ANNUAL GRASS CONTROL IN SEEDLING ALFALFA WITH BAS 517 02H

Frank J. Himmelstein and Prasanta C. Bhowmik[1]

ABSTRACT

BAS 517 02H (BASF) has recently been developed for annual and perennial grass control in all broadleaved crops. A field experiment was conducted in 1986 at the Massachusetts Agricultural Experiment Station to evaluate this new postemergence graminicide for both early and late postemergence annual grass control in seedling alfalfa and to determine the effects of annual grass suppression on alfalfa yield.

BAS 517 02H was evaluated at 0.009, 0.018, 0.035, 0.07 and 0.14 kg ai/ha. Alfalfa 'Saranac AR' was conventionally seeded at 16.8 kg/ha on May 9, 1986. Early postemergence treatments were applied on June 3, 1986 when alfalfa was at the 4 trifoliate leaf stage and the annual grasses were at the 3- to 5-leaf stage. Late postemergence treatments were applied on June 14, 1986 when alfalfa was at the 6- to 12-trifoliate leaf stage and the annual grasses were at the 4- to 5-leaf stage and tillering. The most important grass weed species were yellow foxtail [*Setaria lutescens* (Weigel) F.T. Hubb.] and large crabgrass [*Digitaria sanguinalis* (L.) Scop.]. Broadleaf weeds were controlled with a blanket application of 2,4-DB at 1.12 kg ai/ha on June 9, 1986. Plot size was 15 by 6 m. Treatments were arranged in a randomized complete block design with three replications. All herbicides were applied with a backpack CO_2 sprayer at 152 kPa in 450 L/ha.

BAS 517 02H applied both early and late postemergence resulted in unacceptable to excellent annual grass control by the time of the first alfalfa harvest on August 1, 1986. No difference in grass control occurred between early and late applications. Significantly greater grass control was obtained with BAS 517 02H, as the rate of herbicide increased from 0.009 to 0.07 kg/ha. The 0.07 and 0.14 kg/ha rates reduced average dry matter yields of annual grasses 97 to 100% as compared to the dry matter yield of the control (5711 kg/ha). Dry matter yields of first cut alfalfa increased as weed pressure decreased. Dry matter yields of alfalfa increased as the rate of BAS 517 02H increased from 0.009 to 0.035 kg/ha. No increase in alfalfa yield was obtained at rates greater than 0.035 kg/ha. Average dry matter yields of alfalfa (4481 kg/ha) at the 0.035 to 0.14 kg/ha rate of BAS 517 02H were increased 117% over the dry matter yields of the control.

Little, if any, annual grasses were present at the time of the second harvest on September 8, 1986. The positive response of alfalfa yield to earlier weed control did continue, however, to the second harvest. Average dry matter yields of second cut alfalfa with the 0.018, 0.035, 0.07 and 0.14 kg/ha rates of BAS 517 02H (2472 kg/ha) were increased 23% over the alfalfa dry matter yields of the control. Results indicate the importance of annual grass control for increasing alfalfa yield during the establishment year. A 0.035 kg/ha rate of BAS 517 02H was adequate to provide the weed control necessary for excellent alfalfa establishment.

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FORAGE QUALITY EFFECTS OF POSTEMERGENCE GRAMINICIDES ON AN ALFALFA-ORCHARDGRASS STAND

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ABSTRACT

A study was initiated in 1985 to evaluate forage quality effects of postemergence graminicides (grass herbicides) on a third year stand of alfalfa (Medicago sativa L.) and orchardgrass (Dactylis glomerata L.). Five graminicides and an untreated control were used (Table 1). The treatments were applied April 23, 1985. Yield data and quality samples were collected May 29, July 11, and August 26, 1985. The treatments significantly increased the percent crude protein over the control at all three harvest dates, and the yield of crude protein at the second harvest date. The graminicide treatments yielded a significantly higher percentage of the total season crude protein and total digestible nutrients than the control at the July 11 harvest. Percent TDN and TDN yield were not significantly affected at any harvest. Crude protein yield and percent of the total season yield of crude protein and TDN were not significantly affected at the first or third harvests. Total season yields of forage, crude protein, and total digestible nutrients for the five treatments were not significantly different than the control.

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TABLE 1. 1985 yield data for significantly affected forage quality characteristics and season totals for forage, TDN ,and crude protein yield. The upper portion of the table lists treatment means. The lower portion of the table includes the sum of squares and significance level for the treatments (5 df) and the orthogonal contrast between the control and the graminicide treatments (1 df), and the percent of the treatment variation accounted for by the difference between the control and the graminicide treatments.

		May 29	July 11				August 26	Season Totals		
Treatment	Rate	Crude Protein	Crude Protein	Crude Protein Yield	Portion of[1/] Total Protein Harvested	Portion of Total TDN Harvested	Crude Protein	Total Forage Yield	Total TDN Yield	Total Protein Yield
	(lb ai/A)	(%)	(%)	(Mg/Ha[2/])	(%)	(%)	(%)	(-----Mg/Ha-----)		
cloproxydim	0.125	19.5	20.0	0.672	30.3	28.9	20.1	11.2	7.40	2.23
fluazifop	0.125	20.3	20.5	0.706	33.3	32.0	19.1	10.6	7.07	2.13
sethoxydim	0.500	20.3	20.4	0.692	31.1	30.2	21.4	10.8	7.06	2.22
fenoxaprop	0.250	19.9	20.1	0.599	28.3	26.5	19.2	10.8	7.22	2.12
SC-1084	0.250	19.6	19.6	0.654	31.7	30.6	19.5	10.6	6.97	2.07
Control	--	17.5	18.7	0.574	28.1	26.6	18.7	10.4	7.28	2.04
SOURCE	df									
Treatments	5									
sum of squares		21.87	6.200	5.537 4E	6.689 -3E	8.463 -3E	18.26	2.281 6E	6.285 5E	1.44 1 5E
significance level[3/]		0.0144	0.0652	0.0190	0.0019	0.0008	0.0036	0.8771	0.7689	0.6924
Control v. Treatments	1									
sum of squares		19.85	4.234	1.972 4E	1.235 -3E	1.699 -3E	4.103	8.263 5E	4.874 4E	3.950 4E
significance level		0.0006	0.0089	0.0188	0.240	0.0116	0.0223	0.4411	0.7689	0.3751
percent of treatment variation[4/]		90.76	68.29	35.61	18.46	20.08	22.46	36.22	7.75	27.41

1/ Ratio of the yield for one harvest to the total season yield.

2/ Megagrams per hectare dry matter; 10^6 grams/Megagram.

3/ The probability of rejecting the Null hypothesis ($Mean_{treatment\ 1}=Mean_{treatment\ 2}= \ldots =Mean_{treatment\ 6}$) when it is true.

4/ (Control v. Treatment sum of squares/Treatment sum of squares)*100; represents the amount of variation between treatments that is attributable to the difference between the control and the five graminicide treatments.

EVALUATION OF SELECTIVITY OF SEVERAL NEW POST-EMERGENCE HERBICIDES ON NEW SEEDINGS OF ALFALFA

Robert A. Peters[1/]

ABSTRACT

Treatments were applied on June 10, 1986 on newly seeded alfalfa in the six leaf stage, 4 to 6 inches tall. Lambsquarter (Chenopodium album L.) and common chickweed [Stellaria media (L.) Vill] were the most prevalent weeds present. A sparse large crabgrass [Digitaria sanguinalis (L.) Scop.] stand was present. All treatments were applied in 20 G/A water unless specified. All herbicide rates are in terms of active ingredient per acre.

Good lambsquarters control were obtained from all treatments containing 2,4-DB 1 lb/A. Also, good control was obtained from pyridate 1.8 lb/A plus sethoxydim .2 lb/A + 1% COC, bromoxynil .25 and .38 lb/A and DPX 6316 .03 lb/A plus 1% COC. Common chickweed was controlled by the pyridate, DPX 6316 treatments and imazethapyr.

Excellent control of crabgrass was obtained from the following treatments: BAS 517 H .075 and .1 lb/A, fluazifop butyl .2 lb/A, haloxyfop methyl .125 lb/A, and sethoxydim .15 lb/A in 10 gal/A of carrier. All were tank mixed with 2,4-DB 1 lb/A and 1% COC. When sethoxydim was tank mixed with pyridate antagonism was observed with a reduction in crabgrass control.

Alfalfa was injured by DPX 6316 .03 lb/A plus 1% COC. In the first cutting, July 14, alfalfa yields were increased over the control by pyridate 1.8 lb/A plus sethoxydim .2 lb/A plus 1% COC and imazethapyr .063 and .094 lb/A + 1/4% surfactant. The increase could be related to the excellent control of chickweed.

Second cut August 20, alfalfa yields correlated with the degree of crabgrass control. Significant increases were obtained from BAS 517 H .05 and .1 lb/A, sethoxydim .2 lb/A, haloxyfop methyl .125 lb/A, and fluazifop butyl .2 lb/A all tank mixed with 2,4-DB 1 lb/A + 1% COC. Imazethapyr did not control the crabgrass which dominated the second cutting of alfalfa.

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Transpiration of Quackgrass After Postemergence Herbicides

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ABSTRACT

One of the most important perennial weeds in the northeast is quackgrass (Agropyron repens (L.) Beauv.). A new group of herbicides, the oxyphenoxypropanoates, have been developed that permit postemergence control of quackgrass in the presence of a broadleaf crop. Growth of quackgrass treated with these herbicides stops within 48 hours, but 10 to 14 days are required before 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.

In three separate laboratory studies, quackgrass was treated with fluazifop-P-butyl, haloxyfop, or quizalifop. Each herbicide was applied in single applications of 0.14, 0.28, and 0.56 kg/ha and also in sequential applications of 0.07 + 0.07, 0.14 + 0.14, and 0.28 + 0.28 kg/ha. In a fourth study, the effects of all three herbicides were compared, each being applied at rates of 0.28 and 0.14 + 0.14 kg/ha. The second treatment of the sequential applications was applied 16 days after the initial spraying. Transpiration and diffusive resistance of the quackgrass were monitored with a steady state porometer for 35 days after spraying to determine when moisture usage by the treated plants ceased.

In comparing herbicide treatment effects, none of the herbicides significantly affects transpiration or diffusive resistance prior to 8 days after spraying. Quackgrass sprayed with quizalifop showed the greatest response to herbicide treatment. There was a marked decrease in transpiration and increase in diffusive resistance of all quizalifop treated quackgrass at 8 days after spraying, with the exception of those plants receiving the 0.07 + 0.07 kg/ha rate. Haloxyfop treated quackgrass exhibited treatment effects almost as quickly as quizalifop. However, the transpiration and diffusive resistance of the treated quackgrass was directly proportional to the rate of haloxyfop applied. Fluazifop-P-butyl had the least effect on quackgrass both in terms of speed of action and in the magnitude of response. Only the highest rate of fluazifop-P-butyl significantly decreases transpiration rate and increases diffusive resistance. There did not appear to be an advantage for sequential applications over single treatments for any of the herbicides.

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GRAMINICIDES FOR QUACKGRASS CONTROL

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ABSTRACT

Quackgrass [Agropyron repens (L.) Beauv.] is an aggressive, hard-to-kill perennial weed which spreads by seeds and rhizomes. Tillage or cultivation alone is not the most effective or efficient method of quackgrass control. Because of this, herbicides have become an important part of the current quackgrass control program under any cropping systems. Two field experiments were conducted at the Massachusetts Agricultural Experiment Station. The objectives of the experiment were i) to evaluate the effectiveness of four graminicides in controlling quackgrass and ii) to compare the activity of these compounds with and without a surfactant.

The experimental area was heavily infested with quackgrass. A preemergence application of alachlor and linuron at 1.68 and 1.12 kg/ha was made over the entire area for the control of annual grasses and broadleaf weeds. All postemergence treatments were applied to the quackgrass on May 10, 1986 with a backpack CO_2 sprayer at a pressure of 152 kPa in 225 L/ha. The quackgrass was at the 4- to 5-leaf stage (30 to 35 cm) at the time of treatment. Plots were 3 by 6 m and the treatments were replicated four times in a randomized complete block design. Quackgrass control was rated on June 9 and August 4, 1986. Above-ground shoot counts and shoot dry weights were also determined on August 4, 1986. Three random soil cores (85.6 cm^2 by 15 cm) were taken from each plot for the determination of live and dead rhizomes. Rhizomes were separated from soil and cut into pieces with at least one bud. These rhizome sections were incubated at 30 C and the numbers of live (sprouted) and dead rhizomes were determined over a period of two weeks.

BAS 51702 (BASF), sethoxydim, fluazifop, and haloxyfop at 0.25 kg ai/ha were used alone or in combination with oil concentrate (1.25% v/v) or in combination with oil concentrate (1.25% v/v) and ammonium sulphate at 2.8 kg/ha. The addition of ammonium sulphate to the treatment of BAS 517 02 at 0.25 kg/ha plus BAS 09002 (1.25% v/v) enhanced quackgrass control (23%) as compared to the treatment without ammonium sulphate. The enhanced quackgrass control was also demonstrated by reduced number (14%) of live rhizomes. On the other hand, the addition of ammonium sulphate to either sethoxydim or fluazifop treatment with oil concentrate (1.25% v/v) did not increase quackgrass control, raging from 59 to 73%. Irrespective of the addition of oil concentrate or ammonium sulphate, haloxyfop (0.25 kg/ha) treatments resulted in excellent (92 to 95%) quackgrass control (August 14, 1986). Only 8% of the rhizomes were viable with haloxyfop plus oil concentrate (0.25 kg/ha plus 1.25%, v/v) as compared to 22% viable rhizomes with haloxyfop treatment alone (without an oil concentrate).

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CROWNVETCH AS INFLUENCED BY TILLAGE IN A CORN-CROWNVETCH LIVING MULCH SYSTEM

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ABSTRACT

Crownvetch (Coronilla varia L.) grown with annual rye (Secale cereale L.) increased in dry matter between spring and fall, and alone declined. The spring harvest showed annual rye reduced crownvetch, while the fall harvest showed annual rye increased crownvetch. Crownvetch with annual rye yielded highest under minimum tillage, while crownvetch alone yielded highest under no-tillage. Crownvetch yielded lowest under conventional tillage. Seasonal growth under all treatments was by shoot development. Post herbicide growth began earlier when crownvetch was grown with annual rye. Season end coverage was greatest under no-tillage, and minimum tillage when crownvetch was grown alone, and with annual rye, respectively. Crownvetch growth was least under conventional tillage. The interactions of time and annual rye, and annual rye and tillage are explained by reduced herbicide efficacy.

INTRODUCTION

Crownvetch, when managed in a crop complex as a living-mulch, provides erosion control (2). To avoid crop yield reduction, growth of the crownvetch living-mulch must be suppressed (3). By using herbicides, crownvetch in no-tillage corn can be suppressed without losing its perennial nature. Management of a crop-living-mulch complex is based on knowledge of how agronomic practices affect the species components, and on how these components interact.

In 1985, a study was begun to screen perennial mulch by winter-annual mulch by tillage systems for corn production. In that study, crownvetch strips more than ten years old were used. Information was collected indicating crownvetch growth was different under conventional tillage practices, but not under minimum tillage and no-tillage. To understand how the crownvetch living-mulch is influenced by tillage, a two year study of crownvetch growth in these strips was initiated in 1986. A second factor influencing crownvetch growth, annual rye as a winter-annual mulch, was also included in the study.

MATERIALS AND METHODS

The study site was located on The Pennsylvania State University Rock Springs Agronomy Farm. The site is described as a Hagerstown silt loam with a zero to three percent slope. The site was divided into three blocks. The blocks were split by winter-annual mulch (with and without annual rye), the main plots were divided by vertical perennial mulch strips (crownvetch and no crownvetch) and horizontal tillage strips (conventional tillage, minimum

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tillage and no-tillage). Perennial mulch strips were established in 1973 and remained under no-tillage until 1985 when the tillage treatments were imposed. Plot size of the intersecting strips or working plots were 3.8 m by 6.1 m.

Rye was seeded August 29, 1985 using field harvested grain. Strips were tilled May 12, 1986. Corn (Zea mays L. 'Doeblers 65X') was planted at 0.76 m row spacing May 14, 1986. Twenty-nine point three kilograms of ammonium nitrate and 18.3 Kg of 10-30-10 per hectare were applied by broadcast and in row, respectively. Fonofos was applied at corn planting to control corn rootworm larvae (Diabrotica sp.). The annual rye cover was sprayed with paraquat (0.28 Kg ai/Ha) May 19, 1986. Cyanazine (1.12 Kg ai/Ha) and metolachlor (1.12 Kg ai/Ha) and pendimethalin (1.12 Kg ai/Ha) were applied as a tank mixed pretreatment May 19, 1986. Crownvetch was suppressed in 1986 by incorporating 2,4-D LVE (0.56 Kg ai/Ha) into the tank mix. Corn was harvested October 16, 1986. Plot corn yields were determined by harvesting the three (five rows per plot) inner rows. All agronomic practices were completed using tractor dependent implements.

Crownvetch growth (dry matter, coverage and density) was measured before corn planting on May 10, 1986. Ten 1/10 m2 quadrats (50 by 20 cm) were placed within each plot using random X and Y plot coordinates. Crownvetch seasonal growth was monitored from May 10, 1986 to September 10, 1986. Seasonal growth was measured using ten 1/10 m2 permanent (1 season) quadrats, arranged within each plot as described above. Permanent quadrats were made from wood lath. The quadrat perimeter was painted in a striped fashion, with each stripe being five centimeters in length. These divisions were used to visually divide the quadrat area to assist in consistent crownvetch ground coverage estimation. Crownvetch density was determined by counting the number of stems originating from the soil surface within the quadrat. As an index of light reaching the subcrop canopy, corn coverage was also monitored by the above method until pre-tassel (July 14, 1986). September 20, 1986, all the permanent quadrats were harvested.

Crownvetch dry matter was analyzed using AOV for a split-split plot design with a 2x2x3 (time 2/ by winter-annual mulch by tillage) factorial treatment arrangement. The orthogonal contrasts of no-tillage and minimum tillage vs. conventional tillage, no-tillage vs. minimum tillage, and these contrasts by time and winter-annual mulch were tested. Seasonal crownvetch growth was plotted against time. Corn yield was analyzed using AOV for a split-strip plot design with a 2x2x3 (winter-annual mulch by perennial mulch by tillage) factorial treatment arrangement. The orthogonal contrasts of no-till vs. tillages, minimum tillage vs. conventional tillage, and these contrasts by winter-annual mulch and perennial mulch were tested.

2/ Spring and fall error mean squares were not significantly different ($F^*=39.0/26.5=1.46 < F(1-.20/2;8,8)=2.59$), thus the null hypothesis (homogeneity between variances) was not rejected. Time was introduced into the analysis as the main plot factor.

RESULTS AND DISCUSSION

Analysis of variance (Table 1) for crownvetch yield showed that the interactions of time by winter-annual mulch, and winter-annual mulch by tillage were important. Though the contrast between no-tillage and minimum tillage vs. conventional tillage (P=0.29) was not significant, the contrast explains about 99 percent of the tillage treatment sums of squares. Crownvetch grown in association with a winter-annual mulch increased in dry matter (Table 2) between spring and fall, while crownvetch grown alone declined. The spring harvest showed that the dry matter of crownvetch in association with a winter-annual mulch was less than that of crownvetch grown alone. The fall harvest showed an inverse relationship to that of the spring. Crownvetch grown in association with a winter-annual mulch yielded (Table 3) highest under minimum tillage, followed by no-till, and conventional tillage. Crownvetch alone yielded highest under no-tillage, followed by minimum tillage, and conventional tillage.

The interactions of time and winter-annual mulch, and winter-annual mulch and tillage can apparently be explained by the fact that both annual rye and tillage reduce herbicide efficacy. Possible explanations for this effect are, 1) annual rye slows the development of crownvetch in the spring and intercepts applied herbicide, thus reducing the amount of herbicide received by each crownvetch plant, 2) minimum tillage buries crownvetch without the disruptive effects of conventional tillage. Under annual rye and minimum tillage the highest crownvetch yield was observed, suggesting a synergistic relationship.

