materials. A primary goal was to obtain performance data on three, difficult to control weeds, i.e. annual Lespedeza, Oxalis and blue violet. Mefluidide N[2,4-dimethyl-5-[[(trifluroromethyl)sulfonyl]amino]phenyl]acetamide) has been shown to provide enhanced control of some weeds when mixed with acifluorfen (5-[2-chloro-4-(trifluromethyl)phenoxy]-2-nitrobenzoic acid) (2). In these investigations, mefluidide was mixed with phenoxy herbicides to determine if enhanced violet and annual Lespedeza control could be achieved. Another objective was to determine if standard rates of various phenoxy herbicides would be injurious to a fall seeded, Kentucky bluegrass turf when applied the following spring.

MATERIALS AND METHODS

Table 1: The herbicides evaluated in this study were as follows: MCPA 3.7E (dimethylamine salt of 2 methyl-4-chlorophenoxy acetic acid); 2,4-DP 3.7E (2,4-dichlorophenoxy propionic acid); MCPP + 2,4-D 3.7E (dimethylamine salt of 2,4-dichlorophenoxyacetic acid plus 2(2-methyl-4-chloropheoxy)propionic acid); 2,4-D 3E (N-oleyl-1,3-propylenediamine salt of 2,4-D); Trexsan = 2,4-D + MCPP + dicamba 4E (dimethylamine salt of 2,4-D + MCPP + 3,6-dichloro-o-anisic acid); bromoxynil 2E [octanoic acid ester of (3,5-dibromo-4-hydroxybenzonitrile)]; EH 758 3.7E and EH 766 3.4E (Trimec = dimethylamine salt of 2,4-D + MCPP + dicamba + triclopyr = [(3,5,6-trichloro-2-pyridinyl)oxy]acetic acid). In the white clover, 1983 test, herbicides were applied July 7, 1983 in 50 gpa to a blend of unknown Kentucky bluegrass (Poa pratensis L.) cultivars grown on a Chillum silt loam with a pH of 5.2 and 2.4% organic matter (% OM). In the 1982 dandelion,

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test, herbicides were applied on April 30, 1982 in 30 gpa to the aforementioned, Kentucky bluegrass turf. In the Mayweed-white clover-bareground test, herbicides were applied April 30, 1982 in 30 gpa to a blend of Merion, Vantage and Sydsport Kentucky bluegrass (seeded September, 1981) grown on a Chillum silt loam (pH = 6.1, 3.0% OM).

Table 2: The herbicides evaluated were as follows: EH 765 4.5E (a mixed dimethylamine and diethylamine salt of 2,4-D and MCPP + dicamba); EH 791 3.8E (a mixed isooctyl ester and butoxyethanol ester of 2,4-D and MCPP + dicamba); 2,4-DP 1.9E (a mixed butoxyester of 2-(2,4-dichlorophenoxy) propionic acid and 2,4-D); 2,4-D 3.8E (dimethylamine salt of 2,4-D), 2,4-D 3.0E (propylenediamine salt of 2,4-D); Trimec 3.3EC; 2,4-D + MCPP 3.7E; and bromoxynil. In the white clover test, herbicides were applied on May 9, 1984 in 50 gpa to a mixed stand of tall fescue (*Festuca arundinacea* Schreb.) and Kentucky bluegrass grown on silt loam soil (pH = 6.4, 3.4% OM). In the Oxalis test, herbicides were applied on June 28, 1984 in 50 gpa to Tufcote bermudagrass (*Cynodon dactylon* L. Pers.) grown on a Chillum silt loam (pH = 5.2, 5.3% OM).

Table 3. Herbicides used were previously described. In the dandelion test, herbicides were applied on May 9, 1984 in 50 gpa to Penncross creeping bentgrass (*Agrostis palustris* Huds.) grown on a silt loam soil (pH = 6.1, 3.0% OM). In the annual Lespedeza test, herbicides were applied on June 27, 1984 in 50 gpa to a tall fescue turf. Lespedeza was in the four-branch stage at the time of application.