Figure 1 illustrates the growth of crownvetch under winter-annual mulch and tillage treatments. Both herbicide and tillage practically eliminated crownvetch growth until about three weeks following corn planting. Stem density dropped after herbicide application and never recovered to pre-application levels. Stem density remained relatively constant compared to coverage from mid June to season end, thus increases in plant coverage can only be explained by shoot development. Crownvetch alone under no-tillage and minimum tillage entered an linear growth phase about four weeks after planting, while crownvetch in association with annual rye entered this phase three weeks after planting. Linear growth in all treatments ended about the time of corn silking. The annual rye and tillage effects on herbicide efficacy discussed above are evident by comparison of the final coverages (September 15, 1986). Season end coverage of crownvetch grown alone under no-tillage and minimum tillage was about 25 and 18 percent, respectively. Season end coverage of crownvetch grown in association with annual rye under no-tillage and minimum tillage was about 27 and 40 percent, respectively. Crownvetch coverage under conventional tillage never exceeded ten percent.

Analysis of variance for corn yield showed perennial mulch (P=0.09), and the contrast no-tillage vs. tillages by winter-annual mulch (P=0.11) important. Though the contrast between no-tillage and tillages (P=0.31) was not significant, the contrast explains about 90 percent of the tillage treatment sums of squares. Corn alone, yielded (Table 4) highest under no-tillage, while corn under minimum tillage and conventional tillage yielded similarly. Corn associated with a crownvetch living-mulch, yielded highest under minimum tillage, followed by conventional tillage, and no-tillage.

Table 1. Analysis of variance of crownvetch mean plot dry matter in g per quadrat.

Source	df	SS	MS	F-value	Prob>F
Block	2	14.27	7.13		
Time (T)	1	0.44	0.44	0.51	0.54
Error (a)	2	1.73	0.86		
Winter mulch (WM)	1	0.00	0.00	0.00	0.99
Error (b)	2	6.61	3.30		
T by WM	1	2.74	2.74	8.83	0.09
Error (c)	2	0.62	0.31		
Tillage	2	8.41	4.20	0.72	0.53
NT + Mt vs. CT	1	8.41	8.41	1.45	0.29
NT vs. MT	1	0.00	0.00	0.00	0.98
Error (d)	4	23.25	5.81		
WM by Tillage	2	3.97	1.98	2.21	0.23
NT + Mt vs. CT	1	1.44	1.44	6.13	0.06
NT vs. MT	1	2.52	2.52	10.76	0.03
Error (e)	4	0.94	0.23		
T by Tillage	2	1.96	0.98	0.59	0.58
NT + Mt vs CT	1	1.34	1.34	1.13	0.31
NT vs. MT	1	0.62	0.62	0.53	0.48
T by WM by Tillage	2	0.48	0.24	0.59	0.58
Error (f)	8	9.50	1.18		
Grand Total	35	74.96			

Table 2. Mean crownvetch yields ± 0.18 (standard error for a single table mean) for time by winter mulch treatments summed over tillage in g per quadrat.

Winter mulch	Time	
	Spring	Fall
Rye	0.96	1.74
None	1.52	1.19

Table 3. Mean crownvetch yields ± 0.19 (standard error for a single table mean) for winter mulch by tillage treatments summed over time in g per quadrat.

Winter mulch	Tillage		
	No-tillage	Minimum tillage	Conventional tillage
Rye	1.52	2.15	0.38
None	1.89	1.22	0.95

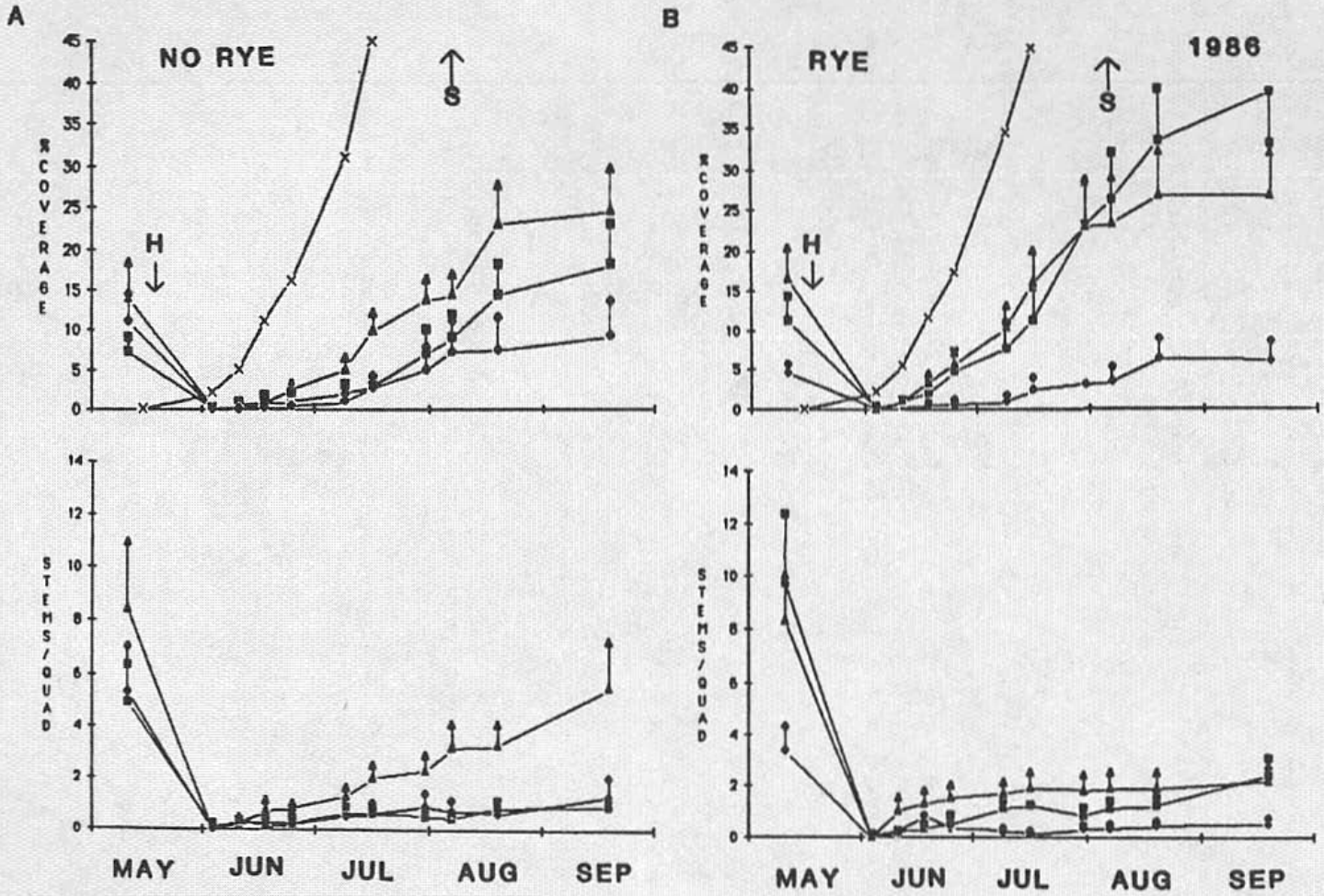

Figure 1. Seasonal crownvetch growth (quadrat mean percent coverage, and density + SE) under no-tillage (triangles), minimum tillage (squares) and conventional tillage (diamonds) against corn coverage (X's). 1A-B is crownvetch growth without, and with a winter-annual mulch, respectively. H = herbicide application; S = corn silking.

Table 4. Mean corn yields ± 1.07 (standard error for a single table mean) for perennial mulch by tillage treatments summed over winter-annual mulch in Kg per plot (bu/A).

Perennial mulch	Tillage		
	No-tillage	Minimum tillage	Conventional tillage
Crownvetch	9.78 (89)	12.14 (111)	11.40 (104)
None	14.01 (128)	13.62 (124)	13.70 (125)

When suppressed, crownvetch is not expected to provide additional nitrogen to the system (1). Excluding other beneficial relationships, corn and living-mulch would likely be competitive. Such competition may be of less consideration when the complex is managed on erosive fields. The interaction between perennial mulch and tillage may be explained by, 1) if the gain in corn yield due to reduced crownvetch (discussed below) is greater than the loss incurred due to tillage, and/or 2) tillage may reduce the competition between corn and a third species, for example a perennial weed.

In the second year of this study, herbicide will not be applied to suppress crownvetch. The components of the complex will be examined to determine if the relationships described above hold the second year under another management scheme.

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TILLAGE AND MULCH SYSTEMS STUDY IN FIELD CORN [1/]

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ABSTRACT

A field study was conducted in 1986 to evaluate the effects of different tillage and mulch systems on corn growth and yield and on weed population. Treatments included a combination of three cultural practices (conventional, minimum tillage, and no-till) with three mulching systems (living mulch, dead mulch, and no mulch). Results showed minimum tillage + no mulch performed the best in terms of both corn and silage yields, followed closely by minimum tillage + dead mulch. By employing living and dead mulch as weed biomass was considerably reduced compared to no mulch. No control of fall panicum (Panicum dichotomiflorum Michx.) was obtained. Control of ivyleaf morningglory [Ipomea hederacea (L.) Jacq], velvetleaf (Abutilon theophrasti L.), horseweed (Conyza canadensis L.) and jimsonweed (Datura stramonium L.) was variable, but generally acceptable.

INTRODUCTION

Widespread use of herbicides has often led to unwanted results such as increased production costs per acre, polluted water resources, and herbicide-resistant weed populations. For these reasons more and more attempts have been made to consider cultural practices to find methods of weed suppression using less herbicides. Among the cultural practices, with respect to weed control, one might be the use of a living mulch in the context of a reduced or no-tillage system.

Previous studies showed that using a reduced or no-tillage system, weed control becomes a major problem (2,4,5) with increased energy inputs needed. This weed problem can be considerably reduced by using a legume as living mulch (1,2), with an added advantage of getting nitrogen from the legume.

The objective of this study was to evaluate the combined effect of living mulch (LM), dead mulch (DM) and no mulch (corn alone-CA) with conventional (CT), minimum, (MT) and no-tillage (NT) systems on field corn (Zea mays L.) growth and yield, as well as on weed populations. Subterranean clover (Trifolium subterraneum L.), used as a living mulch, is a winter annual forage legume native to Mediterranean areas (3). Subterranean clover, besides its ability to reseed in greenhouse and field trials performed at the Adelphia Research Center,

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[1/] New Jersey Agricultural Experiment Station Publication No. J-15173-1-86.

[2/] Weed Sci. Tech. and Res. Prof. of Weed Sci., respectively, Dept. of Soils and Crops, N. J. Agr. Exp. Stn., Cook College-Rutgers University, New Brunswick, N.J. 08903.

Adelphia, N. J. in 1985-1986, indicated an increase in nitrogen level as much as 250-300 kg/ha. As dead mulch, an annual rye (Secale cereale L.) was used.

MATERIALS AND METHODS

This study was conducted in 1986 at the Adelphia Research Center, Adelphia, N.J. Soil was a Sassafras loam with 1.8% organic matter and a pH of 6.1. The experimental design was a 3 by 3 factorial C.R. with 4 replications including all major combinations of tillage practices and mulch treatments which are at the present time reasonable for commercial practice within the region.

Conventional tillage (CT) included moldboard plowing followed by tandem disc and springtooth cultivator, minimum tillage (MT) consisted of tillage by a heavy offset disc followed by a springtooth cultivator; and for no-till (NT) a commercial planter designed for this purpose was used.

The cultivar used for corn was Midstates 747 and Nangeela for subterranean clover. The planting dates were August 24, 1985, for the subclover, September 26, 1985 for rye and May 29,1986 for corn. The herbicides applied were glyphosate (3 kg/ha) to kill the living rye to create the dead mulch (May 13, 1986) and metolachlor + atrazine (1.68 + 1.34 kg/ha) applied in a band over the row to knock down the subclover (May 30, 1986).

Herbicide applications were made using a CO_2-propelled backpack sprayer using water as the carrier, delivering a volume of 378 l/ha at a pressure of 220 kPa.

Two destructive harvests for evaluating weed and clover biomass (DM) were made on July 29 and Octuber 7 within randomly placed 50 x 50 cm squares (4 per each plot of 9 x 6 m). On July 29, weed, clover and corn were visually rated for stand and vigor. Number of plants/ha, plant heights and number of leaves/plant for corn were also recorded. On September 26, 2 rows of corn from each plot were harvested for silage yield (DM) determinations.

On October 7, 1986, the corn was harvested for grain and adjusted to 15.5% moisture; weed and subclover biomass (DM) and subclover comeback and vigor were also recorded.

All data were subjected to statistical analyses by analyses of variance and LSD multiple comparison tests were made.

RESULTS AND DISCUSSION

Of the weeds present in the field, fall panicum was by far the most abundant specie. From Table 1 it can be seen that none of the treatments provided satisfactory control of fall panicum. With respect to other weeds, dead mulches provided better control of velvetleaf,

ivyleaf morningglory was better controlled by living mulches than dead mulches. With regard to the weed cover treatments containing living mulch performed the best (20%, 21.2% and 27.5%). This suggests that under conditions of having well-established living mulch, weed problems can be considerably reduced. From Table 1 it can be seen that minimum and no-tillage systems provided better weed control and less area open to weeds than conventional tillage.

A similar pattern is shown in Table 2, where the effects of tillage and mulch on weeds and clover biomass (DM) are presented. At the first harvest (July 29) conventional tillage resulted in greater weed biomass than minimum or no-tillage. Living mulch at that date resulted in less weed biomass than dead mulch or corn alone. At the end of the growing season (October 7) corn alone resulted in the largest weed biomass. For both harvests, a significant difference among treatments was obtained. The largest clover biomass was obtained using minimum tillage (Trmt. 6). The highest percentage of subclover recovery was recorded for the same treatment.

Corn was initially planted at a rate of approximately 70,000 plts/ha. From Table 3, it can be seen that no statistically significant differences were present for any of the treatments with respect to number of plants/ha, plant heights or number of leaves/plant of corn. A significant difference among the treatments was obtained with regard to yield grain and silage yields. These were the highest for the combination minimum tillage + no mulch treatment. The second best treatment was minimum tillage + the dead mulch combination.

There were no significant differences in tillage systems. The greatest variability was given by the mulch factor.

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Table 1. Effect of tillage and mulch systems on weed control.[1]

Treatment	WEED CONTROL					Weed Cover, %
	PANDI[2]	IPOHE	ABUTH	CONCA	DATST	
1. CT + DM	3.8	8.5	10.0	10.0	10.0	31.5
2. CT + CA	5.8	3.8	7.0	7.5	8.5	28.5
3. CT + LM	1.0	10.0	9.8	3.0	10.0	27.5
4. MT + CM	2.5	6.5	10.0	10.0	10.0	48.7
5. MT + CA	3.5	3.5	8.0	10.0	10.0	25.0
6. MT + LM	4.3	8.3	9.8	6.8	10.0	20.0
7. NT + DM	1.3	6.0	10.0	10.0	7.0	37.5
8. NT + CA	1.8	10.0	8.8	3.8	8.3	51.5
9. NT + LM	4.3	10.0	10.0	3.8	10.0	21.2
LSD 0.05						NS

[1] Weed control: 0-10 scale; 0 = no control, 10 = total control (Rated July 29).
[2] PANDI = Panicum dichotoflorum Michx.
IPOHE = Ipomea hederacea (L) Jacq.
ABUTH = Abutilon theophrasti L.
CONCA = Conyza canadensis L.
DATST = Datura stramonium L.

Table 2. Effect of tillage and mulch systems on weeds and clover biomass (DM)

Treatment	Weed biomass (dry weight)		Subclover biomass (dry weight)	Subclover	
	July 29 kg/ha	Oct. 7 kg/ha	kg/ha	Comeback %	Vigor %
1. CT + DM	660 c[1]	3930 ab			
2. CT + CA	2860 ab	3140 ab			
3. CT + LM	1680 bc	1820 bc	1960 ab	65.8	71.5
4. MT + DM	772 bc	1632 bc			
5. MT + CA	2920 a	3412 ab			
6. MT + LM	1912 b	2460 b	2440 a	71.6	76.8
7. NT + DM	3548 a	3712 ab			
8. NT + CA	3092 a	4880 a			
9. NT + LM	1490 bc	1400 c	1280 b	58.8	85.0
LSD 0.05					

[1] LSD 5% level - Means followed by the same letter are not significantly different.

Table 3. Effects of tillage and mulch systems on plant growth components, grain and silage yields, Adelphia, N.J., 1986.

Treatment	Growth Components[1]			Corn Grain[2]			Silage
	No. Plants x 1000 per Ha	Height cm	No. Leaves per plant	Rating S July 29	Rating V July 29	Yield Oct. 7 kg/ha	Yield Sept. 30 Mt/Ha[3]
1. CT + DM[5]	59.6	115.5	12.5	0.0	1.8	5946 abc[4]	8.2 bc
2. CT + CA	65.3	120.0	13.0	0.5	0.5	7178 abc	10.3 ab
3. CT + LM	56.9	99.3	12.0	1.8	1.0	6256 abc	5.9 c
4. MT + DM	54.2	121.0	12.5	0.0	0.3	7277 abc	7.9 c
5. MT + CA	69.1	121.5	13.5	0.0	0.0	9093 a	10.8 a
6. MT + LM	55.6	101.8	11.5	1.0	1.3	3948 c	6.0 c
7. NT + DM	58.7	118.0	13.0	0.3	2.0	6663 abc	6.9 c
8. NT + CA	59.2	101.8	11.5	1.0	2.8	5020 bc	7.2 c
9. NT + LM	52.0	92.0	11.0	1.5	1.5	5532 bc	6.7 c
LSD 0.05	NS						

[1] As rated on July 29, 1986
[2] At 15.5% moisture content
[3] MT/Ha = Metric ton/hectare
[4] LSD 5% level - Means followed by the same letter are not significantly different
[5] CT = Conventional tillage
DM = Dead mulch
LM = Living mulch
MT = Minimum tillage
CA = Corn alone
NT = No tillage

ALFALFA CONTROL IN NO-TILLAGE CORN

S. J. Olsen and N. L. Hartwig[1/]

ABSTRACT

Alfalfa (Medicago sativa L. 'Iroquois') is a problem weed when no-tillage corn (Zea mays L.'Pioneer 3591 (R)') is planted into an old alfalfa sod. A single treatment at planting time is commonly ineffective which means a post treatment of dicamba is required to finish the alfalfa off. An experiment was conducted in central Pennsylvania to determine the efficacy of several spring applied herbicide treatments on a two year old alfalfa sod, and secondarily to determine if an early atrazine treatment applied in late March preceeding the planting time treatment would improve the control of alfalfa.

Six herbicide treatments were included in the study (Table 1). The first set of three treatments had atrazine applied on March 25 at 2.0 lbs ai/A. The second set of three treatments had atrazine at 2.0 lbs ai/A included with the preemergence treatments on April 28 when alfalfa was six inches tall.

Alfalfa control is critical in corn production since it can drastically reduce corn yields. All treatments containing the pre-mix of the potassium salt of dicamba and atrazine both with or without 2,4-D gave excellent alfalfa control and control was not improved by splitting out 2 lb/A of atrazine ane applying it early. The treatment containing the early application of atrazine and pre-mix of the potassium salt of dicamba and atrazine produced the highest corn yield, although not significantly different from the same treatment with 2,4-D (Table 1). These treatments also resulted in greater corn stand, height and lower alfalfa and broadleaf weed yield. Grass weed yield for the two treatments using 2,4-D were significantly greater because of the better broadleaf control, thus permitting more grass growth.

The split application of atrazine was not seen to significantly increase the control of alfalfa when yield ratings were taken at the end of August, but did significantly increase the corn yields except for the treatments using 2,4-D.

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Table 1. Effect of Spring Applied Treatments For Alfalfa Control in No-Tillage Corn - 1986

No.	Treatment	Timing	Rate	Alfalfa Control	Alfalfa Yield	BLeaf Yield	Grass Yield	Corn Height	Corn Yield
			(lb ai/A)	(%)	(Dry Matter in lb/A)			(Inches)	(bu/A)[1]
1	(A) + simazine 90DF + atrazine 90DF	Pre	2 + 1 + .92	38 c[2]	47 a	24 b	27 ab	76 ab	142 c
2	(A) + simazine 90DF + (B)	Pre	2 + 1 + 1.4	79 ab	5 b	26 b	5 b	79 ab	178 a
3	(A) + simazine 90DF + (B) + 2,4-D LVE	Pre	2 + 1 + 1.4 + .5	95 a	0.5 b	11 b	59 a	80 a	167 ab
4	atrazine 90DF + simazine 90DF	Pre	2.92 + 1	42 c	62 a	47 a	32 ab	68 c	97 d
5	atrazine 90DF + simazine 90DF + (B)	Pre	2 + 1 + 1.4	74 b	6 b	22 b	29 ab	76 b	140 c
6	atrazine 90DF + simazine 90DF + (B) + 2,4-D LVE	Pre	2 + 1 + 1.4 + .5	86 ab	3 b	13 b	70 a	78 ab	145 bc

[1] Bushels/Acre at 15.5% moisture

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

(A)atrazine 4L at 2.0 lb ai/A applied 3/25/86

(B)pre-mix of K salt of dicamba + atrazine at 1.1 + 2.2 lb ai/A

PYRIDATE AND PRE- AND POSTEMERGENCE COMBINATIONS IN CORN [1/]

M. J. Else, R. D. Ilnicki and A. Enache [2/]

ABSTRACT

Studies at the Adelphia Research Center in Freehold, New Jersey in 1984 and 1985 indicated that pyridate shows promise for postemergence weed control in corn (Zea mays L.). Further studies on the performance of pyridate and preemergence and postemergence herbicide combinations were conducted in 1986.

Corn (cv. 'Midstates 747B') was planted on May 13. Postemergence applications were made on May 30 when corn was in the three-leaf stage. Seedling weeds present at the time of treatment were ivyleaf morningglory (Ipomea hederacea (L.) Jacq.), common lambsquarters (Chenopodium album L.), redroot pigweed (Amaranthus retroflexus L.), giant foxtail (Setaria faberi Herrm.), barnyardgrass (Echinochloa crus-galli L.), and jimsonweed (Datura stramonium L.). Crop and weeds were rated for stand and vigor on August 6.

Weed rating results showed that pyridate performed well in controlling giant foxtail, barnyardgrass and redroot pigweed. Pyridate did not control common lambsquarters, and provided only partial control of ivyleaf morningglory and velvetleaf. Yield performance was best in pyridate treatments which also included preemergence metolachlor.

Conclusions from the three years of study are that pyridate may prove useful for postemergence weed control in corn, particularly for control of triazine-resistant pigweed. Control of some weeds, however, will have to be achieved through the addition of other preemergence and postemergence herbicides.

1/ New Jersey Agricultural Experiment Station Publication No. J15472-5-86.

2/ Graduate student, Res. Prof. of Weed Sci., Weed Sci. Tech., respectively, Dept. of Soils and Crops, N.J. Agr. Exp. Stn., Cook College-Rutgers University, New Brunswick, N.J. 08903.

ACTIVITY OF TRIDIPHANE IN ANNUAL GRASS CONTROL IN CORN

P.C. Bhowmik, S.M. Podmayer, and B.J. Germond, Sr.[1/]

ABSTRACT

The postemergence effectiveness of tridiphane applied alone or in combination with atrazine in field corn was compared with other herbicide treatments in field experiments conducted at the University of Massachusetts Experiment Station. Major weed species were large crabgrass [Digitaria sanguinalis (L.) Scop.], fall panicum (Panicum dichotomiflorum Michx.), yellow foxtail [Setaria lutescens (Weigel) Hubb.], redroot pigweed (Amaranthus retroflexus L.), and common lambsquarters (Chenopodium album L.). Corn 'Agway 584s' was planted on a Hadley fine sandy loam soil on May 15,1985 and May 5,1986 at a density of 63,790/ha and row spacing of 75 cm. Plots were 3 m by 6 m. On May 16,1985 and May 6,1986 preemergence herbicide treatments were applied with a CO2 backpack sprayer in 136 L/ha at 152 kPa. Postemergence treatments were applied on June 19,1985 when the grasses were at the 4- to 6-leaf stage, followed by 7-day split applications on June 25,1985. In 1986, postemergence treatments were made on May 28 and June 10, when the grasses were at the 1- to 3-leaf and 4- to 6-leaf stages, respectively. Split applications following late postemergence treatments were applied on June 18,1986.

Visual injury ratings (July 12, 1985 and June 17, 1986) indicated little or no injury for all herbicide treatments. Weed control ratings (July 12,1985) indicated excellent (above 95%) control of all weed species present for all herbicide treatments. By September 12, 1985, all herbicide treatments maintained excellent control of all weed species, with a split application of tridiphane showing little advantage over a single application. In 1986, weed control ratings (June 17) indicated excellent control of all weed species with all herbicide treatments. Tridiphane treatments showed excellent grass control on August 19, with the split application of tridiphane giving greater season-long control than the split application of atrazine alone in 1986.

Silage yields from all herbicide treatments in both 1985 and 1986 were significantly greater than that of the untreated check. The highest silage yields were obtained with tridiphane and atrazine (0.84 and 2.24 kg/ha) at the 4- to 6-leaf stage plus a 7-day split application of atrazine (1.12 kg/ha) and with the hoed check in 1985. In 1986, highest silage yields were obtained with the treatment combination of atrazine and cyanazine at 1.68 and 2.24 kg/ha applied at the 1- to 3-leaf stage, and with the hoed check.

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FALL HERBICIDE APPLICATIONS FOR NO-TILLAGE CORN IN SODS

Russell R. Hahn[1/]

ABSTRACT

The frequent failure to adequately control dandelion (*Taraxacum officinale* Weber in Wiggers #[2] TAROF) and the remaining alfalfa (*Medicago sativa* L. #MEDSA) when planting no-tillage corn (*Zea mays* L.) in sods prompted investigations to compare at-planting herbicide programs with weed control programs initiated the previous fall. The experiments were conducted on a gravelly loam soil with 2.8% organic matter in Columbia County, New York. A randomized complete-block design with four replications was used for experiments initiated in 1983 and 1984. Herbicide treatments were applied in water to 10 by 25 ft plots using flat spray tips mounted on a compressed air plot sprayer. Alfalfa and dandelion control ratings were made in July each year. In addition, large crabgrass [*Digitaria sanguinalis* (L.) Scop. #DIGSA] control ratings were made in 1984. Grain yields were determined by harvesting an area 5 by 15 ft in the center of each plot.

Two general approaches were employed for sod suppression. One compared split applications of atrazine with programs where all of the atrazine was applied at planting. The other compared fall or spring applications of glyphosate. In both cases, the fall applications were followed by at-planting applications of flowable atrazine and cyanazine with 1/4% (v/v) of nonionic surfactant. This at-planting application provided knockdown of emerged weed seedlings and provided part, or all of the residual weed control for those treatments initiated the previous fall. Similar quantities of atrazine and cyanazine were tank-mixed with glyphosate when the latter was applied at planting. Finally, paraquat was used for knockdown when all of the atrazine was applied at planting. Examples of these two approaches are shown in Table 1 along with weed control ratings, corn populations, and grain yields for these treatments.

Sod control programs initiated in the fall were more effective in controlling dandelion and alfalfa and resulted in significantly higher corn populations than their spring-applied counterparts (Table 1). These differences in weed control and plant populations were not reflected in grain corn yields. This lack of yield response is attributed to the fact that soil moisture conditions were favorable during critical periods of the growing season in both 1984 and 1985. Similar rates of 2,4-D(LVE) or dicamba were equally effective in controlling dandelion when tank-mixed with atrazine and applied in the fall, however, when tank mixed with atrazine, cyanzine and paraquat at planting, 2,4-D(LVE) was more effective against this perennial broadleaf species.

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[2/] Letters following this symbol are a WSSA-approved computer code from Composite List of Weeds, Weed Sci. 32, Suppl. 2. Available from WSSA, 309 West Clark Street, Champaign, IL 61820.

Table 1. Weed control ratings, population counts, and grain corn yields in 1984 for selected herbicide programs initiated the previous fall or at planting for no-tillage corn in sod.

			Weed Control[a/]			Corn	
Herbicides	Rate	Timing	MEDSA	TAROF	DIGSA	Population	Yield
	(lb/A)					(plants/A)	(bu/A)
Atrazine (4L)	2.0	Fall	8.8	9.3	6.3	21,650	153
2,4-D (LVE)	0.5	Fall					
Crop Oil Conc.	- [b/]	Fall					
Atrazine (4L)	2.0	Spring					
Cyanazine (4L)	2.0	Spring					
Nonionic Surfactant	- [c/]	Spring					
Atrazine (4L)	4.0	Spring	6.5	7.8	4.8	19,875	150
Cyanazine (4L)	2.0	Spring					
2,4-D (LVE)	0.5	Spring					
Paraquat	0.5	Spring					
Nonionic Surfactant	- [c/]	Spring					
Glyphosate	2.0	Fall	9.5	10.0	6.8	21,350	145
Atrazine (4L)	2.0	Spring					
Cyanazine (4L)	2.0	Spring					
Nonionic Surfactant	- [c/]	Spring					
Glyphosate	2.0	Spring	5.8	7.3	2.8	18,875	139
Atrazine (4L)	2.0	Spring					
Cyanazine (4L)	2.0	Spring					
LSD (0.05)			(0.9)	(0.8)	(1.2)	1,600	17

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

[b/] Booster Plus E added at 1% (v/v) of spray mixture.

[c/] X-77 added at ¼% (v/v) of spray mixture.

NO-TILL CORN: SURFACE APPLIED VERSUS IMPREGNATED HERBICIDES

L. M. Kaufman and R. L. Ritter[1/]

ABSTRACT

Field studies were conducted in 1984 to 1986 to examine the efficacy of herbicides applied in water or impregnated on dry fertilizer, for the control of triazine resistant smooth pigweed (Amaranthus hybridus L.) in no-tillage corn (Zea mays L.). Trials were conducted in Beltsville, MD, on a site containing a natural population of triazine resistant smooth pigweed. The soil, a Galestown silt loam, had a pH of 6.8 with 2.5% (w/w) organic matter. At time of application, the site averaged a 75% residue cover of corn stover and dried weed residue all 3 years. Studies were arranged as randomized complete block designs with three replications. Individual plots were eight rows wide (0.8 m row spacing) by 8 m long in 1984 and 1986, and twelve rows wide by 9 m long in 1985. Corn (var. 'Pioneer 3184' in 1984, 'Pioneer 3192' in 1985 and 1986) was no-till planted by May 1 every year.

Herbicide applications were made by May 1, all 3 years. Herbicides applied in water (hereafter referred to as surface applications) were made with a CO_2 pressurized backpack sprayer that delivered 187 L/ha of water carrier at 138 kPa pressure, traveling 4.8 km/h. Impregnated applications were accomplished by mixing prescribed amounts of herbicide and fertilizer in a cement mixer, then immediately broadcasting this mixture by hand to established plots. In 1984 and 1985, 1120 kg/ha of a 16-8-8 grade fertilizer were applied to the test site, either alone or as an impregnated fertilizer. In 1986, 672 kg/ha of a 14-7-7 grade fertilizer were used. Additional nitrogen, as ammonium nitrate, was broadcast across the site in 1986. Visual weed control ratings were made throughout the season on a scale of 0 to 100, with 0 indicating no weed control and 100 corresponding to complete control. Yields were obtained with a standard field combine.

In 1984, impregnated applications of butylate or EPTC were superior in the control of smooth pigweed in comparison to surface applications of these materials. Best control was achieved with impregnated applications of EPTC. In 1986, microencapsulated formulations of butylate and EPTC were examined as surface applications, versus impregnated applications of the emulsifiable liquid formulations. In general, either formulation of butylate was weak in controlling smooth pigweed. Best control was obtained with the microencapsulated formulation of EPTC.

Cycloate was also studied all 3 years. In general, regardless of rate, impregnated applications of cycloate performed better in the control of smooth pigweed than surface applications. As impregnated applications, control achieved with cycloate was better than that achieved with EPTC.

Alachlor and metolachlor were also examined in these studies. It appeared that surface applications of alachlor provided better control of smooth pigweed than impregnated applications. Results obtained with metolachlor were variable. No definite conclusions comparing efficacy obtained with either product were drawn.

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Field Studies with SC-0051 AND SC-0774 in Corn

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ABSTRACT

Field studies to investigate the efficacy of two experimental corn (Zea mays L. 'Pioneer 3378'®, 'Pioneer 3352'®, and 'Gutwein 69 B'®) herbicides, SC-0051 and SC-0774, were conducted at the Eastern Shore Agricultural Experiment Station, Painter, Virginia. The studies took place during 1985 and 1986 growing seasons, under both conventional and no-tillage cropping systems. The two herbicides exhibited markedly different spectra of weed control. With SC-0051, preemergence treatments at 1.1 kg ai/ha and postemergence treatments at 0.6 kg/ha, provided good control of common lambsquarters (Chenopodium album L.), common ragweed (Ambrosia artemisiifolia L.), and smooth pigweed (Amaranthus hybridus L.). Postemergence treatments of SC-0051 at 0.6 kg/ha also controlled fall panicum (Panicum dichotomiflorum L.) and partially controlled large crabgrass [Digitaria sanguinalis (L.) Scop.] and giant foxtail (Setaria faberi Herrm.). Preemergence treatments of SC-0774 at 1.1 kg ai/ha provided good control of large crabgrass and fall panicum, and suppressed giant foxtail and common lambsquarters. Corn showed no injury at these use rates. While neither herbicide applied alone provided acceptable control of both broadleaf and grass weeds, combinations of the two herbicides or combinations with atrazine and/or metolachlor provided good broad- spectrum weed control. The postemergence activity of SC-0051 was greatly enhanced with 1% (v/v) crop oil concentrate.

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GIANT FOXTAIL AND VELVETLEAF CONTROL IN NO-TILLAGE CORN

N. L. Hartwig[1]

INTRODUCTION

Giant foxtail (Setaria faberi Herrm.) and velvetleaf (Abutilon theophrasti Medic.) continue to be two of the most common weeds in corn (Zea mays L.). They tend to be somewhat more of a problem in no-tillage corn due to reduced herbicide activity as a result of crop and weed residues. It is also common for some of these weeds to already have germinated by the time the corn is planted. Therefore, preemergence herbicides must be applied up to four weeks before planting to be effective. This is possible only when one or more components of the herbicide mixture has a residual activity of 10 to 12 weeks to carry through until the corn canopies over. When the initial herbicide treatment is delayed until planting time, one or more components of the herbicide mixture must have contact or post-emergence activity to eliminate the emerged weeds. For control of giant foxtail and velvetleaf, herbicide mixtures must be effective on grasses and broadleaves with a possible third herbicide component for contact or post-emergence activity.

MATERIALS AND METHODS

Two studies were conducted at State College, PA in a field that has a long history of giant foxtail infestation and a minor but significant problem with velvetleaf. The weeds were allowed to go to seed the year before each trial was established. The soil is a Hagerstown silt loam (Typic Hapludult) with approximately 10% sand, 67% silt, 20% clay and 2.5% organic matter. Soil pH was 6.0 in 1984, but no lime was applied, and 6.2 in 1985 before 3000 lb/A of calcitic lime was applied. Fertility was maintained according to a soil test with 100 lb/A of 10-30-10 applied in the row at planting and 150 lb/A of nitrogen applied broadcast as ammonium nitrate in 1984 and urea in 1986 just after corn planting. Granular carbofuran was applied in the row at the rate of 1 lb/A for corn root worm and other soil insect control. The trials were randomized complete block designs with three replications. The plots were 15 by 25 ft. with 6 (30 inch) corn rows per plot. A 5 ft. alleyway was created by killing the corn at the end of each plot, leaving a working plot size of 15 by 20 ft.

'Doeblers 58X' corn was planted with a John Deere Maximerge no-till planter on May 22, 1984. Preplant treatments were applied May 17 when giant foxtail was up to two-leaf stage, preemergence treatments on May 22 when giant foxtail was up to two-leaf stage and early post treatments were applied on June 4 when giant

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foxtail was up to three-leaf stage and corn was in the two- to three-leaf stage. 'Pioneer 3591' corn was planted with a John Deere Maximerge no-till planter on May 20, 1985. Preplant treatments were applied May 13 when giant foxtail was in the two- to three-leaf stage, and post treatments June 11 when giant foxtail was eight- to ten-inches and corn was in the five-leaf stage. All treatments were applied with a small tractor mounted plot sprayer with 8001 LP flat fan nozzles at 22 psi pressure in 20 gal/A of water.

RESULTS AND DISCUSSION

In 1984, almost all herbicide treatments gave better than 90% overall weed control on May 22 and better than 95% control on June 29 except for the weedy check (Table 1). None of the treatments significantly reduced corn stand or height which would indicate that all of these treatments are safe for use on corn. The only treatment that did not effectively control giant foxtail as indicated by the giant foxtail yield at the end of the season was treatment 9 (paraquat PP followed by atrazine + tridiphane E. post when giant foxtail was 6 to 8 in.). This was also the only treatment that had a significant reduction in corn yield, undoubtedly due to giant foxtail competition. Giant foxtail yields up to 1000 lb/A were not significantly different from zero.

Velvetleaf control was excellent for all treatments except for treatments 9 (sethoxydim + Bicep + 2,4-D LVE @ 0.1 + 2.25 + 0.5 lb ai/A PP) and 21 (alachlor ME + atrazine + glyphosate Pre @ 2.5 + 1.5 + 1 lb ai/A). The herbicides in treatment 9 did not have enough residual activity to control late germinating velvetleaf. Alachlor is known for being very weak on velvetleaf and the atrazine in treatment 21 was not sufficient to provide control.

In summary, effective treatments for control of a mixture of giant foxtail and velvetleaf in no-tillage corn include a burndown herbicide such as cyanazine or paraquat or a good foliar systemic grass herbicide such as sethoxydim or glyphosate applied preplant or preemergence to the corn. Herbicides with sufficient residual activity to provide control until the corn is canopied over, may be tank mixed with any of the above foliar applied herbicides. Such herbicides include atrazine, simazine, alachlor, metolachlor, MON-091 or pendimethalin .

If some giant foxtail has escaped the initial treatment, post-emergence control is possible with atrazine + tridiphane or cyanazine + tridiphane. In order for tridiphane to work, the giant foxtail can not be past the three-leaf stage. For treatment nine, paraquat did not have any residual activity to hold the giant foxtail back. It was six- to eight-inches tall before the atrazine + tridiphane was applied which resulted in very poor control. Escaped velvetleaf can be controlled with a number of foliar applied herbicides such as EH 540, bromoxynil, atrazine or pendimethalin.