Table 4. The herbicides evaluated were previously described. The chemicals were applied to the same site on May 5, 1983, and May 25 and June 27, 1984 in 50 gpa. The roadside turf was Kentucky bluegrass grown on a Chillum silt loam with a pH of 5.2 and 2.4% OM.

Weed coverage and bareground were visually estimated using a 0 to 100% scale where 0 = no weeds or no turf, and 100 = entire plot area covered with weeds or turf. Plot size was either 1.5 by 1.5 m or 1.5 by 3.0 m with three or four replication per treatment. The statistical design was a randomized complete block at all sites. All data were analyzed using the analysis of variance and signficantly different means (p = 0.05) were separated using the Bayes Least Significant Difference multiple comparison test.

RESULTS AND DISCUSSION

Table 1. All herbicides, except bromoxynil, effectively controlled dandelions. All herbicides including the propylenediamine salt of 2,4-D alone, effectively controlled white clover. The ability of propylenediamine salt of 2,4-D to control white clover was previously demonstrated (1). Some herbicides (i.e. MCPP + 2,4-D and 2,4-D + MCPP + dicamba) applied on April 30, 1982 to control henbit (*Lamium amplexicaule* L.) and chickweed (*Stellaria media* (L.) Vill.), surprisingly provided excellent control of Mayweed (*Anthemis arvensis* L.) and white clover. In the aforementioned test, the henbit and chickweed had naturally senesced by the time plots were rated on July 26, 1982. Bareground data, collected on two dates, showed that none of the herbicides deleteriously affected the density of the immature, Kentucky bluegrass stand.

Table 2. All herbicides significantly reduced white clover when plots were rated June 19, but both formulations of 2,4-D alone provided an unacceptable level of control. White clover populations were reduced dramatically following summer stress and natural senescence by September. For most turfgrass managers, rapid white clover control with materials containing 2,4-D plus MCPP

or dicamba would be preferable to the erratic control provided by the propylenediamine salt of 2,4-D alone (See Table 1). The errect-type of Oxalis (O. stricta), was effectively controlled by all herbicides evaluated, except bromoxynil and 2,4-D alone.

Table 3. Lowest dandelion populations were observed in plots treated with 2,4-D + MCPP, but there were no significant differences among herbicide treatments. Annual Lespediza was most effectively controlled by EH 765 + mefluidide and EH 791. At the rates evaluated, tank mixing mefluidide with EH 765, 2,4-D + MCPP + dicamba or bromoxynil did not provide an additive level of annual Lespediza control.

Table 4. There were no, perceptible reductions in common blue violet populations provided by any of the herbicide combinations listed.

LITERATURE CITED

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2. Hook, B.J., and S. Glenn. 1984. Mefluidide and acifluorfen interactions on ivyleaf morningglory (Ipomoea hederacea), velvetleaf (Abutilon theophrasti) and common cocklebur (Xanthium pensylvanicum). Weed Sci. 32:198-201.

Table 1. Evaluation of various herbicides for control of dandelion and white clover and the effect of these herbicides upon density of an immature, Kentucky bluegrass turf.

		Weed Cover		1982 Weed Cover	1982 Bareground	
		1982	1983	Mayweed +		
Treatment	Rate	Dandelion[a]	White Clover[b]	White Clover[c]	June 15	July 26
	(lb ai/A)	%				
MCPA 3.7 EC	0.9	0.2a*	*	2.5bc	7a	12a
2,4-DP 3.7 EC	1.4	*	0.0a	*	*	*
2,4-D + MCPP 3.7 EC	3.0	0.0a	*	0.2a	10a	13a
Propylenediamine salt of 2,4-D 3.0 EC	0.9	0.0a	1.3a	1.4ab	8a	10a
2,4-D + MCPP + dicamba (Trexsan 4EC)	1.6	0.8a	0.7a	0.2a	8a	10a
Bromoxynil 2 EC	0.5	3.8b	*	1.5ab	7a	12a
EH 758 3.7 EC	1.4	*	0.0a	*	*	*
EH 766 3.4 EC	1.3	*	0.0a	*	*	*
Untreated	-	4.3b	8.3b	3.3c	9a	12a