Table 1. Research results for giant foxtail and velvetleaf control in no-tillage corn - 1984

Treatment				Weed Control		Corn			Giant		Corn
No	Herbicide	Timing	Rate	5/22	6/29	Injury	Stand	Height	Foxtail	Velf	Yield
			lb ai/A	%	%	%	plants/A	cm	----lb/A-----		bu/A
1	cyanazine + pendimethalin	E.Post	2+1.5	92.a[a]	100.a	3.c	24,878.a	253.a	826.bc	0.b	106.ab
2	cyanazine + Bicep PP + dicamba	E.Post	2+2.25+.25	99.a	99.a	3.c	24,103.a	254.a	68.c	9.b	115.ab
3	cyanazine + Bicep PP + EH 540[b](8oz)	E.Post	2+2.25+.3	97.a	99.a	3.c	25,362.a	258.a	892.bc	23.b	119.ab
4	cyanazine + Bicep PP + EH 540[b](12oz)	E.Post	2+2.25+.45	99.a	99.a	10.bc	22,942.a	234.a	87.c	48.b	111.ab
5	cyanazine + Bicep PP + atrazine + EH 540[b]	E.Post	2+2.25+2+.3	100.a	100.a	3.c	25,071.a	241.a	3.c	0.b	115.ab
6	cyanazine + Bicep PP + atrazine + EH 540[b]	E.Post	2+2.25+2+.45	100.a	100.a	12.bc	22,942.a	226.a	0.c	0.b	89.ab
7	sethoxydim + Bicep + 2,4-D LVE	PP	0.1+2.25+0.5	97.a	86.a	7.bc	24,103.a	214.a	167.c	765.a	92.ab
8	sethoxydim + Bicep + bromoxynil	PP E.Post	0.1+2.25+ 0.5	97.a	98.a	12.bc	23,910.a	249.a	971.bc	8.b	133.a
9	paraquat[c] PP + atrazine + tridiphane	E.Post	0.25+1.5+0.5	87.a	100.a	13.bc	23,426.a	219.a	1,994.ab	0.b	73.bc
10	cyanazine PP + atrazine + tridiphane	E.Post	2+1.5+0.5	95.a	95.a	13.bc	23,522.a	217.a	145.c	150.b	84.abc
11	cyana + tridiphane[d] PP+ atrazine + tridiphane	E.Post	2+0.5+1.5+0.5	99.a	100.a	15.bc	24,878.a	239.a	14.c	0.b	116.ab
12	atr + tridiphane[d] PP + atrazine + tridiphane	E.Post	2+0.5+1.5+0.5	100.a	100.a	15.bc	23,232.a	231.a	0.c	0.b	115.ab
13	cyana PP + tridiphane + cyana	E.Post	2+0.5+1.6	99.a	100.a	13.bc	23,522.a	241.a	275.c	0.b	92.ab
14	alachlor + pendimeth + cyanazine	Pre	1.5+1+2	99.a	99.a	3.c	23,813.a	244.a	145.c	38.b	115.ab
15	alachlor + pendimeth + atrazine	Pre	1.5+1+1	99.a	96.a	5.c	24,587.a	243.a	54.c	75.b	108.ab
16	alachlor + pendimeth + atrazine	Pre	2.0+1+1	99.a	95.a	3.c	24,587.a	252.a	81.c	23.b	124.ab
17	alachlor + pendimeth + atrazine	E.Post	1.5+1+1	90.a	99.a	8.bc	24,006.a	238.a	964.bc	5.b	107.ab
18	alachlor + pendimeth + atrazine	E.Post	2.0+1+1	95.a	99.a	5.c	23,426.a	245.a	754.bc	15.b	119.ab
19	acetochlor + atr + glyphosate	Pre	2.0+1.5+1	100.a	99.a	15.bc	23,232.a	237.a	3.c	17.b	106.ab
20	alachlor EC + atr + glyphosate	Pre	2.5+1.5+1	98.a	97.a	12.bc	22,264.a	241.a	167.c	105.b	107.ab
21	alachlor ME + atr + glyphosate	Pre	2.5+1.5+1	99.a	98.a	7.bc	24,490.a	246.a	65.c	213.a	109.ab
22	simazine + atr + glyphosate	Pre	1.5+1.5+1	99.a	99.a	13.bc	22,070.a	221.a	12.c	6.b	101.ab
23	alachlor EC + atr + cyanazine	Pre	2.5+1+2	99.a	93.a	5.c	24,006.a	252.a	14.c	23.b	125.ab
24	alachlor ME + atr + cyanazine	Pre	2.5+1+2	100.a	95.a	13.bc	23,522.a	233.a	4.c	75.b	104.ab
25	Hoed Check		--	98.a	100.a	45.a	21,780.a	218.a	17.c	9.b	106.ab
26	Weedy Check		--	23.b	94.a	25.b	22,361.a	164.b	3,357.a	60.b	40.c

[a] Means followed by the same letter are not significnatly different at the 5% level according to Duncan's new multiple range test.

[b] Mixture of DMA salts of 2,4-D, MCPP and dicamba @ 2.6 + 1.3 + 0.9 lbs ai/gal.

[c] Includes X-77 @ 8 oz/100 gal (1.6 oz/A)

[d] Includes emulsifiable crop oil @ 1 qt/A

In 1985, giant foxtail control on July 20 was better than 68% for all treatments except those containing bifenox (treatments 28-30). Bifenox does not have enough burndown activity to control emerged giant foxtail. Competition also resulted in severe stunting of the corn. Velvetleaf infestation was not that great and every treatment gave 85% control or better. Herbicide injury resulted in severe stunting for treatments 8 and 9 (cyanazine + atrazine or pendimethalin + 2,4-D applied post). The corn was in the five-leaf stage when these treatments were applied, but the major reason for injury was the 2,4-D in the mixture. The corn was almost flat for about a week after treatment. Corn stands were significantly reduced in the weedy check and treatment 11 (alachlor + atrazine), for which there is no logical explanation. None of the treatments gave perfect weed control, however, only the weedy check and those treatments containing bifenox were significantly worse than the rest in controlling giant foxtail. When giant foxtail control was poor, velvetleaf control was good due to competition. When giant foxtail was resonably good, the only treatment that provided significantly worse velvetleaf control than the best was treatment 16, (alachlor + cyanazine @ 3 + 1.5 lb/A). Corn yields were generally significantly reduced when giant foxtail dry weight yields exceeded 1000 lb/A.

In summary, the same herbicides good for burndown in 1984 were also good in 1985. Residual herbicides for grass control might also include CGA 172764 and CGA 174104. Residual herbicides for broadleaf weed control should also include pyridate. The only additional post emergence broadleaf herbicide that should added to those found effective in 1985 is CN-11-6180 (premix of atrazine + dicamba). There were no treatments better than the proven standard of cyanazine + atrazine + metolachlor @ 2 + 1 + 1.25 lb/A but many treatments were equal.

ACKNOWLEDGEMENT

I would like to thank all of those chemical companies whose herbicides are represented in these trials for the financial support.

Table 2. Research results for giant foxtail and velvetleaf control in no-tillage corn - 1985

Treatment				Weed Cont.7/20			Corn				
No	Herbicide	Timing	Rate	Gift	Velf	Injury	Height	Stand	Giant Foxtail	Velf	Corn Yield
			lb ai/A	%	%	%	cm	plants/A	------lb/A------		bu/A
1	cyana + atrazine + metolachlor	PP	2 + 1 + 1.25	96.a[a]	99.ab	0.e	226.abc	25,942.a	382.d	0.c	126.abc
2	cyana + pyridate + metolachlor	PP	2 + .9 + 1.25	92.a	97.abc	0.e	229.ab	25,942.a	337.d	51.abc	125.abc
3	sethoxydim + Bicep + 2,4-D LVE	PP	.15 + 2.25 + .5	89.a	86.cd	13.cde	196.a-e	24,200.a	427.d	323.ab	98.a-e
4	metolachlor + paraquat + X-77[b]	PP	2 + .25 + .25	92.a	97.abc	0.e	220.a-d	26,426.a	434.d	110.ac	98.a-e
5	+ dicamba	Post	4 + .25 + .25	98.a	99.ab	5.de	216.a-d	26,620.a	303.d	26.abc	125.abc
6	CGA 172764 + paraquat + X-77[b]	PP	2 + .25 +								
	+ Banvel	Post	.25	88.a	99.a	3.e	202.a-e	26,523.a	899.d	0.c	93.a-e
7	CGA 174104 + paraquat + X-77[b]	PP	2 + .25+								
	+ dicamba	Post	.25	82.a	94.a-d	13.cde	184.a-e	25,652.a	869.d	280.abc	84.a-e
8	cyanazine + atrazine. + 2,4-D[c]	Post	2 + 1 + .25	88.a	100.a	33.bc	180.b-e	25,071.a	1,827.bcd	0.c	87.a-e
9	cyana + pendimethalin + 2,4-D[c]	Post	2 + 1.5 + .25	77.a	100.a	43.ab	151.ef	23,522.ab	1,895.bcd	0.c	76.b-e
10	alachlor EC +	PP	2.5 + 1.5	89.a	97.abc	23.b-e	189.a-e	27,104.a	704.d	144.abc	79.b-e
11	atrazine	PP	3.0 + 1.5	92.a	99.a	0.e	217.a-d	17,134.c	472.d	24.abc	118.a-d
12	alachlor MT	PP	2.0 + 1.5	80.a	95.a-d	2.e	208.a-d	25,120.a	865.d	76.abc	111.a-e
13	+		2.5 + 1.5	86.a	88.a-d	0.e	223.abc	25,652.a	1,003.cd	246.abc	89.a-e
14	atrazine	PP	3.0 + 1.5	92.a	97.abc	2.e	215.a-d	25,458.a	846.e	54.abc	112.a-e
15	alachlor EC +	PP	2.5 + 1.75	88.a	97.abc	3.e	218.a-d	26,136.a	367.d	17.abc	91.a-e
16	cyanazine	PP	3.0 + 1.75	90.a	86.bcd	0.e	222.abc	25,652.a	337.d	331.a	99.a-e
17	alachlor EC+cyanazine+ atrazine	PP	2.0 + 1 + 1	88.a	99.ab	0.e	228.ab	25,652.a	607.d	0.c	114.a-e
18	alachlor EC+simazine + atrazine	PP	2.5 + 1 + 1	93.a	99.ab	0.e	236.a	25,458.a	637.d	2.c	112.a-e
19	alachlor MT + cyanazine +	PP	2.0 + 1 + 1	93.a	97.abc	0.e	223.abc	25,942.a	292.d	68.abc	121.abc
20	atrazine	PP	2.5 + 1 + 1	93.a	95.a-d	0.e	222.abc	25,168.a	337.d	42.abc	116.a-d
21	alachlor + simazine +	PP	2.0 + 1 + 1	88.a	93.a-d	0.e	220.a-d	23,135.ab	956.cd	15.abc	131.ab
22	atrazine	PP	2.5 + 1 + 1	94.a	99.ab	0.e	219.a-d	25,071.a	589.d	0.c	115.a-e

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

[b] Includes X-77 at 8 oz/100 gal = 1.6 oz/A

[c] 2,4-D amine

Table 2. Research results for giant foxtail and velvetleaf control in no-tillage corn - 1985 cont.

Treatment				Weed Cont.7/20		Corn			Giant		Corn
No	Herbicide and Timing		Rate	Gift	Velf	Injury	Height	Stand	Foxtail	Velf	Yield
			lb ai/A	%	%	%	cm	plants/A	------lb/A------		bu/A
23	alachlor EC + PPG 1259	PP	2.5+.15+.25	68.a[a]	99.a	10.cde	194.a-e	24,684.a	2,097.bcd	68.abc	73.cde
24	+ paraquat + X-77[b]	PP	2.5+.20+.25	70.a	97.abc	23.b-e	167.def	24,297.a	2,097.bcd	102.abc	63.de
25	alachlor EC + PPG 1013 + paraquat + X-77[b]	PP	2.5+.15+.25	72.a	98.abc	0.e	212.a-d	26,523.a	2,247.bcd	0.c	94.a-e
26	alachlor + cyanazine + PPG 1259	PP	2.5+2.0+.25	90.a	98.abc	0.e	230.ab	23,329.a	734.d	17.abc	118.a-e
27	metolachlor + cyana. + PPG 1013	PP	2.5+2.0+.15	90.a	95.a-d	0.e	237.a	21,490.abc	944.cd	153.abc	128.abc
28	bifenox 4F+nothing	PP	2.0 + 0	33.b	100.a	57.a	129.fg	23,329.ab	3,440.abc	0.c	16.fg
29	bifenox 4F+alachlor EC	PP	2.0 + 2.5	30.b	100.a	30.bcd	171.c-f	25,942.a	4,179.ab	25.abc	59.ef
30	bifenox 4F+metolachlor	PP	2.0 + 2.0	25.b	99.a	23.b-e	182.a-e	25,555.a	5,077.a	34.abc	74.cde
31	fluorochloridone + metolachlor	PP	.5 + 2.5 + 0	90.a	98.abc	17.cde	186.a-e	25,168.a	1,273.cd	297.abc	77.b-e
32	fluorochloridone + meto + para[b]	PP	.5 + 2.5 + .25	96.a	85.d	3.e	217.a-d	24,006.a	322.d	229.abc	114.a-e
33	fluorochloridone + metolachlor	PP	1 + 2.5 + 0	91.a	97.abc	0.e	231.ab	24,781.a	562.d	34.abc	114.a-e
34	fluorochloridone + meto + para[b]	PP	1 + 2.5 + .25	97.a	93.a-d	2.e	217.a-d	23,522.ab	27.d	102.abc	109.a-e
35	cyanazine PP + metolachlor PP +ME 4 bromoxynil	Post	2 + 2.5 + .375	92.a	99.a	0.e	213.a-d	26,233.a	884.d	0.c	107.a-e
36	+ME 4 bromoxynil	Post	2 + 2.5 + .5	95.a	100.a	7.de	205.a-d	26,910.a	180.d	0.c	113.a-e
37	+AXF-1309	Post	2 + 2.5 + .375	65.a	99.a	17.cde	195.a-e	22,554.ab	2,351.bcd	17.abc	88.a-e
38	+AXF-1309	Post	2 + 2.5 + .5	94.a	98.abc	0.e	231.ab	24,297.a	315.d	17.abc	112.a-e
39	+ME 4 brom.+atrazine	Post	2+2.5+.375+.5	95.a	100.a	0.e	231.ab	24,587.a	292.d	0.c	132.ab
40	+ME 4 brom.+cyanazine	Post	2+2.5+.375+.6	98.a	100.a	0.e	226.abc	23,426.ab	75.d	0.c	119.a-e
41	+ CN-11-6180	Post	2 + 2.5 + 1 qt.	99.a	99.a	0.e	226.abc	25,555.a	168.d	42.abc	136.a
42	+ CN-11-6180	Post	2 + 2.5 + 2 qt.	98.a	100.a	3.e	223.abc	25,555.a	180.d	0.c	113.a-e
43	+ dicamba	Post	2 + 2.5 + .25	96.a	99.ab	0.e	229.ab	26,620.a	217.d	2.c	129.abc
44	cyanazine + paraquat + X-77[b]	PP	4.0 + .25	96.a	100.a	0.e	220.a-d	24,684.a	217.d	34.abc	122.abc
45	alachlor EC + paraquat + X-77[b]	PP	3.7 + .25	75.a	95.a-d	5.de	205.a-d	26,426.a	1,123.cd	204.abc	65.de
46	metolachlor + paraquat + X-77[b]	PP	3.0 + .25	96.a	96.a-d	0.e	210.a-d	27,201.a	187.d	136.abc	104.a-e
47	Hoed Check	---	---	97.a	99.a	22.b-e	196.a-e	24,103.a	344.d	10.bc	95.a-e
48	Weedy Check	---	---	32.b	100.a	63.a	99.g	17,811.bc	4,036.ab	17.abc	4.g

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

[b] Includes X-77 at 8 oz/100 gal = 1.6 oz/A

CORN YIELD POTENTIAL FOLLOWING ALACHLOR AND METOLACHLOR TREATMENTS

N. L. Hartwig and W. C. Fleet[1]

INTRODUCTION

There has been a long ensuing battle between Monsanto and CIBA-GEIGY over the relative corn (Zea mays L.) injury potential of alachlor and metolachlor. If one assumes that no herbicide is totally safe, then there is the potential for injury from any herbicide if soil and environmental conditions are conducive for above normal activity and the crop variety is a little more sensitive than the average. Theoretically, obvious injury symptoms will be only occasionally observable when these conditions are met. However, when averaged over a large number of studies that represent many soil types, environmental conditions and corn varieties, it may be possible to show significant differences between two herbicides that are very similar in activity when applied at the labeled rate. The purpose of these studies was to try to show significant differences in corn injury or yield as a result of alachlor or metolachlor use.

MATERIALS AND METHODS

An initial study was conducted at the Pioneer Hi-Bred International, Inc., Corn Breeding Station in Middletown, Delaware in 1983. The soil was a Metapeake silt loam (Typic Hapludult). The trial was a split-plot design with herbicide treatments assigned to the whole plots. Alachlor [2-chloro-N-(2,6-diethylphenyl)-N-(methoxymethyl)acetamide] at 3 lb/A, metolachlor [2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide] at 2.5 lb/A, and a blanket treatment of atrazine [6-chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine] at 2 lb ai/A was applied preemergence on May 12, 1983. All herbicide treatments were applied with a small plot sprayer using 8002 LP nozzles at 20 psi in 20 gal. of water. Nine Pioneer hybrids were planted conventionally with a small plot cone planter on May 12, 1983 to the sub-plots. Sub-plots were 5 by 18 ft. with two (30 inch) corn rows per sub-plot. Fertilizer and lime were applied according to soil test.

In 1985 and 1986, two studies were conducted successively on the same area at the Rock Springs Agronomy farm in State College, PA. The soil was a Hagerstown silt loam (Typic Hapludult) with approximately 10% sand, 67% silt, 20% clay and 2.5 % organic matter. The field has been in conventionally planted (plowed, disked and harrowed) corn since 1984. There were no perennial weeds to

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interfere with the study. In 1985 the trial was a randomized complete block design with 22 replications and five herbicide treatments randomly assigned to each replication. Plots were 30 by 70 ft. with 12 (30 inch) corn rows per plot. 'Pioneer 3591' corn was planted on May 1 in 1985 with 120 lb/A of 10-30-10 fertilizer in the row. Urea was broadcast at a rate of 75 lb/A of nitrogen at planting time followed by a sidedress application of liquid nitrogen at 75 lb/A. All herbicide treatments were applied preemergence on May 8, 1985.

In 1986 the trial was a split-plot design with 20 replications. The same five herbicide treatments were used as in 1985 but the plots were split and planted to two corn hybrids with 6 (30 inch) rows of each. Plots were now 15 by 70 ft. 'Pioneer 3591' (a variety adapted to central PA and thought to be tolerant to acid amides) and 'Pioneer 3233' (a variety adapted to southeastern PA and thought to be sensitive to acid amides) were both planted on April 30, 1986 with 100 lb/A of 10-30-10 fertilizer in the row. Urea was broadcast and disked in prior to corn planting at a rate of 150 lb/A of nitrogen. All herbicide treatments were applied preemergence on May 1, 1986.

All herbicide treatments were applied with a 3-point hitch small farm sprayer with 8003 Tee-jet nozzles at 30 psi in 20 gal. of water. For the first two weeks following application the weather was warm and moist in 1985 with an average daytime high of 73.4°F. and a total of 0.9 inches of rainfall. In 1986 it was cool and dry for the first two weeks following application with an average daytime high of 47.3°F and a total of 0.25 inches of rainfall. It was so dry for a week before planting in 1986 that corn germination was delayed in some plots.

Percent corn injury was determined in 1985 and 1986 by counting the number of plants in the whole plot showing leaf looping, crinkling and stunting typical of acid amides and dividing by the total number plants per plot when the corn was in the 6 to 8 leaf stage. Stand counts were also made at this stage and corn height measurments were done in July. The whole plot,12 (70 ft.) rows in 1985 and 6 (70 ft.) rows in 1986, was harvested for yield each year. Corn yields were converted to a 15.5% moisture basis.

RESULTS AND DISCUSSION

When comparing nine Pioneer hybrids in 1983, it was quite obvious that some varieties were more sensitive to acid amides than others (Table 1). In general, varieties that showed sensitivity were sensitive to both alachlor and metolachlor. Pioneer 3380 and 3930 did appear to be more sensitive to metolachlor than alachlor. None of the varieties showed more injury to alachlor than to metolachlor. Of all the varieties tested, Pioneer 3233 seemed to be the most sensitive to alachlor and metolachlor. This variety was used in another test in 1986 at the Rock Springs Agronomy Farm.

In 1985, using a hybrid adapted to central Pennsylvania (Pioneer 3591), there were no significant differences in corn height, stand, injury or yield between the cyanazine + atrazine check and alachlor or metolachlor (Table 2). The

coefficient of variability was 9.8% for the corn yield which is very good but not good enough to show a significant difference of 3.7 bu/A; the difference between the lowest and highest yielding treatments.

In 1986, Pioneer 3591 (which appeared non-sensitive to acid amides in 1985), and Pioneer 3233 (which was the most sensitive of the hybrids in the 1983 test), were compared. Pioneer 3233 (long season) had a significantly greater height and stand than Pioneer 3591 (Table 3). The height or stand was not affected by addition of alachlor or metolachlor for either variety. There was no signficant difference in injury or yield between either variety. The amount of visual injury symptoms were so little as to be insignificant for either variety.

The addition of alachlor or metolachlor did not have any effect on the yield of Pioneer 3591 but did significantly reduce yields of Pioneer 3233 when compared to the cyanazine + atrazine check. There was no difference in corn yield between alachlor and metolachlor however.

SUMMARY

There are differences between varieties in their sensitivity to acid amides, specifically alachlor and metolachlor. When a variety is sensitive, its usually sensitive to both alachlor and metolachlor with an occassional variety that appears to be more sensitive to metolachlor than alachlor.

ACKNOWLEDGEMENT

We would like to thank Monsanto Chemical Co., and Pioneer Hi-Bred International, Inc. for their financial support for this research.

Table 1. Corn yields and yields as percent of a weed free check[a] for nine corn hybrids after treatment with alachlor and metolachlor.

Corn Hybrid	Herbicide Treatment		
	Check	alachlor (3 lb/A)	metolachlor (2.5 lb/A)
	bu/A (%)	bu/A (%)	bu/A (%)
Pioneer 3380	129 (100) a[b]	123 (95) a	105 (81) abc
Pioneer 3378	126 (100) a	118 (94) a	120 (95) a
Pioneer 3358	115 (100) a	104 (91) ab	96 (83) abc
Pioneer 3535	108 (100) a	99 (92) ab	97 (90) ab
Pioneer 3930	94 (100) a	81 (86) ab	67 (71) bc
Pioneer 3184	118 (100) a	97 (82) ab	84 (71) bc
Pioneer 3192	137 (100) a	112 (82) ab	104 (76) bc
Pioneer 3744	123 (100) a	96 (78) ab	97 (79) abc
Pioneer 3233	166 (100) a	121 (73) b	108 (66) c
Average	124 (100)	106 (86)	98 (79)

[a] Whole trial area, including the check, was treated with atrazine at 2 lb ai/A

[b] Percent means followed by the same letter are not significantly different at the 5% level according to Scheffe's test.

Table 2. Corn height, stand, injury and corn yield following treatment with alachlor and metolachlor in 1985.

Treatment			Corn			
No.	Herbicide	Rate	Height	Stand	Injury[a]	Yield
	Pioneer 3591 (non-sensitive)	lb ai/A	cm	plants/A	%	bu/A
1	cyanazine + atrazine + nothing	2.0+1.0+0	140[b] a[c]	22,382 a	5.2 a	121.1 a
2	cyanazine + atrazine + alachlor	2.0+1.0+2.0	141 a	22,308 a	5.6 a	120.6 a
3	cyanazine + atrazine + alachlor	2.0+1.0+3.0	141 a	22,037 a	5.2 a	117.6 a
4	cyanazine + atrazine + meto	2.0+1.0+1.5	142 a	22,078 a	5.4 a	121.3 a
5	cyanazine + atrazine + meto	2.0+1.0+2.5	144 a	22,409 a	5.0 a	121.4 a

[a] Percent corn injury was determined by counting the number of plants in the whole plot showing leaf looping, crinkling and stunting typical of acid amides and dividing by the total number plants per plot.

[b] Mean for 22 replications.

[c] Means followed by the same letter are not significantly different at the 10% level according to Duncans Multiple Range test.

Table 3. Corn height, stand, injury and corn yield for two hybrids following treatment with alachlor and metolachlor in 1986.

Treatment			Corn			
No.	Herbicide	Rate	Height	Stand	Injury[a]	Yield
		lb ai/A	cm	plants/A	%	bu/A
1	cyanazine + atrazine + nothing	2.0+1.0+0	205[b] a[c]	25,669 a	.20 a	112.7 a
2	cyanazine + atrazine + alachlor	2.0+1.0+1.5	203 a	25,868 a	.28 a	111.4 a
3	cyanazine + atrazine + alachlor	2.0+1.0+3.0	205 a	25,536 a	.24 a	109.5 a
4	cyanazine + atrazine + meto	2.0+1.0+1.5	202 a	25,638 a	.27 a	109.8 a
5	cyanazine + atrazine + meto	2.0+1.0+2.5	202 a	25,754 a	.22 a	111.0 a
	Pioneer 3591(non-sensitive)	Average	204 b[d]	25,693 b	.24 a	110.9 a
6	cyanazine + atrazine + nothing	2.0+1.0+0	224[b] a[c]	26,530 a	.15 a	111.8 a
7	cyanazine + atrazine + alachlor	2.0+1.0+1.5	219 a	26,625 a	.16 a	105.2 c
8	cyanazine + atrazine + alachlor	2.0+1.0+3.0	218 a	26,212 a	.22 a	108.3 ab
9	cyanazine + atrazine + meto	2.0+1.0+1.5	222 a	26,527 a	.21 a	107.0 bc
10	cyanazine + atrazine + meto	2.0+1.0+2.5	221 a	26,521 a	.18 a	109.8 ab
	Pioneer 3233 (sensitive)	Average	221 a[d]	26,483 a	.18 b	108.4 a

[a] Percent corn injury was determined by counting the number of plants in the whole plot showing leaf looping, crinkling and stunting typical of acid amides and dividing by the total number plants per plot.

[b] Mean for 20 replications.

[c] Herbicide treatment means for each hybrid followed by the same letter are not significantly different according to a LSD (0.10) = (3.86 bu/A).

[d] Corn hybrid means followed by the same letter are not significantly different according to orthogonal contrast comparisons.

Chloroacetamide Comparisons in Corn and Soybeans

J. Peyton Doub, Henry P. Wilson, and Thomas E. Hines[1]

ABSTRACT

Repeated annual applications of alachlor and metolachlor were made from 1982 to 1986 on the same no-till corn (*Zea mays* L.) plots. Control of large crabgrass [*Digitaria sanguinalis* (L.) Scop.] by alachlor declined to less than 50% by 1986. Large crabgrass control by metolachlor remained above 80% throughout the study. A high population of fall panicum [*Panicum dichotomiflorum* (L.) Michx.] developed in metolachlor-treated but not in alachlor-treated or chloroacetamide-free plots. In a two-year continuous no-till corn study established in 1985, high populations of giant foxtail (*Setaria faberii* Herrm.) were present by 1986. In both years, a microencapsulated formulation of alachlor provided giant foxtail control comparable to that provided by metolachlor and superior to that provided by the emulsifiable concentrate of alachlor. By the end of 1986, significantly more fall panicum was observed in metolachlor-treated than in alachlor-treated plots. Additional single year studies in conventional tillage and no-till corn and soybeans [*Glycine max* (L.) Merr.] generally demonstrated that microencapsulated alachlor performed equal to or better than the emulsifiable concentrate. A microencapsulated metolachlor formulation performed as well as emulsifiable concentrate metolachlor.

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Evaluation of Weed Control in Soybeans by FMC-57020

William K. Vencill, Henry P. Wilson, and Thomas E. Hines[1]

ABSTRACT

Field studies were conducted in 1986 to evaluate weed control by FMC-57020 in soybeans [Glycine max (L.) Merr. 'Essex'] with early preplant, preemergence, and preplant incorporated applications of FMC-57020 alone and in combinations with other soybean herbicides. In full season no-till soybeans, FMC-57020 was applied at 1.1 kg ai/ha alone or in combination with imazaquin or chlorimuron plus linuron. There were not significant differences in large crabgrass (Digitaria sanguinalis L.) or common lambsquarters (Chenopodium album L.) control by FMC-57020 alone or in combination with imazaquin or chlorimuron plus linuron at an early preplant application in late April versus preemergence treatments applied in mid-June. There was significantly lower control of large crabgrass by early preplant applications of FMC-57020 plus a preemergence application of linuron versus preemergence application of FMC-57020 plus linuron. There was not any decrease in weed control from the early summer to late summer rating of all treatments which included FMC-57020. In conventional soybeans, preemergence applications of FMC-57020 alone at rates of 0.6 to 1.1 kg/ha alone and in combinations with linuron, imazaquin, and chlorimuron plus linuron gave excellent control of large crabgrass, barnyardgrass [Echinochloa crus-galli (L.) Beauv.], and common lambsquarters. Preemergence treatments of FMC-57020 followed by 0.4 kg ai/ha acifluorfen postemergence gave good control of large crabgrass, barnyardgrass, and common lambsquarters. No differences in efficacy of FMC-57020 were detected between the emulsifiable concentrate and wettable powder formulations in the preemergence applications. Preplant incorporated FMC-57020 applications at 0.4 kg/ha in combination with trifluralin and ethalfluralin gave moderate control of large crabgrass and good control of barnyardgrass and common lambsquarters. Preplant incorporated combinations of 0.8 kg/ha FMC-57020 plus either imazaquin or metribuzin provided good control of all three species. Smooth pigweed (Amaranthus hybridus L.) control was sporadic when FMC-57020 was applied alone in either an early preplant, preemergence, or preplant incorporated application.

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A COMPARISON OF PREPLANT INCORPORATED AND PREEMERGENCE COMBINATIONS OF IMAZETHAPYR AND IMAZAQUIN [1/]

E. Prostko, R. D. Ilnicki and A. Enache [2/]

ABSTRACT

Field studies were conducted at the Soils and Crops Research Center, Adelphia, N. J., in 1986 to compare preplant incorporated and preemergence treatments of imazaquin and imazethapyr, alone and in combination with alachlor and metolachlor. Results of the studies indicate that at a rate of 0.070 kg/ha, imazaquin and imazethapyr alone, as preplant incorporated treatments, significantly increased yields compared to the preemergence treatments at the same rate as a direct result of improved weed control. When these herbicides were combined with either alachlor or metolachlor, there was no significant increase in yields between the two application schedules.

INTRODUCTION

Two members of the imidazolinone herbicide family, imazaquin [2-[4,5-dihydro-4 methyl-4-(1-methylethyl)-5-oxo-1H-imadazol-Z-yl]-3 quinolinecarboxylic acid] and imazethapyr [2-[4,5-dibydro-4 methyl-4-(1-methylethylO-5-oxo-1H-imadazol-2-yl]-5-ethyl-3-pyridine carboxylic acid], may be applied preplant incorporated, preemergence, or postemergence for the control of a wide range of annual broadleaf weeds in soybeans [Glycine max (L.) Merr.]. Imazaquin combined with acetanilide herbicide can control a wide spectrum of weeds when applied as either preplant incorporated or preemergence applications (1,3). Imazethapyr effected excellent weed control when applied as a preplant incorporated treatment (2). The purpose of this study was to compare preplant incorporated and preemergence treatments of imazaquin and imazethapyr, alone and in combination with alachlor [2-chloro-2′,6′-diethyl-N-(methoxymethyl)acetanilide] and metolachlor [2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methyethyl)acetamide].

MATERIALS AND METHODS

Two field studies were conducted at the Soils and Crops Research Center, New Jersey Agricultural Experiment Station, Adelphia, N.J., in 1986. The preemergence study was conducted on a Sassafras loam soil while the preplant incorporated study was conducted on a Holmdel loam.

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[1]New Jersey Agricultural Experiment Station Publication No. J-15173-7-86.

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Both studies were established in a randomized complete block design with three replications. In the preemergence study, soybeans (cv. Pella) were planted on June 5 and treated 24 hours later. In the preplant incorporated study, treatments were applied on June 19 and the soybeans planted 24 hours later. Plot size was 3.1 by 5.9 m with 4 rows per plot spaced at 76 cm. Treatments were applied with a hand-held CO_2 powered sprayer using 730616 nozzle tips (Spraying Systems Co., Chicago, Ill.) delivering a volume of 378 l/ha at a pressure of 220 kPa. Weed control ratings were taken approximately 5 weeks after treatment and the following weeds were evaluated for control: common lambsquarters [Chenopodium album L.], common ragweed [Ambrosia antemisiifolia L.], and stinkgrass [Eragrostis cilanensis (All.) E. Mosher].

The middle two of the four-row plots were machine-harvested on October 26. The seed was later cleaned, weighed, and yields determined in kg/ha.

RESULTS AND DISCUSSION

Results of the two field studies are summarized in Table 1. Although not reported here, there was no serious injury to the soybeans from any of the herbicide treatments and application schedules. Several interesting observations can be made from this summary table. Preplant incorporated treatments were generally better for weed control by both herbicides than the preemergence treatments. Imazethapyr effected slightly better control than imazaquin. At a rate of 0.07 kg/ha, imazaquin and imazethapyr alone, as preplant incorporated treatments, increased yields as compared to the preemergence treatments of the same rate. Both herbicides were not effective on stinkgrass. Addition of the acetanilide herbicides, alachlor and metolachlor, improved overall weed control by increasing the control of stinkgrass. Any differences between the degree of weed control obtained by the imadazolinone herbicides applied alone or by schedule, was masked by the addition of the acetanilides.

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Table 1. The effect of imazaquin and imazethapyr, alone and in combination with alachlor and metolachlor, on weed control and soybeans, Adelphia, N.J., 1986.

Treatment	Rate AI (kg/ha) and Schedule[1]	WEED CONTROL[2] CHEAL	AMBEL	ERANC	Soybean Yield (kg/ha)[3]
1. Imazethapyr	0.07 PPI	10.0	7.3	5.0	2435.1 ab
	0.07 PRE	4.0	6.3	8.0	1325.9 defg
	0.14 PPI	8.3	5.6	10.0	2063.4 abcde
	0.14 PRE	9.0	9.7	3.3	1261.5 efg
2. Imazaquin	0.07 PPI	8.0	8.6	4.3	2556.1 ab
	0.07 PRE	6.7	6.7	3.3	794.0 gf
	0.14 PPI	10.0	8.0	5.3	2437.8 ab
	0.14 PRE	9.7	10.0	3.3	1481.8 cdefg
3. Imazethapyr	0.07 + 1.60 PPI	8.0	10.0	10.0	2489.0 ab
+ Metolachlor	0.07 + 0.168 PRE	9.6	9.7	10.0	2275.8 abc
	0.14 + 1.68 PPI	10.0	7.3	10.0	2497.3 ab
	0.14 + 1.60 PRE	3.0	9.9	6.7	1808.4 bcdef
4. Imazaquin	0.07 + 1.68 PPI	10.0	9.0	10.0	2200.9 abcd
+ Metolachlor	0.07 + 1.68 PRE	9.9	10.0	10.0	2949.7 a
	0.14 + 1.68 PPI	10.0	7.6	10.0	2733.5 ab
	0.14 + 1.68 PRE	3.0	10.0	10.0	2478.8 ab
5. Imazethapyr	0.07 + 1.68 PPI	7.3	7.6	10.0	2317.6 abc
+ Alachlor	0.07 + 1.68 PRE	8.7	10.0	9.7	1924.0 bcde
	0.14 + 1.68 PPI	10.0	8.0	10.0	2507.8 ab
	0.14 + 1.68 PRE	6.0	9.8	10.0	2282.6 abc
6. Imazaquin	0.07 + 1.68 PPI	10.0	7.6	10.0	2584.3 ab
+ Alachlor	0.07 + 1.68 PRE	9.8	10.0	10.0	2293.5 abc
	0.14 + 1.68 PPI	10.0	10.0	10.0	2602.0 ab
	0.14 + 1.68 PRE	9.3	10.0	10.0	2628.0 ab
7. Untreated Check	--	3.3	3.3	3.3	285.9 g

[1]Schedule: PRE - Preemergence applied June 6
PPI - Preplant incorporated applied June 19

[2]Weed Control = 0-10 Scale; 0 = no control; 10 = total control
CHEAL = Chenopodium album L.
AMBEL = Ambrosia antemisiifolia L.
ERANC = Eragrostis cilianensis (All.) E. Mosher

[3]Values with different letters are significantly different at the 5% level according to Duncan's multiple range test.

Cinmethylin Activity in Soybeans

Henry P. Wilson and Thomas E. Hines[1]

The activity of cinmethylin was investigated preemergence in conventional and full-season no-till soybeans [Glycine max (L.) Merr.]. In 1985, preemergence applications of cinmethylin controlled large crabgrass [Digitaria sanguinalis (L.) Scop.] and combinations with linuron or metribuzin controlled common lambsquarters (Chenopodium album L.) but were not sufficiently active against common ragweed (Ambrosia artemisiifolia L.). Preemergence applications of cinmethylin followed by postemergence applications of acifluorfen or bentazon failed to control common lambsquarters and common ragweed in 1985 but controlled common lambsquarters in 1986. Combinations of cinmethylin with linuron, linuron plus chlorimuron, or imazaquin controlled barnyardgrass [Eschinochloa crus-galli (L.) Beauv.], fall panicum (Panicum dichotomiflorum Michx.) and common lambsquarters but soybeans treated with chlorimuron were reduced in height. In no-till soybeans, cinmethylin provided season-long control of annual grasses and combinations with metribuzin or linuron were effective against smooth pigweed (Amaranthus hybridus L.) and common lambsquarters in 1985. In 1986, no-till studies included early pre-plant and at-planting cinmethylin applications and also investigated approaches for control of existing vegetation. Split applications of paraquat controlled prickly lettuce (Lactuca serriola L.) and horseweed [Conyza canadensis (L.) Cronq.] and were enhanced by chlorimuron and 2,4-D. Single and split applications of HOE-39866 controlled prickly lettuce and horseweed but these two species were less sensitive to glyphosate. Early control of large crabgrass was good with cinmethylin but diminished with time so that by late July, escapes were observed. By late August, crabgrass control was highest from treatments involving split applications of cinmethylin totaling 1 lb ai/A. Initial soybean injury was evident from treatments containing linuron plus chlorimuron and imazaquin. Soybean growth reductions of August 27 were thought to be primarily related to low control of prickly lettuce.

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PREEMERGENCE CINMETHYLIN COMBINATIONS IN SOYBEANS [1/]

R. D. Ilnicki, Adrian Enache, and Eric Prostko [2/]

ABSTRACT

Cinmethylin is a new preemergence grass herbicide being developed for use in soybeans. The objective of this study was to evaluate this herbicide in soybeans alone and in combination with some broadleaf herbicides for weed control and crop tolerance.

In 1985, soybeans (cv. Midstates) were planted in Holmdel loam soil on June 27 and treated the same day with cinmethylin, metribuzin, linuron and combinations of these herbicides. The area included the following weeds: common lambsquarters (Chenopodium album L.), redroot pigweed (Amaranthus retroflexus L.), velvetleaf (Abutilon theophrasti L.), common ragweed (Ambrosia artemisiifolia L.), jimsonweed (Datura stramonium L.), and fall panicum (Panicum dichotomiflorum Michx.).

In 1986 soybeans (cv. Pella) were planted in Sassafras loam soil on June 5 and treated the same day with cinmethylin, metribuzin, chloramben, linuron, imazethapyr, imazaquin and combinations of cinmethylin with these herbicides. Weeds in the experimental area included common lambsquarters, redroot pigweed, wild radish (Raphanus raphanistrum L.), and barnyardgrass (Echinochloa crus-galli (L.) Beauv.).

In 1985 it was observed that cinmethylin gave excellent control of fall panicum but was not completely effective on redroot pigweed and jimsonweed. Combinations with metribuzin or linuron improved control of these weeds.

In 1986, common lambsquarters and wild radish were not controlled by cinmethylin. Additions of metribuzin or linuron, broadened the spectrum of all weeds controlled.

Chloramben effected good control of all weeds and combinations with cinmethylin did not improve control. Imazethapyr and imazaquin produced about the same degree of broadleaf control and combinations with cinmethylin effected excellent broad spectrum weed control.

No injury to soybeans from any of the treatments was noted. Significant increases in yield resulted where control of all weeds was accomplished by combination treatments.

1/ New Jersey Agricultural Experiment Station Publication No. K-15472-2-86.

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LACTOFEN-GRASS HERBICIDE COMBINATIONS IN SOYBEANS [1/]

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ABSTRACT

Lactofen is a recently-released herbicide which shows promise for pre- and postemergence use in soybeans (Glycine max L.). Field studies were conducted in 1985 and 1986 to evaluate the effectiveness of postemergence applications of lactofen in combination with grass and some broadleaf herbicides.

In 1985 postemergence applications of lactofen alone and in combination with sethoxydim, fluazifop, and metolachlor were made to soybeans in the third trifoliate stage. Weeds present were common lambsquarters (Chenopodium album L.), redroot pigweed (Amaranthus retroflexus L.), velvetleaf (Abutilon theophrasti L.), and fall panicum (Panicum dichotomiflorum Michx.).

In 1986 postemergence treatments of lactofen with fluazifop, sethoxydim, haloxyfop, and quizalofop (DPX Y6202) were applied when soybeans were in the second-to-third trifoliate stage. Weeds present were common purslane (Portulaca oleracea L.), common lambsquarters, redroot pigweed, common ragweed (Ambrosia artemisiifolia L.), and fall panicum.

Lactofen controlled redroot pigweed, common lambsquarters, and common purslane. Some control of velvetleaf and common ragweed was obtained. Fall panicum was controlled only with the addition of grass herbicides.

Yield performance was generally best in 1985 in herbicide combinations which included preemergence metolachlor. Combinations of lactofen and postemergence grass herbicides, however, also performed well. Lactofen performance at the high (0.22 kg/ha) rate was better than that at the low (0.17 kg/ha) rate.