a/ Herbicides were applied April 30, 1982 and plots were rated July 30, 1982.
b/ Herbicides were applied July 7, 1983 and plots were rated September 23, 1983.
c/ Herbicides were applied to a fall, 1981 seeded stand of Kentucky bluegrass on April 30, 1982 and weed cover was rated on July 26, 1982.
*Means in a column followed by the same letter are not significantly different at the p=0.05 level according to Bayes LSD.
*Treatment not evaluated.

Table 2. Evaluation of various herbicides for control of white clover and Oxalis (*O. stricta*).

Treatment	Rate	Weed Cover		
		White Clover[a]		Oxalis[b]
		June 19	Sept 21	
	(lb ai/A)	%		
EH 765 4.5 EC	2.2	0.3d	0.3b	4.3c
EH 791 3.8 EC	1.6	2.0d	1.0b	4.7c
Dimethylamine salt of 2,4-D 3.8 EC	1.9	43.0bc	6.0ab	*
2,4-DP 1.9 EC	1.8	4.3d	1.9b	4.0c
Propylenediamine salt of 2,4-D 3.0 EC	1.5	33.0c	9.3ab	19.0bc
Dimethylamine salt of 2,4-D + MCPP + dicamba (Trimec 3.3 EC)	1.6	2.8d	0.1b	6.7c
Dimethylamine salt of 2,4-D + MCPP 3.7 EC	5.6	1.0d	0.3b	7.0c
Bromoxynil 2 EC	1.0	*	*	33.0ab
Bromoxynil 2 EC	2.0	*	*	28.3ab
Untreated 2 EC	-	76.2a	15.0a	42.0a

a/ Herbicides were applied on May 9, 1984.
b/ Herbicides were applied on June 28, 1984 and plots were rated July 24, 1984.
+ Means in a column followed by the same letter are not significantly different at the p=0.05 level according to Bayes LSD.
* Treatment not evaluated.

Table 3. Evaluation of herbicides for control of dandelion and annual Lespediza.

Treatment	Dandelion[a]		Annual Lespediza[b]	
	Rate	Weed Cover	Rate	Weed Cover
	(lb ai/A)	—%—	(lb ai/A)	—%—
EH 765 4.5 EC	1.1	1.1b[+]	2.2	11.2ab
EH 765 4.5 EC + Mefluidide 2S	*	*	2.2 + 0.125	4.0b
EH 791 3.8 EC	1.2	0.6b	1.6	3.5b
Dimethylamine salt of 2,4-D	1.0	1.4b	*	*
2,4-DP 1.9 EC	1.4	1.1b	1.9	47.5ab
2,4-DP 1.9 EC + Mefluidide 2S	*	*	1.9 + 0.125	44.0ab
Propylenediamine salt of 2,4-D 3.0 EC	1.1	0.8b	*	*
2,4-D + MCPP + dicamba (Trimec) 3.3 EC	1.3	1.4b	1.6	28.5ab
2,4-D + MCPP + dicamba (Trimec) 3.3 EC + Mefluidide 2S	*	*	1.6 + 0.125	18.8ab
2,4-D + MCPP + dicamba (Trimec) 2.1 EC	0.9	2.2b	*	*
2,4-D + MCPP 3.7 EC	5.6	0.3b	*	*
Bromoxynil 2 EC	*	*	2.0	52.5a
Bromoxynil 2 EC + Mefluidide 2S	*	*	2.0 + 0.125	48.2ab
Untreated	-	5.5a	-	53.8a

a/ Herbicides were applied May 9, 1984 and plots were rated June 19, 1984.
b/ Herbicides were applied June 27, 1984 and plots were rated August 7, 1984.
[+]Means in a column followed by the same letter are not significantly different at the p=0.05 level according to Bayes LSD.
*Treatment not evaluated.

Table 4. The following herbicide treatments failed to control common blue violet (Viola papilionacea) in 1983 or 1984.

1983 Herbicides[a]	Rate	1984 Herbicides[b]	Rate
	(lb ai/A)		(lb ai/A)
2,4-DP 3.7 EC	1.4	2,4-DP 1.9 EC	1.8
Dimethylamine salt of 2,4-D + MCPP + dicamba (Trexsan 4 EC)	1.0	2,4-DP 1.9 EC + Mefluidide 2S	1.8 + 0.125
Propylenediamine salt of 2,4-D 3.0 EC	0.9	EH 765 4.5 EC EH 765 4.5 EC + Mefluidide 2S	2.2 2.2 + 0.125
EH 758 3.7 EC (Trimec + Triclopyr)	1.4	EH 791 3.8 EC EH 791 3.8 EC + Mefluidide 2S	1.6 1.6 + 0.125
EH 766 (Trimec + Triclopyr)	1.3		

a/ Herbicides were applied on May 5, 1983.
b/ Herbicides were applied May 25 and June 27, 1984 to the same plots.

DEVELOPMENT OF SMALL PLOT SPRAY EQUIPMENT FOR LAWN CARE RESEARCH

K.A. Hurto and M.J. Thielen 1/

ABSTRACT

Development and evaluation of herbicides for use in lawn care operations require research application techniques different from those traditionally used to evaluate pesticides for use in golf course or general turf maintenance operations, since different spray volume and spray equipment are used in lawn care. Most lawn care operators use the ChemLawn spray gun to apply herbicides to lawn turfs. This gun is equipped with a nozzle that has 48 straight spray jets, each with a 1.27 mm orifice diameter. The spray gun is calibrated at a 250 ml s^{-1} flow rate to apply materials at 1,625 L ha^{-1} (174 gpa). Nozzle pressure is 16 kPa (2.3 psi). At this flow rate, the nozzle generates a spray droplet spectra that has a volume median diameter (VMD) of 2,100 microns. Less than 0.25 percent of the total spray volume is emitted as particles smaller than 250 microns. This spray droplet spectra is significantly different from the droplet spectra emitted by flat fan nozzles normally used to apply herbicides for turfgrass weed control. For example, a 80 degree flat fan nozzle designed to deliver a 22 ml s^{-1} flow rate at 207 kPa (30 psi) pressure has a VMD of 129 microns.

Small plot CO_2 sprayers used in research are designed to apply pesticides with flat fan nozzles at low spray volumes. With this equipment, the spray volume used in lawn care operations cannot be simulated unless the ground speed is reduced. But even then, the spectral characteristics of spray droplets generated from flat fan nozzles are significantly different from the ChemLawn nozzle. For certain evaluations, such as preemergence herbicide efficacy, this may not be critical. However, if the study is designed to evaluate treatment combinations for turfgrass selectivity or efficacy of postemergence herbicide applications, differences in spray droplet spectra of a flat fan nozzle compared to the ChemLawn nozzle will affect results due to differences in interception, distribution, and retention of spray droplets by plants.

A nozzle developed by Bete Fog Nozzle, Inc. was evaluated for its potential use in small plot research studies. The nozzle design incorporates two nozzles that are mounted opposite each other, resulting in an intersecting spray pattern that generates a spray droplet spectra similar to that of the ChemLawn nozzle. Several modifications are required by an investigator to adapt this nozzle for use in small plot research. 1) The diameter of the siphon tube used to deliver the spray mixture to the nozzle must be increased to maintain the required flow rate. 2) Plot layout must be designed with sufficient border area at each end of the plot to allow for overspray. 3) Because of variation in spray deposition across the spray swath, only 67 to 75 percent of the central area of the spray swath should be considered in evaluating treatment effects.