In 1986 the postemergence combinations that performed best were combinations of lactofen and quizalofop, sethoxydim, and haloxyfop. Lactofen/grass herbicide combinations generally performed better than either alone, and addition of other herbicides did not significantly improve yield performance of lactofen/grass herbicide mixtures.

1/ New Jersey Agricultural Experiment Station Publication No. J-15472-4-86.

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GROWTH EFFECTS OF 2,4-DB ON SOYBEANS

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ABSTRACT

Field studies were conducted in 1986 to examine the effects of postemergence applications of 2,4-DB on growth and yield of soybeans [Glycine max L. (Merr.)]. Research was conducted at two locations. The first location was the Wye Research and Education Center in Queenstown, MD. Soil type was a Matapeake silt loam with a pH of 6.3 and 1.5% (w/w) organic matter. The other location was in Beltsville, MD, utilizing a Galestown silt loam, having a pH of 6.4 and 2.0% (w/w) organic matter. At both locations, studies were arranged as randomized complete block designs with three replications. Individual plots were four rows wide (0.8 m row spacing) by 8 m long. Soybean variety Williams was used at Queenstown, while variety Union was used at Beltsville. Fertilizer was applied according to state soil test recommendations. Preemergence weed control was obtained with standard soybean herbicides.

Postemergence herbicide applications were made when the soybeans were in the V1 to V2 stage of development. Herbicides were applied in water utilizing a CO_2 pressurized backpack sprayer that delivered 290 L/ha of water carrier at 262 kPa pressure, traveling 4.8 km/h. Herbicide treatments evaluated included the following: a) aciflourfen at 0.56 kg/ha, b) bentazon at 0.84 kg/ha, c) 2,4-DB at 73, 146, 292 and 585 ml/h, and d) cultivated check (untreated). Data collected included the following: a) soybean height measurements mid-season and at harvest, b) pod counts, seeds per pod and seed weight at harvest, and c) soybean yield that was obtained with a standard field combine.

At the Queenstown location, the highest rate of 2,4-DB tested resulted in a significant reduction in soybean plant height when measured mid-season and at harvest. Yet, there were no differences in yield or yield parameters from any of the treatments at the Queenstown location.

At the Beltsville location, the two highest rates of 2,4-DB resulted in significant reductions in soybean plant height when measured mid-season and at harvest. Once again, there were no differences in yield or yield parameters from any of the treatments at the Beltsville location.

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THE EFFECT OF LATE-SEASON HERBICIDE APPLICATIONS ON VELVETLEAF SEED

Mark A. Isaacs, E. C. Murdock [1/]

ABSTRACT

Field experiments were conducted at Clemson, South Carolina in 1984 and 1985 to evaluate the effect of late-season herbicide applications on velvetleaf (Abutilon theophrasti) reproductive capability. Herbicides utilized were chlorimuron, imazaquin, glyphosate, 2,4-DB, and 2,4-D and were applied at 0.28, 0.28, 0.28, 0.28, and 0.56 kg/ha, respectively. Treatments were applied when plants were in the early bloom (I), late bloom to early fruit (II), and late fruit growth stages. Greatest reductions in velvetleaf seed number and weight occurred when herbicides were applied at application times I and II, and chlorimuron, 2,4-D, and glyphosate reduced seed number 100, 86, and 82%, respectively, when applied at the early bloom stage. When applied at application time I, 2,4-DB and imazaquin reduced seed number 63 and 59%, respectively. Chlorimuron, imazaquin, and 2,4-D were equally effective in reducing seed number when applied at application time II, providing an average reduction of 69%. All herbicides reduced seed weight when applied at application times I and II, with the exception of glyphosate and 2,4-DB which did not when applied at application time II. Averaged across application times I and II, chlorimuron, imazaquin, and 2,4-D reduced seed weight 74, 41 and 29%, respectively. Herbicides did not significantly reduce velvetleaf seed number or weight when applied at application time III. Averaged across herbicides seed numbers were reduced 78, 55, and 13% at application times, I, II, and III, respectively; seed weights were reduced 56, 23, and 1%.

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WEED SUPPRESSION FROM COVER CROPS IN FULL SEASON NO-TILL SOYBEANS

Q. R. Johnson and F. J. Webb[1]

ABSTRACT

Field experiments were conducted in 1985 and 1986 to evaluate the ability of cover crops to suppress problem weeds in the establishment of full season no-till soybeans (Glycine max L.). Of particular interest was horseweed (Conyza canadensis L.), which is a very difficult weed to control when establishing full season no-till soybeans in Delaware.

Winter rye (Secale cereale L.) and Austrian winter peas (Pisium sativum arvense) were established during the previous fall of each year. Soybeans were planted into these covers and a no cover area in 38.1 cm rows with a Kinsey no-till planter on June 18 of each year. Various herbicide combinations were applied with a CO_2 propelled sprayer using 8004 (1985) and 8002 LP (1986) flat fan tips on 50.8 cm spacing at 281 l/ha on June 20 of each year, and were evaluated in each cover for weed control.

Both winter rye and Austrian winter peas provided excellent suppression of horseweed (Table 1). Few if any horseweed plants existed in either cover at soybean planting time. All of the treatments applied provided complete burndown of the two covers. Horseweed was very thick at planting time in the no cover area. In 1985, combinations of paraquat (0.50 lb a.i./A) plus linuron (0.75 lb a.i./A), paraquat (0.50 lb a.i./A) plus metribuzin combined with DPX-6025 (0.25 lb a.i./A), paraquat (0.50 lb a.i./A) plus linuron combined with DPX-6025 (0.50 lb a.i./A), and paraquat (0.50 lb a.i./A) plus alachlor (2.00 lbs a.i./A) plus linuron (0.75 lb a.i./A) provided good to excellent control of horseweed. Paraquat (0.50 lb a.i./A) plus imazaquin (0.13 lb a.i./A) also provided fair to good control of horseweed.[2] As a result of drought conditions in 1986 horseweed plants were more difficult to control. Therefore, none of the herbicide combinations provided greater than poor to fair horseweed control. Suppression of common ragweed (Ambrosia artemisiifolia L.), and fall panicum (Panicum dichotomiflorum Michx.) by the winter rye and Austrian winter peas was also evident in 1985 and 1986.

Soybean yields in 1985 for almost all herbicide combinations were much higher in the Austrian winter pea cover than with no cover, with highest yields occurring in the winter rye cover. Yield differences among herbicide treatments were generally a reflection of weed control. Yields for 1986 are expected to be somewhat different because of droughty conditions that existed throughout the growing season. The best soybean stand and growth occurred in the winter rye cover. The poorest stand and growth occurred in the Austrian winter peas as a result of early depletion of available water by this cover. Poor horseweed control from all treatments in the no cover area will ikely reduce 1986 soybean yields.

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[2]All treatments were applied with a non-ionic surfactant at 0.25% V/V.

Table 1. Weed Suppression From Cover Crops in No-Till Soybeans

Treatment*	Rate a.i./A	Horseweed 1985 NC**	Horseweed 1986 NC	Ragweed 1985 NC	Ragweed 1985 Pea	Ragweed 1985 Rye	Ragweed 1986 NC	Ragweed 1986 Pea	Ragweed 1986 Rye	Fall Panicum 1985 NC	Fall Panicum 1985 Pea	Fall Panicum 1985 Rye	Yield 1985 NC	Yield 1985 Pea	Yield 1985 Rye
paraquat	0.50	58.8	70.0	61.3	96.8	96.5	84.3	78.3	86.0	70.0	94.8	95.0	29.1	40.2	45.3
paraquat metolachlor	0.50 2.00	75.0	68.3	60.0	98.8	97.3	86.7	81.7	86.3	65.0	95.5	97.3	24.4	37.0	41.4
paraquat linuron	0.50 0.75	96.8	61.7	89.8	98.8	99.0	97.7	99.0	99.0	90.8	97.0	98.8	38.5	42.5	51.0
paraquat metolachlor linuron	0.50 2.00 0.75	77.5	61.7	97.0	99.0	99.0	97.7	99.0	99.0	97.5	99.0	98.8	41.4	43.8	47.4
paraquat FMC 57020	0.50 1.00	95.8	68.3	78.8	95.5	98.8	98.3	93.7	98.0	94.5	99.0	99.0	42.0	46.9	49.6
paraquat imazaquin	0.50 0.13	82.0	60.0	50.0	99.0	98.3	99.0	99.0	99.0	67.5	98.8	93.5	22.7	38.4	37.6
paraquat alachlor MT linuron	0.50 2.00 0.75	89.5	61.7	93.8	98.3	98.8	97.3	97.7	98.3	90.3	98.8	96.3	41.7	44.3	46.6
paraquat metribuzin+ DPX-6025	0.50 0.25	96.5	--	76.8	99.0	99.0	--	--	--	87.0	98.8	94.5	38.9	46.8	45.3
paraquat linuron+ DPX-6025	0.50 0.50	89.3	55.0	90.8	98.8	99.0	98.3	98.3	99.0	86.0	99.0	95.5	42.3	42.0	48.0
paraquat alachlor EC linuron	0.50 2.00 0.75	--	76.7	--	--	--	97.7	98.3	98.7	--	--	--	--	--	--

*All treatments contain a non-ionic surfactant (0.25% V/V)
**NC = No Cover

Weed Response to HOE-00661 in No-Till Soybeans[1]

ABSTRACT

J.A. Grande, S.A. Harrison, and R.A. Beardmore[2]

A series of field experiments established from 1984 to 1986 compared the efficacy of HOE-00661 applied as a single preemergence treatment to split applications applied early pre-plant (7-28 days) and preemergence at reduced rates.

The split applications of HOE-00661 at 0.23 kg/ha for a total applied use rate of 0.46 kg/ha provided superior efficacy of emerged annual broadleaf weeds and grasses as compared to single preemergence applications of 0.84 kg/ha. The control of annual grasses (Panicum and Setaria sp.) from the early pre-plant and preemergence split applications indicated a greater positive response than that observed for broadleaf weed control when compared to single preemergence applications.

Data from a single experiment in which "low" rates of HOE-00661 (0.23 kg/ha) were applied early pre-plant only compared to "higher" rates (0.84 kg/ha) applied preemergence suggest that the smaller weed size at the early pre-plant application timings is the critical influencing factor allowing for a reduction in the total amount of HOE-00661 applied to full-season no-till soybeans.

The economy of a herbicide rate reduction in the fifty percent order of magnitude would need to be compared to the increased application costs associated with the split applications by the soybean producer.

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[1]Code number for Ignite™ herbicide (Hoechst-Roussel Agri-Vet Co.)

[2]Early Development Group, Field Technical Group, Field Technical Group, respectively, Hoechst-Roussel Agri-Vet Co., Somerville, N.J. 08876.

HERBICIDE PERFORMANCE IN CONVENTIONAL AND NO-TILL SMALL GRAINS

F. J. Webb and Q. R. Johnson[1]

ABSTRACT

Field weed control studies were conducted on conventional tillage and no-tillage wheat (Triticum aestivum L.) and barley (Hordeum Vulgarel.) in 1984, 1985 and 1986. Control results of henbit ((Lamium amplexicaule L.) and common chickweed (Stellaria media (L.) Vill.) was generally acceptable with DPX-E8698, DPX-R9674, bromoxynil (3,5-dibromo-4-hydroxyben-zonitrile), 2,4-D ester [(2,4-dichlorophenoxy) acetic acid] dicamba (3,6-dichloro-O-anistic acid) and dinoseb (2-sec-butyl-4,6-dinitrophenol) and combinations of these materials. Carolina geranium (Geranium carolinianum L.) was satisfactorily controlled with dinoseb plus 2,4-D ester in 1986. DPX-E8698 at both rates, DPX-R9674 and DPX-M6316 both at 0.048 lb/A, 2,4-D ester at 0.75 lb/A and bromoxynil plus 2,4-D ester both at 0.50 lb/A were also satisfactory in controlling carolina geranium in 1985, but were unsatisfactory in 1986. This was probably due to extreme early spring drought in 1986.

The no-tillage studies showed that DPX-E8698 at 0.031 lb/A and 0.048 lb/A, DPX-T6376 at 0.016 lb/A, paraquat at 0.38 lb/A, glyphosate at 0.50 lb/A and 0.75 lb/A and HOE-0661 at 0.50 lb/A and 0.75 lb/A provided good to excellent common chickweed and henbit control. The DPX materials also provided residual control activity. All fall no-tillage herbicide treatment ratings were improved with a spring application of 2,4-D ester plus dicamba at 0.38 lb/A and 0.13 lb/A respectively.

INTRODUCTION

Broadleaf weed control in conventionally planted wheat and barley has been routinely performed in early spring. With only the phenoxy and benzoic acid materials available, effectiveness on the most common weed species has only been moderate to good (3). In more recent years fall applications of selected phenoxys, nitriles, phenols and the most recently developed sulfonylurea (1,2) has opened new avenues to effective small grain weed control.

In the early evaluation of no-till establishment of wheat and barley, it was identified that effective fall weed control is important. The tillage process in conventionally planted small grains creates a weed free seed bed where the emerging crop seedlings and weed seedlings start growth together. In most no-till situations many of the winter weeds have germinated and established in the preceding crop and are very competitive to the later planted crop. It's only been in no-till plantings that significant yield reductions have been measured as a result of weed competition in wheat and barley herbicide research.

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Reported here are multiple year test results on fall and spring applied herbicides on both conventional tillage and no-tillage planted wheat and barley.

MATERIALS AND METHODS

All studies were conducted at the University of Delaware Research and Education Center, Georgetown, Delaware during 1984, 1985, and 1986. The soil types range from a Sassafras sandy loam soil (Class I) to an Evesboro loamy sand soil (Class III). These soils are sandy texture in the plow layer, generally 0.8 to 1.25 percent organic matter with a pH of 5.8 to 6.0. The wheat and barley was planted following corn (Zea mays L.) or soybeans (Glycine max L.) harvest with the crop residues being left on the soil surface for the no-till plantings. Both grains were winter varieties planted in the fall in a complete randomized block design with four replications. Fertilizer was applied according to soil test analysis with fall N, P_2O_5 and K_2O and spring topdress nitrogen.

All treatments were applied either in the fall or spring as designated in the individual tables. Plot size was 9 feet x 25 feet long. All herbicides were applied in water with a CO_2 propelled sprayer, calibrated using tee jet (Spray Systems Company, Chicago, Illinois) 8004 flat fan tip at 42 p.s.i., to deliver 30 gal/A. Herbicide rates and application schedules are presented in the tables.

RESULTS AND DISCUSSION

The 1986 conventional tillage wheat and barley study, (Table 1) showed that DPX-E8698 provided excellent common chickweed control in wheat with slightly poorer control of henbit and poor control of carolina geranium in barley. The performance of DPX-R9674 was very similar to that of DPX-E8698 with DPX-M6316 showing trends towards the poorest control of these weed species, although not significantly different. Bromoxynil alone provided fair control of common chickweed, but was improved some with the addition of 2,4-D ester at .50 lb a.i./A. Henbit control was good in barley with bromoxynil with no improvement with the addition of 2,4-D ester except on carolina geranium, but was still unsatisfactory control. The 2,4-Ds, dicamba and their combinations, all provided good control of common chickweed except with 2,4-D ester plus dicamba with a surfactant which provided significantly poorer control than that same combination without surfactant. The author knowing that an adjuvant should not have that type of interference with these chemicals, believes that there is something wrong with these plot ratings. The henbit control with these materials was good, but carolina geranium was poor.

Dinoseb provided fair control of common chickweed in wheat, excellent control of henbit and poor control of carolina geranium in barley. There was a trend of improved weed control with the addition of 2,4-D ester to the dinoseb on all weed species in both crops, especially on carolina geranium which was significantly better than all other treatments. The harvested yields of both wheat and barley were not significantly higher than the check plot (3) with the application of any of the spring herbicide treatments.

The 1985 spring wheat study, (Table 2) revealed good control of carolina geranium with DPX-E8698, where in 1986 its control was poor. DPX-R9674 provided poor control of both horseweed (Conyza canadensis L.) and carolina geranium at

the .024 lb/A, but improved significantly at the .048 lb/A to an excellent rating. Both DPX-M6316 and DPX-R8224 provided poor control of carolina geranium at the low rate and only DPX-M6316 improved significantly to an excellent rating at the high rate of .048 lb/A. DPX-M6316 was excellent on horseweed at both rates and DPX-R8224 provided poor control. Fluorochloridone provided poor control on both weed species. 2,4-D ester controlled horseweed 77.3 percent at 0.50 lb/A and had a trend of improvement to 94.3 percent at 0.75 lb/A. The combinations of 2,4-D and dicamba or bromoxynil and dicamba both provided excellent control of horseweed. The bromoxynil and 2,4-D combination was significantly less effective than the previously mentioned combinations. Carolina geranium was only controlled effectively by 2,4-D at 0.75 lb/A and bromoxynil plus 2,4-D combination. Yields were poor in this study and showed no significant differences.

The wheat and barley no-till study conducted in 1986 provided excellent common chickweed and henbit control with all of the fall treatments (Table 3). All treatment plots yielded significantly higher than the checks in both crops. The 1984 study (Table 4) evaluated fall and early spring treatments with 2,4-D ester plus dicamba applied as a spring sequential treatment across one half of all the plots. Paraquat provided inadequate common chickweed control in both wheat and barley and was improved to excellent levels at the 0.38 lb/A rate with the spring application of 2,4-D plus dicamba. Glyphosate was only slightly improved in wheat with the 2,4-D plus dicamba spring treatment, where in barley it was improved by 27 percent. DPX-M6316 control of common chickweed was improved with the spring treatment of 2,4-D plus dicamba in both crops, but was still unsatisfactory for adequate control. DPX-T6376 provided good chickweed control and was only slightly improved with the spring sequential treatment on both crops. HOE-0661 provided good weed control in wheat and poor control in barley, but with the spring 2,4-D plus dicamba treatment common chickweed control was dramatically improved in barley.

Yields were only taken in the wheat plots, which indicated slightly improved yields with the spring 2,4-D plus dicamba treatment. Without the sequential spring treatment of 2,4-D plus dicamba, paraquat, glyphosate and HOE-0661 yielded significantly higher than the DPX materials in this study.

No-till wheat and barley weed control can be summarized from average rating in 1984, 1985 and 1986 (Table 5). Paraquat has provided good control of common chickweed and henbit in wheat but has been less effective in barley, which ranged in the 80% level with spring ratings. Glyphosate performance indicates improved control of both weed species in both crops with the best control in wheat. The average yield between the two glyphosate rates is slightly better than for paraquat and even higher compared to HOE-0661. The HOE-0661 common chickweed and henbit control for wheat and barley are very similar to that of the paraquat treatments. All of the desiccation materials performed better in wheat than in barley which is a common occurrence because of later wheat planting and generally less weed competition.

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Table 1. Performance of spring applied herbicides in wheat and barley, 1986.

		Wheat		Barley		
Treatment	Rate a.i./A	Common Chickweed	Yield bu/A	Henbit	Carolina Geranium	Yield bu/A
Check		0.0	48.3	0.0	0.0	75.0
OPX-E8698	0.016	96.8	38.8	75.0	22.5	70.8
surf. (.25%)	0.024	83.3	38.0	68.8	17.5	75.3
	0.031	88.5	42.0	82.5	22.5	71.8
OPX-R9674	0.016	83.3	39.5	70.0	20.0	71.8
surf. (.25%)	0.024	85.8	38.3	75.0	20.0	72.5
	0.031	93.3	45.3	58.8	20.0	66.8
OPX-M6316	0.016	78.5	37.0	82.5	20.0	82.8
surf. (.25%)	0.024	67.5	44.3	60.0	17.5	79.8
	0.031	87.3	43.0	60.0	25.0	74.8
Bromoxynil	0.25	78.3	39.8	87.5	15.0	83.3
	0.50	66.0	39.8	82.5	7.5	77.8
2,4-D ester	0.38	70.0	43.0	73.8	30.0	77.3
	0.50	89.5	45.3	82.5	40.0	71.5
	0.75	94.5	38.3	83.8	61.3	65.3
2,4-D ester	0.50	70.0	38.3	75.0	31.3	82.5
surf. (.25%)	0.25					
2,4-D ester	0.38	93.3	32.0	80.0	66.0	71.0
dicamba	0.13					
	0.50	94.3	32.3	73.8	37.5	69.5
	0.13					
2,4-D ester	0.38	47.3	37.5	78.3	51.3	68.3
dicamba	0.13					
surf. + (.25%)	0.25					
Bromoxynil	0.50	82.3	42.8	86.0	47.5	72.8
2,4-D ester	0.50					
dicamba	0.125	98.0	33.3	77.5	5.0	79.3
2,4-D acid	0.38	88.5	38.5	78.3	35.0	68.0
	0.50	61.0	39.5	83.8	38.3	78.8
2,4-D amine	0.38	74.3	40.3	83.8	12.5	81.3
	0.50	64.5	41.0	81.0	22.5	80.3
dinoseb	1.13	51.0	44.3	82.5	12.5	83.0
	1.50	74.8	37.5	97.0	35.0	72.8
dinoseb	1.13	74.5	39.5	95.5	99.0	69.0
2,4-D ester	0.25					
LSD .05		31.6	7.4	16.8	22.0	15.4

Table 2. Performance of spring applied herbicides in wheat, 1985.

Treatment	Rate a.i./A	Control Ratings: Horseweed	Carolina Geranium	Yield bu/A
Check	--	0.0	0.0	10.1
DPX-E8698	0.024	99.0	98.0	12.9
surf. (.25%)	0.048	99.0	99.0	13.5
DPX-R9674	0.024	40.0	47.5	6.4
surf. (.25%)	0.048	88.3	92.0	11.6
DPX-M6316	0.031	93.5	59.8	8.4
surf. (.25%)	0.048	94.0	94.3	10.4
DPX-R8224	0.25	42.5	41.0	11.6
surf. (.25%)	0.38	49.8	57.5	13.4
fluorochloridone	0.38	22.5	27.5	6.9
2,4-D ester	0.50	77.3	45.0	10.4
	0.75	94.3	89.3	9.6
2,4-D ester	0.38	99.0	67.5	9.1
dicamba	0.13			
Bromoxynil	0.50	67.3	93.3	12.7
2,4-D ester	0.50			
Bromoxynil	0.50	93.0	22.5	10.8
dicamba	0.63			
LSD .05		22.61	21.04	4.0

Table 3. Performance of herbicides for fall vegetation control in no-till wheat and barley, 1986.[1]

Treatment	Rate[2] a.i./A	WHEAT: Common Chickweed	Henbit	Yield bu/A	BARLEY: Common Chickweed	Henbit	Yield bu/A
Check		0.0	0.0	24.0	17.5	15.0	50.5
DPX-E8698	0.031 (PE)	99.0	99.0	46.5	99.0	99.0	71.0
	0.048	99.0	99.0	43.8	99.0	99.0	68.8
paraquat	0.125	99.0	99.0	40.8	99.0	99.0	63.8
DPX-E8698	0.031						
DPX-E8698	0.024	98.5	99.0	40.5	99.0	99.0	83.3
	0.031 (Post)	98.3	99.0	43.0	99.0	99.0	72.8
	0.048	99.0	99.0	37.3	99.0	99.0	68.0
paraquat	0.25 (PE)	96.0	95.8	40.0	93.5	88.0	69.8
	0.38	97.3	98.0	43.0	95.8	92.0	74.8
glyphosate	0.50 (PE)	98.8	99.0	42.0	94.0	92.5	79.3
	0.75	98.8	99.0	43.8	97.5	96.3	71.8
LSD .05		1.8	1.3	7.5	8.7	7.3	10.6

[1] weed ratings taken 4/9/86

[2] PE - preemergence 10/30/85; Post - postemergence 11/18/85

Table 4. Performance of fall, fall and spring and spring applied herbicides for no-till wheat and barley, 1984.[1]

		NO-TILLL WHEAT				NO-TILL BARLEY	
				Yield Bu/A			
Treatment	Rate[2] a.i./A	Common Chickweed	Common Chickweed (dicamba + 2,4-D)[3]	Without Spring Trt.	With Spring Trt.	Common Chickweed	Common Chickwee (dicamba 2,4-D)
Check		20.0	80.0	40.5	67.0	0.0	48.0
paraquat	0.25 (PE)	85.0	94.0	71.3	75.5	45.0	59.0
paraquat	0.38 (PE)	79.0	94.0	69.3	77.0	70.0	91.0
glyphosate	0.50 (PE)	90.0	95.0	69.3	75.8	58.0	85.0
DPX-M6316	0.016 (ES)	58.0	84.0	58.6	70.8	30.0	45.0
DPX-M6316	0.031 (ES)	36.0	73.0	62.4	68.6	25.0	43.0
DPX-M6316	0.048 (ES)	41.0	93.0	62.9	70.1	10.0	33.0
DPX-T6376	0.016 (ES)	89.0	94.0	63.1	69.1	84.0	86.0
HOE-0661	0.50 (PE)	90.0	91.0	70.3	77.2	55.0	81.0
HOE-0661	0.75 (PE)	90.0	94.0	66.5	75.3	40.0	76.0
LSD .05				3.3	3.3		

[1] weed control ratings made on 6/18/84

[2] time of application - PE - preemergence to crop 10/31/83 and ES - early spring 4/20/86

[3] Banvel (0.13 lb/A) and 2,4-D ester (0.38 lb/A) applied over all treatments on 4/10/84

Table 5. Average performance of fall applied herbicides for no-till wheat and barley in 1986, 1985 and 1984.

		Wheat					Barley				
		Spring Ratings		Fall Ratings			Spring Ratings		Fall Ratings		
Treatment	Rate a.i./A	2 yr. avg. Common Chickweed	2 yr. avg. Henbit	1 yr. avg. Common Chickweed	1 yr. avg. Henbit	3 yr. avg. Yield bu/A	3 yr. avg. Common Chickweed	3 yr. avg. Henbit	3 yr. avg. Common Chickweed	3 yr. avg. Henbit	2 yr. avg. Yield bu/A
Check	--	5.0	0.0	0.0	0.0	37.6	5.8	7.5	5.8	7.5	38.3
paraquat	0.25	90.5	86.1	84.0	84.0	47.1	67.4	75.9	83.8	79.4	61.0
	0.38	88.2	87.2	86.0	86.0	48.6	78.2	80.4	88.6	84.0	62.3
glyphosate	0.50	94.4	95.2	90.0	90.0	49.5	83.3	86.3	88.4	87.9	69.4
	0.75						85.7	85.1	88.2	89.6	62.6
HOE-0661	0.50	94.5	86.9	85.0	84.0	49.7	69.5	76.8	85.4	85.4	56.5
	0.75	94.4	89.0	86.0	86.0	49.3	65.8	78.1	87.2	87.1	60.1

EFFECT OF FALL WEED CONTROL ON THE YIELD OF WINTER WHEAT

Thomas E. Vrabel[1/]

ABSTRACT

In a study conducted in Salem, Maryland, several herbicide combinations were evaluated for the control of common chickweed [Stellaria media (L.) Vill.], henbit (Lamium amplexicaule L.) and spring whitlowgrass (Draba verna L.) in winter wheat (Triticum aestivum L. 'Saluda'). The treatment plots were 0.36 ha in area and were replicated three times. All operations were conducted using commercial farming equipment. Weeds were at the 4 to 6 leaf stage at the time of treatment. The treatments of 0.28 kg/ha bromoxynil plus 0.43 kg/ha dinoseb, 0.43 kg/ha bromoxynil plus 0.43 kg/ha MCPA and 0.43 kg/ha bromoxynil plus 0.28 kg/ha 2,4-D ester all provided acceptable weed control and were responsible for a significant increase in yield over the untreated control. No permanent crop injury occurred with any of the treatments evaluated. The increased yield provided by the weed control treatments resulted in an increased grower profit of $32.75 to $51.87 per hectare.

INTRODUCTION

In recent years, northeastern farmers have become more serious about growing winter wheat by adopting intensive cereal management practices in an effort to increase yield and reduce the cost per unit of production. Adopted production practices include higher seeding rates, narrow row spacings, increased fertility, fall weed control, disease control and the use of a growth regulator to reduce lodging and increase harvesting efficiency. Of these practices, only fall weed control has not gained wide acceptance. This is due to a perception that winter annual weeds are not large enough in size or compete with the crop for a long enough period of time to cause a decrease in yield. Studies conducted in the Pacific northwest have shown that winter annual broadleaf weeds can substantially reduce wheat yields. Swan and Furtick showed that coast fiddleneck (Amsinckia intermedia Fisch and Mey.) at a population density of as low as 11 plants/m² reduced winter wheat yields by 25% (2). At the same population density blue mustard [Chorispora tanella (Pallas) DC.] depressed winter wheat yields by 28% if left untreated and by 13% if controlled in the spring (1). At the present time little research looking at the population dynamics of winter annual weeds and their effects on winter wheat yield has been conducted in the northeast.

In an effort to address this topic a study was initiated in the fall of 1985 to determine the effect of populations of common chickweed, henbit, and spring whitlowgrass on the yield of winter wheat. This study also evaluated the effectiveness of combinations of bromoxynil (3,5-dibromo-4-hydroxybenzonitrile) with dinoseb [2-(1 methylpropyl)-4,6 dinitrophenol], MCPA [(4-chloro-2-methylphenoxy)acetic acid] or 2,4-D ester [(2,4-dichlorophenoxy)acetic acid] in controlling these weed species. In order to reduce the variability inherent

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with small plot research individual plots were 0.36 hectares in area and all operations were conducted with commercial farming equipment.

MATERIALS AND METHODS

This experiment was conducted in Salem, Maryland on a Metapeake silt loam with a pH of 6.4, an organic matter content of 2.5% and a cation exchange capacity of 6.3 meq/100 g. Wheat of the variety 'Saluda' was planted in 10 cm rows on November 5, 1985. Herbicide treatments were applied on January 17, 1986 using a tractor mounted CDA with a spray boom 18.3 meters in width. Spray pressure was 210 kPa and spray volume was 94 l/ha. At the time of herbicide application weeds were at the 4 to 6 leaf stage and wheat was between growth stages 3 and 4 (Feeke's large scale). Herbicide application was intended to occur during the first half of December but due to extremely wet soil conditions had to be delayed until January 17. Weed density counts were made on April 15, 1986 and consisted of making 10 counts of 0.56 m^2 in area per treatment. Individual plot size was 0.36 ha with each treatment replicated three times in a completely randomized design. The experiment was harvested on June 26 using a John Deere combine with a 6.1 m wide head.

RESULTS AND DISCUSSION

Weed pressure was heavy for all species present and was uniform throughout the experimental area. The herbicide treatments of 0.28 kg/ha bromoxynil plus 0.43 kg/ha dinoseb, 0.43 kg/ha bromoxynil plus 0.43 kg/ha MCPA and 0.43 kg/ha bromoxynil plus 0.28 kg/ha 2,4-D ester all gave acceptable control of common chickweed and henbit and excellent control of spring whitlowgrass (table 1). The treatment of bromoxynil plus dinoseb caused a noticeable leafburn on the wheat that was rapidly grown out of by green up. All treatments produced yields that were significantly higher than the untreated control. Based on 1986 wheat prices and herbicide costs the herbicide treatments produced the following increases in profit to the farmer: bromoxynil plus dinoseb - $40.75/ha, bromoxynil plus MCPA - $51.87/ha and bromoxynil plus 2,4-D ester - $32.75/ha.

Herbicide efficacy on common chickweed and henbit was lower than anticipated. This result is attributed to the weeds being winter hardened by the time of herbicide application and that the herbicides were used at the lower end of their recommended rates of application. Despite leaving chickweed populations of 15.7 to 30.2 plants/m^2 and henbit populations of 7.4 to 10.1 plants/m^2 the herbicide treatments did produce a significant yield increase and reutrn on investment. Further studies need to be done with these weed species to determine whether further reductions in their population densities would produce a greater wheat yield response.

In summary, the results of this study show that a mixed population of common chickweed, henbit, and spring whitlowgrass can reduce the yield of witer wheat. The use of combinations of bromoxynil with dinoseb, MCPA, or 2,4-D ester provided acceptable control of these weed species and returned a significant profit on the farmer's investment.

LITERATURE CITED

(1) Swan, D.G. 1971. Competition of blue mustard with winter wheat. Weed Sci. 19:340-342.

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Table 1. Effect of early winter weed control on weed densities and crop yield in winter wheat. (a)

Treatment	rate(kg/ha)	common chickweed plants/m²	common chickweed %control	henbit plants/m²	henbit %control	spring whitlow grass plants/m²	spring whitlow grass %control	yield T/ha
Bromoxynil + Dinoseb	0.28 + 0.43	15.7 b	84 a	10.0 b	72 a	12.4 b	94 a	5.27 a
Bromoxynil + MCPA	0.43 + 0.43	23.2 b	76 a	7.4 b	79 a	11.3 b	95 a	5.05 a
Bromoxynil + 2,4-D ester	0.43 + 0.28	30.2 b	69 a	10.1 b	72 a	2.4 b	99 a	5.10 a
Untreated control	- - -	97.2 a	0 b	35.7 a	0 b	215.0 a	0 b	4.48 b

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

WEED CONTROL PROGRAMS FOR INTENSIVE WHEAT MANAGEMENT

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ABSTRACT

Field experiments were established to evaluate sulfonylurea experimental herbicides relative to standard herbicides for weed control in intensively managed wheat (Triticum aestivum L.) with respect to rate and timing of application. Experiments were established at three locations in Virginia and conducted in small-plot format utilizing a randomized complete block design in four replications. Herbicide treatments included DPX-M6316, DPX-E8698, DPX-R9674, CGA-131036, dinoseb, and combinations of DPX-M6316 plus bromoxynil, DPX-E8698 plus bromoxynil, DPX-R9674 plus bromoxynil, dinoseb plus bromoxynil, bromoxynil plus MCPA, and 2,4-D plus dicamba. Herbicide applications were made with either fall (November) or spring (March) timing of application. Major weed species present at experiment locations included common chickweed [Stellaria media (L.) Vill.], henbit (Lamium amplexicaule L.), mouseear chickweed (Cerastium vulgatum L.), mayweed (Anthemis arvensis L.), mustard species, and wild garlic (Allium vineale L.).

Fall applications of DPX-E8698, DPX-L9674, dinoseb, and combinations which included one of these three herbicides gave greater than 90% control of common chickweed, henbit, mouseear chickweed, mayweed, and mustards. Henbit control was less with fall applications of DPX-M6316 than with DPX-E8698 or DPX-R9674, but control of other species was similar. Fall bromoxynil treatments provided poor or fair control of these species, and no advantage of bromoxynil combinations with sulfonylurea herbicides or dinoseb relative to application of these herbicides alone was observed. Spring treatments with sulfonylurea herbicides including DPX-M6316, DPX-E8698, DPX-R9674, and CGA-131036 generally provided excellent control of weed species present in experimental areas, and provided significantly better control of common chickweed and wild garlic than the spring standard 2,4-D plus dicamba treatment. No herbicide treatment caused a significant reduction in wheat vigor. Competition from uncontrolled weeds generally did not have a deleterious effect on wheat yield. In one experiment, however, heavy mayweed pressure caused yields to be reduced in treatments where control of this species was not adequate.

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POSTEMERGENCE WEED CONTROL IN CORN

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ABSTRACT

Field studies were conducted in 1986 to examine the efficacy of a variety of new postemergence herbicides for use in corn (Zea mays L.). Research was conducted at two locations. The first location was the Wye Research and Education Center in Queenstown, MD. Soil type was a Matapeake silt loam with a pH of 6.1 and 1.5% (w/w) organic matter. Weed species reported on at this site were common lambsquarters (Chenopodium album L.) and velvetleaf (Abutilon theophrasti Medic.). The other location was in Beltsville, MD, utilizing a Galestown silt loam soil, having a pH of 6.8 with 2.5% (w/w) organic matter. The primary weed species reported on at this site was triazine resistant smooth pigweed (Amaranthus hybridus L.). At both locations, studies were arranged as randomized complete block designs with three replications. Individual plots were four rows wide (0.8 m row spacing) by 8 m long. Corn (var. 'Pioneer 3352' in Queenstown and var. 'Pioneer 3192' in Beltsville) was planted by May 5 at both locations. Fertilizer was applied according to state soil test recommendations.

Herbicide applications were made when the corn was in the four to five leaf stage of development. Weeds generally averaged 2.5 to 7.5 cm in height. Herbicides were applied in water utilizing a CO_2 pressurized backpack sprayer that delivered 187 L/ha of water carrier at 138 kPa pressure, traveling 4.8 km/h. Visual weed control ratings were made throughout the season on a scale of 0 to 100, with 0 indicating no weed control and 100 corresponding to complete control. Yields were obtained with a standard field combine.

At the Queenstown location, postemergence applications of SC-0051 or SC-0098 provided excellent (≥90%) control of velvetleaf throughout the growing season. SC-0051 also provided excellent postemergence control of common lambsquarters. Control of common lambsquarters with SC-0098 was variable. DPX-M6316 and benazolin were also tested for postemergence activity at the Queenstown location. Corn injury, in the form of stunting, was observed from applications of DPX-M6316. By 4 weeks after application of DPX-M6316, poor to fair control (60 to 80%) of common lambsquarters and good control (80 to 90%) of velvetleaf was obtained. The reverse was true for benazolin. By 4 weeks after application, good to excellent control of common lambsquarters and poor to fair control of velvetleaf was achieved with benazolin. By the end of the growing season, benazolin was still providing good control of common lambsquarters, while control obtained with DPX-M6316 was unacceptable (≤60%).

At the Beltsville location, postemergence applications of SC-0051 or SC-0098 provided excellent control of smooth pigweed, when preceded by a preemergence application of metolachlor plus atrazine. Benazolin provided poor to excellent control of smooth pigweed when preceded by a preemergence application of metolachlor plus atrazine. Postemergence applications of DPX-M6316 also provided excellent control of smooth pigweed, although treated plants were very slow in showing initial activity.

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USE OF PEST SURVEY DATA FOR ESTIMATING CROP LOSSES

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ABSTRACT

Pest data was collected in 1986 on a weekly basis from over 16,000 acres enrolled in grower financed scouting programs in nine Maryland counties. University trained scouts sampled 605 corn fields and 324 soybean fields operated by 100 and 72 growers, respectively.

Weed information was recorded either as counts per 25 sq. ft. when weeds were uniformly distributed or as a rating when distribution was spotty. No attempt was made to list all species located within a field. Only those weeds considered to be of economic importance or of noxious potential were recorded.

In corn, 25 weed species of economic importance were reported. On the light sandy soils of the Eastern Shore, less than 2% of the fields had weed populations high enough to justify postemergence treatment. The predominate species were fall panicum, foxtail, and large seeded broadleaves.

On the heavier soils of Central Maryland where continuous corn and reduced tillage practices are prevalent, weed pressure was much heavier and composed of harder to control species. Triazine resistant smooth pigweed and fall panicum were of economic importance in 15% of all fields and post emergence control was recommended in 8% and 5%, respectively. Canada thistle was important in 14% of fields and spot treatments were recommended. Lambsquarters which is also triazine resistance in many areas was common in 10% of fields. Milkweed, briars/brambles, hemp dogbane, and horsenettle each infested 5-10% of the acreage. Also present in several fields were poison ivy, Johnsongrass, morningglory, and bindweed. All other weeds were found in less than 4% of the fields.

In contrast to corn, soybean weed problems were more severe on the Eastern Shore. Of the 23 species of economic importance, morningglories were dominant. One third of all fields were infested with morningglories and over 10% required post emergence controls. Horsenettle and cocklebur were of economic importance in 6% of fields. Velvetleaf, pigweed, lambsquarters, Johnsongrass, and jimsonweed were prevalent in only 1-5% of the soybean fields.

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RE-45601: A NEW SELECTIVE POSTEMERGENCE GRASS HERBICIDE

D. D. Rogers [1/]

ABSTRACT

RE-45601 [2/] is a new selective postemergence grass herbicide under development by Chevron Chemical Company, Agricultural Chemicals Division for use in soybeans, cotton, peanuts, sugar beets, potatoes, alfalfa, and most vegetable crops. In the herbicidal class cyclohexanedione-oxime, RE-45601 is effective against a wide range of annual and perennial grasses. Single applications of 84 to 140 gm ai/ha provide effective control of annual grasses and johnsongrass [Sorghum halepense (L.) Pers.]. Rates of 280 gm ai/ha or multiple applications may be required for some perennial grasses such as bermudagrass [Cynodon dactylon (L.) Pers.]. An oil concentrate is recommended at 2.34 L/ha for all postemergence applications. Best results have been obtained when grass species are actively growing and less than 20 cm in height. Preemergence activity for annual grass control has been observed from application rates of 140 to 280 gm ai/ha when applied preemergence or preplant incorporated to many broadleaf crops.