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SECOND ANNUAL NORTHEASTERN COLLEGIATE WEED SCIENCE CONTEST - 1984

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ABSTRACT

The second annual Northeastern collegiate weed science contest was held on August 7, 1984, at the Rutgers Research & Development Center, Bridgeton, N.J. Five graduate and one undergraduate teams representing five universities from across the Northeastern United States and Canada competed in the event.

The contest was structured similarly to weed contests held in other regions of the country. The students had to compete in four categories; sprayer calibration, weed identification, recognizing herbicide injury, and problem solving, whereby a student had to act as a county agent or company representative and role play with a grower that had a field problem.

Plaques were awarded to the top team, and top overall student, all from the University of Guelph.

Certificates of merit were awarded to the team from Rutgers and the team from Virginia Polytechnic Institute & State University for finishing second and third place, respectively. Certificates of merit were also warded to individuals placing second and third overall.

The contest was warmly received by all individuals involved. From a student's perspective the experience was both rewarding and educational. Professional and personal contacts were initiated and one's knowledge broadened by exposure to crops, weeds, and situations which may not be found in one's own locale.

The Northeastern collegiate weed science contest will continue to grow in the Northeast. The NEWSS plans to make the contest an annual event with it being held at various sites across the Northeastern United States and Canada.

Plans are already under way for the 1985 contest. Rohm & Haas Company will host the contest at the company's research facility in Spring House, Pennsylvania on August 6, 1985.

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HERBICIDE APPLICATORS FOR SMALL SCALE FARMING

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ABSTRACT

Various hand operated herbicide applicators were tested for potential use in small scale agriculture. Field studies were conducted in Swaziland, Africa, as part of a U.S. Agency for International Development project.[2/] Evaluations were made with the developing farmer in mind and included economic factors, weed control, and overall practicality.

Tested were CDA units, hydraulic sprayers, and granular applicators. Most are currently commercially available, some in various stages of development. Table 1 contains information on individual applicators. Treatments were applied as either a broadcast or a band application.

Sweet corn was used as the test crop in two field experiments. Atrazine and metolachlor, in a commercially available blend (Gesagram), was applied at the rates of 1.12 kg/ha ai of each material. In addition, a hand held wiper was used with glyphosate as an alternative to hoeing for one treatment in the second experiment. Checks included hand hoeing or no weeding.

The following general conclusions were reached:

1. CDA applicators in general provided better weed control and yields than did hydraulic sprayers.
2. Broadcast treatments outyielded hand hoeing and were superior to banding (50 cm width) of the herbicide when no supplemental mechanical cultivation was used.
3. Granular treatments usually performed better than comparable spray applications.
4. Units with peristaltic (hose) pumps, thus removing ground speed as a factor in application rate, provided an important advantage.

While these studies were conducted for farmers in a developing country setting, it is personally believed that several units tested have merit for certain small scale growers and landscape operations in the U.S.A.

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Table 1. Applicator descriptions and yield and weed control information for applicator tests.

Applicator/Treatment	Source(s)	Est. Cost (%)	Pump Type	Spray Vol/ha (l)	Treatment Type	Yield[A/] T/ha	Weed[A/] Control (%)
CDA							
Birky	Ciba-Geigy	100	Piston	20	B.C.	3.01	95
Herbie	Micron	75	Gravity	8	B.C.	3.56	98
P-AS	Nat. Inst. of Ag. Eng., U.K.	N/A	Peristalic	18	B.C./Band	3.38/2.48	95/95
Hydraulic							
Wheelbarrow	Various, R.S.A.	130	Peristalic	135	Band	1.85	80
Knapsack	Solo Motors	90	Piston	230	Band	2.85	95
Granular							
Wheelbarrow	Various, R.S.A.	160	--	--	Band	1.80	85
Spinner Spreader	Seymour	45	--	--	B.C.	3.56	98
Others							
Wiper	Micron West, Inc.	35	--	--	Spot.	1.59	50
Hoe	--	8	--	--	Spot.	2.85	85
LSD .05						1.00	

[A/] Yield and weed control ratings are for Experiment II only.