[1/] Chevron Chemical Company, Ocoee, FL 32761

[2/] Trade name SELECT TM

STATUS OF IMAZAQUIN IN THE NORTHEAST

Rick W. Chamblee and W. Frank Congleton 1/

Field studies were conducted in 1985 and 1986 to determine the efficacy of imazaquin for control of weeds that commonly infest soybean [Glycine max (L.) Merr.] fields. Season-long control of major weed species such as common lambsquarters (Chenopodium album L.), cocklebur (Xanthium strumarium L.), redroot pigweed (Amaranthus retroflexus L.), jimsonweed (Datura stramonium L.), common ragweed (Ambrosia artemisiifolia L.), and pitted morningglory (Ipomoea lacunosa L.) was obtained with preemergence applications. In addition to the above weeds, preplant incorporated applications were effective against giant ragweed (Ambrosia trifida L.), burcucumber (Sicyos angulatus L.), velvetleaf (Abutilon theophrasti Medik.), and ivyleaf morningglory [Ipomoea hederacea (L.) Jacq.]. A combination of pendimethalin and imazaquin provided excellent control of shattercane [Sorghum bicolor (L.) Moench].

The data presented was from field studies conducted in cooperation with growers in Delaware, Maryland, New Jersey and Pennsylvania. In these tests, herbicides were applied with CO2 pressurized backpack sprayers on plots that measured 3 by 13 meters. Treatments were replicated 3 times utilizing a randomized complete block design at each location. Visual weed control ratings were made on a scale of 0 to 100, with 0 indicating no control. In table 1, results from the study on burcucumber and ivyleaf morningglory are presented. Table 2 is a summary of the data from a site infested with shattercane.

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Table 1. Control of burcucumber and ivyleaf morningglory in soybeans, 1986.

Herbicide treatment	Rate (kg ai/ha)	Appl. meth.	Percent control Burcucumber 7/16	Burcucumber 8/12	Ivyleaf mg. 7/16	Ivyleaf mg. 8/12
Pendimethalin + imazaquin	0.83 0.14	PPI	98	90	97	94
Pendimethalin + imazaquin	0.83 0.14	PRE	98	88	72	60
Metolachlor + imazaquin	1.65 0.14	PPI	100	95	93	87
Metolachlor + imazaquin	1.65 0.14	PRE	87	80	78	75
Metolachlor + DPX 8259	1.65 0.50	PRE	92	77	77	58
Acifluorfen	0.55	21 DAP	0	30	0	92
Untreated			0	0	0	0
LSD (0.05)			9	15	12	19

Expermental site was near Willards, MD. on a sandy loam soil. Planting date was June 25, 1986. Preplant incorporated (PPI) and preemergence (PRE) herbicides were applied 6/25. Preplant herbicides were incorporated with a combination disk operated at a depth of 10 cm. The acifluorfen treatment was applied 7/16 (21 DAP). Rain (2.95 cm) occurred within 4 days of planting.

Table 2. Control of shattercane in soybeans, 1986.

Herbicide treatment	Rate kg ai/ha	Applic. meth.	Shattercane Control 6/09	7/08
			%	
Pendimethalin + imazaquin*	(0.83 + 0.14)	PPI	94	84
Pendimethalin + imazaquin*	(0.83 + 0.14)	PRE	92	58
Pendimethalin + imazaquin	1.12 + 0.14	PPI	96	93
Pendimethalin + imazaquin	1.12 + 0.14	PRE	94	83
Metolachlor + imazaquin	2.24 + 0.14	PPI	93	83
Metolachlor + imazaquin	2.24 + 0.14	PRE	89	56
Alachlor + imazaquin	2.24 + 0.14	PPI	85	75
Alachlor + imazaquin	2.24 + 0.14	PRE	89	68
Fenoxan + imazaquin	0.55 + 0.14	PPI	98	95
Fenoxan + imazaquin	0.55 + 0.14	PRE	95	89
Pendimethalin + metribuzin	0.83 + 0.55	PPI	92	82
Pendimethalin + linuron	0.83 + 0.83	PRE	72	33
Pendimethalin + metribuzin	1.12 + 0.55	PPI	86	75
Pendimethalin + linuron	1.12 + 0.83	PRE	88	42
Untreated			0	0
LSD (0.05)			11	17

Experimental site was near East Petersburg, Pa. on a clay loam soil. Soybeans were planted May 19, 1986. Both preplant incorporated (PPI) and preemergence (PRE) herbicides were applied 5/19. Preplant herbicides were incorporated with a combination disk operated at a depth of 9 cm. Rain (2.0 cm) occurred within 3 days of planting.

*Package mix.

WEED CONTROL IN CORN WITH TRIDIPHANE - TRIAZINE COMBINATIONS

BRIAN D. OLSON[1]

ABSTRACT

Four field studies were conducted to determine the efficacy of post-emergence herbicide treatments on grasses and broadleaves in corn in 1986. Two separate field studies were conducted in Phelps, New York by the author, one in Valatia, New York by Dr. R. R. Hahn and one in Deerfield, Massachusetts by Dr. P. C. Bhowmik. Each study was set up in a completely randomized block design with four replications for each treatment. In Phelps the plots were 3 x 12 m and each treatment was applied with a CO_2 backpack sprayer delivering 187 L/ha. The plots in Valatia were 3 x 7 m and each treatment was applied with a compressed air plot sprayer delivering 280 L/ha. In Deerfield the plots were 3 x 6 m and the treatments were applied with a CO_2 backpack sprayer delivering 187 L/ha.

Alachlor (2.2 kg/ha) & atrazine (1.7 kg/ha) treatments were applied preemergence (PRE) and early-post emergence (EPO). Atrazine (2.2 kg/ha) & crop oil concentrate (2.3 kg/ha), cyanazine (2.2 kg/ha), and atrazine (1.7 kg/ha) & cyanazine (2.2 kg/ha) were applied as standard EPO treatments. Tridiphane (0.6 kg/ha) & atrazine (1.7 ka/hg) & crop oil concentrate (2.3 L/ha) was applied EPO and late post-emergence (LPO). Applications of atrazine (1.7 ka/hg) & crop oil concentrate (2.3 L/ha) with and without tridiphane (0.6 kg/ha) applied LPO were followed by an application 6-8 days later (LLP) of atrazine (1.1 kg/ha) & crop oil concentrate (2.3 L/ha). From each separate field study efficacy data for one grass species, application dates, and size of grasses are presented in Table 1.

At the first site in Phelps (loamy sand) there was a heavy infestation of yellow foxtail (Setaria glauca (L.) Beauv.) distributed uniformly across the field. All treatments provided excellent control of yellow foxtail except for cyanazine alone and the LPO treatment of tridiphane & atrazine. A moderate infestation of fall panicum (Panicum dichotomiflorum Michx.) was evenly distributed across the second site in Phelps (loamy sand). Three treatments provided acceptable control of fall panicum; tridiphane & atrazine (EPO), cyanazine & atrazine, and cyanazine followed by alachlor & atrazine (EPO). The test site in Valatia (Hoosic gravelly loam) had a uniform stand of large crabgrass (Digitaria sanguinalis (L.) Scop.). Atrazine & cyanazine provided excellent control followed by tridiphane & atrazine (EPO), cyanazine and alachlor & atrazine (EPO). At the Deerfield test site (Hadley fine sandy loam) there was an even distribution of fall panicum. Excellent control was recorded for the alachlor & atrazine (PRE), cyanazine and atrazine & cyanazine treatments followed by tridiphane & atrazine (EPO) then the split application of tridiphane & atrazine.

This study demonstrated that the efficacy of EPO applications of tridiphane & atrazine and atrazine & cyanazine were similar. The data also indicates that the efficacy of a LPO application of tridiphane & atrazine can be increased by a follow up application of atrazine & crop oil concentrate.

[1] Technical Service and Development Rep., DOW Chemical U.S.A, 400 Perinton Hills Office Park, Fairport, New York 14450.

Table 1. The effect of post-emergence herbicide treatments on grass control in corn for 1986 in New York and Massachusetts.[a]

Treatment	Rate (kg ai/ha)	Time appl.	SETGL cntl[b]	PANDI cntl	DIGSA cntl	PANDI %cntl[c]
Alachlor + atrazine	2.2 + 1.7	PRE	-	-	4.5	99.0a[d]
Alachlor + atrazine	2.2 + 1.7	EPO	10.0	7.5	7.8	-
Atrazine + crop oil	2.2 + 2.3 L	EPO	10.0	2.3	4.5	55.0d
Cyanazine	2.2	EPO	8.3	8.8	7.8	99.0a
Atrazine + cyanazine	1.7 + 2.2	EPO	9.8	8.5	9.1	99.5a
Tridiphane + atrazine + crop oil	0.6 + 1.7 + 2.3 L	EPO	9.8	8.8	8.3	88.8ab
Tridiphane + atrazine + crop oil	0.6 + 1.7 + 2.3 L	LPO	7.5	4.8	5.5	-
Tridiphane + atrazine + crop oil Atrazine + crop oil	0.6 + 1.7 + 2.3 L 1.1 + 2.3 L	LPO LLP	10.0	4.5	6.8	78.8bc
Atrazine + crop oil Atrazine + crop oil	1.7 + 2.3 L 1.1 + 2.3 L	LPO LLP	10.0	2.5	3.0	66.3cd
Untreated check			0.0	0.0	0.0	0.0e
Least significant diff. (0.05)			.8946	2.389	0.3	-
Time applied						
PRE			-	-	6/3	5/10
EPO			6/20	6/20	6/13	5/28
LPO			6/26	6/26	6/21	6/10
LLP			7/1	7/1	6/26	6/18
Date rated			8/13	7/29	7/8	8/19
Size of grasses						
EPO			2-3 L	2-3 L	0-1 L	3 L
LPO			3-4 L	3-4 L	3-4 L	4 L
LLP			4-6 L	4-6 L	4-6 L	5 L
Location						
City				Phelps	Valatia	Deerfield
State				NY	NY	MA

a. Data represents the mean of 4 replications.
b. Based on a scale of 0 to 10: 0 = no control, 10 = complete control.
c. Based on a scale of 0 to 100 percent control.
d. Numbers followed by the same letters are not significantly different at the 5% level as determined by Duncan's multiple range test.

DIGSA = Digitaria sanquinalis PANDI = Panicum dichotomiflorum
SETGL = Setaria glauca

Italian Ryegrass Control in No-Till Corn

Thomas E. Hines and Henry P. Wilson[1]

ABSTRACT

No-till (NT) corn (Zea mays L.) is frequently planted into stubble remaining after production of small grains followed by double-crop NT soybeans [Glycine max (L.) Merr.] the previous season. An increase in the incidence of Italian ryegrass (Lolium multiflorum Lam.) as the predominant species at corn planting, necessitates herbicide programs that provide control of existing Italian ryegrass and have residual activity against summer annual species. One study in 1985 and two in 1986 were established to investigate such herbicide programs. Italian ryegrass control in both years was highest from herbicide combinations that included the non-selective herbicides paraquat or HOE-39866. A rate response in 1985 showed that HOE-39866 was most effective at 0.8 kg ai/ha and above. In 1986, the addition of atrazine to a combination of HOE-39866 plus metolachlor slowed the rate of Italian ryegrass control but after 4 wk resulted in higher percent control than HOE-39866 plus metolachlor. Several two- and three-way combinations of atrazine, metolachlor, cyanazine, and simazine failed to provide adequate control of Italian ryegrass in the absence of either of the non-selective herbicides but generally provided adequate late-season control of large crabgrass [Digitaria sanguinalis (L.) Scop.], giant foxtail (Setaria faberii Herrm.), yellow foxtail [Setaria glauca (L.) Beauv.], fall panicum (Panicum dichotomiflorum Michx.), and smooth pigweed (Amaranthus hybridus L.). Control of a high population of Italian ryegrass with 1.1 kg ai/ha glyphosate plus atrazine and alachlor was not adequate in 1986. Low rainfall in the spring of both years reduced the possibility of root uptake of residual herbicides by Italian ryegrass, minimizing contributions these herbicides could have made to overall control of this species.

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Alachlor and Metolachlor Formulation Comparisons

J. Peyton Doub and Henry P. Wilson[1]

ABSTRACT

Filter paper disks in petri dishes were moistened with solutions of microencapsulated and emulsifiable concentrate alachlor and metolachlor. Four concentrations ranging from 10^{-3}M to 10^{-6}M were used. Seeds of barnyardgrass [Echinochloa crus-galli (L.) Beauv.], fall panicum [Panicum dichotomiflorum (L.) Michx.] and large crabgrass [Digitaria sanguinalis (L.) Scop.] were sown on the paper, and shoot lengths and freshweights were recorded after 1 wk. Shoot growth (both parameters) in solutions of emulsifiable concentrate alachlor was less than that in solutions of microencapsulated alachlor. Shoot growth of barnyardgrass in mixed solutions of these two alachlor formulations was intermediate. All three annual grass species produced comparable shoot growth in solutions of microencapsulated and emulsifiable concentrate metolachlor. Air drying of the filter paper disks following application increased the activity of microencapsulated alachlor against barnyardgrass to the level obtained with the emulsifiable concentrate.

Microencapsulated and emulsifiable concentrate formulations of alachlor and metolachlor were surface applied to pots of steam sterilized potting mix (sandy loam soil, sand, and peat moss in an 8:4:3 ratio). Rates used were 1.4 and 2.8 kg ai/ha alachlor and 0.8 and 1.7 kg ai/ha metolachlor. Seeds of barnyardgrass were sown, and the soil was kept continually moist for one week, after which shoot lengths and freshweights were recorded. Shoot growth (both parameters) on pots treated with microencapsulated alachlor was more than that on pots treated with the emulsifiable concentrate. Microencapsulated and emulsifiable concentrate metolachlor performed comparably. Incorporation to a depth of 7 to 8 cm reduced the barnyardgrass control by all treatments but did not change the relative activity of formulations.

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FALSE CHAMOMILE CONTROL IN SPRING OAT

Leigh S. Morrow and Gregory A. Porter[1/]

ABSTRACT

False chamomile [Matricaria maritima L.] is now a commonplace and troublesome weed in Northern Maine cropland. During the last decade it has spread quickly and gone from a weed of minor concern to one of our major weed species. It has finely divided and thread-like leaves and its daisy type flowers are produced on plants from one to three feet in height. There are several reasons why false chamomile has spread to its current population in Northern Maine. First, it is often mistaken for two other less troublesome weeds, oxeye daisy [Chrysanthemum Leucanthemum L.] and pineapple-weed [Matricaria matricariodes (Less.) Porter]. Second, false chamomile is a prolific seed producer and a winter annual which allows it to be very vigorous and competitive in the early spring. Finally, predominant herbicide practices in a potato [Solanum tuberosum L.] and oat [Avena sativa L.] crop rotation are marginally effective on false chamomile. Approximately 50,000 hectares in Northern Maine are cropped to potato and oat annually and false chamomile threatens the whole region.

Several herbicide evaluation trials were conducted in an emerged oat crop at the Maine Agricultural Experiment Station in Presque Isle in 1986. Replicated plots were utilized and herbicide mixtures were applied with hand-held and compressed-air equipment at a volume of 372 l/ha and a pressure of 276 kPa. Six registered compounds and one experimental, DPX-M6316, were evaluated for effect on false chamomile.

Essentially, dinoseb, dicamba, bromoxynil, MCPA, and 2,4-D were ineffective when applied alone. Bromoxynil plus MCPA at a 0.56 plus 0.56 kg ai/ha rate was the most effective combination treatment, and that was still unsatisfactory. Although the oat crop was sacrificed, both the 1.1 and 2.2 kg ai/ha rates of glyphosate were very effective on false chamomile and should be considered for use in a fallow situation. The most promising treatments were the four rates, 0.009, 0.018, 0.026, and 0.035 kg ai/ha, of DPX-M6316 applied alone. Maximum weed control was achieved at 0.026 kg ai/ha with no noted crop injury. Oat yield was not measured due to the severity of the false chamomile infestation in other herbicide plots and check plots.

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SURFACTANT EFFECTS ON BARNYARDGRASS SEEDS

Woodland Hurtt and Richard H. Hodgson[1/]

ABSTRACT

Previous investigations established that polyoxyethylene sorbitan monolaurate (Tween 20) and monooleate (Tween 80) surfactants at concentrations up to 0.4% v/v stimulated germination of barnyardgrass [Echinochloa crus-galli (L.) Beauv.] spikelets (seeds) in petri dishes. In the present studies we examined the time-course of imbibition to determine if this physical process was also stimulated by Tween. We determined the effects of Tween 20, incubation temperature, and accelerated afterripening on water uptake and germination of barnyardgrass seeds. The effects of Tween 20 on germination of deglumed seeds were also examined. Seeds placed in 10-cm petri dishes containing one sheet of Whatman #3 filter paper moistened with 3.4 ml of treatment solution were incubated in germinators at several temperature and light regimes. Experiments were randomized complete blocks with five replicated treatments.

Dormant seeds were imbibed in water at 25 and 30 C for 12, 24, and 48 h. They absorbed measurable quantities of water in 12 h. Water absorption was linear, amounting to 49 and 57 mg/50 seed after 48 h at 25 and 30 C, respectively. Tween 20 at 0.2% v/v increased water uptake by 20 and 13%, after 48 h at 25 and 30 C, respectively. The stimulatory effects of Tween were most pronounced during the first 24 h.

Seeds that had been afterripened at 50 C to partially overcome dormancy imbibed from 82 to 96% as much water as did dormant seeds, depending on treatment and temperature. Dormant and afterripened seeds imbibed equivalent amounts of water when treated with Tween. Tween stimulated imbibition in afterripened seeds from 32 to 64%. Germination of afterripened seeds after 7 days incubation at 25/15 and 30/20 C was 0 and 6%, respectively. Tween treatments increased germination to 7 and 49%, respectively. Only 5% of the Tween-treated, dormant seeds germinated at 30/20 C. In another lot of afterripened seeds we determined that either degluming or incubation in 0.4% v/v Tween 20 increased germination more than two-fold after 7 days. This suggests that the glumes represent a primary barrier to water absorption and that Tween facilitates water movement across this barrier.

These studies demonstrate that Tween 20 accelerated imbibitional water uptake in barnyardgrass seeds at different levels of dormancy. This physical effect is positively correlated with subsequent germination and operates over a range of temperatures on seeds having different levels of dormancy. Enhancement of water uptake appears to be one mechanism whereby Tween stimulates barnyardgrass germination.

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EFFECTS OF TOP-CLIPPING ON THE TRANSLOCATION OF GLYPHOSATE

M. A. Cairoli and D. S. Glenn[1/]

ABSTRACT

Wick bar applications of glyphosate to Johnsongrass that was top-clipped immediately prior to application has been reported to provide greater control and less rhizome regrowth than applications to unclipped plants.

Experiments were conducted to determine the absorption and translocation of ^{14}C-glyphosate in unclipped and top-clipped Johnsongrass and the effects of ethrel applications on absorption and translocation of glyphosate.

^{14}C-glyphosate was applied on the surface in three totally expanded leaves of intact plants (60 cm height) and on the cut surfaces (stem and leaves) of plants top-clipped to 30 cm immediately prior to application (CUT). Plants had been treated previously with glyphosate or glyphosate and ethrel with a forceps-sponge applicator, at the same height. At the end of the period of treatment (10 days) plants were harvested and divided into treated zone, remainder of the treated leaf (only in intact plants), aerial parts, crown, and nodes and internodes from rhizomes.

The results demonstrated that the absorption (% of total recovery) was greater in CUT plants treated with glyphosate alone (12.42%) or combined with ethrel (13.25%) compared to the intact plants (4.53 and 3.95% respectively). The higher absorption in CUT plants could be due to the wound providing a direct route of entry of glyphosate into the plant.

Translocation of ^{14}C-glyphosate was greater in CUT plants compared to UNCUT plants. Translocation (% of ^{14}C recovered) for CUT treatments with glyphosate applied alone (19.7%) or combined with ethrel (21.7%) was significantly greater than that in intact plants treated with glyphosate alone (8.4%) or combined with ethrel (8.5%).

Greater Johnsongrass control and reduced rhizome regrowth with wick bar applications of glyphosate to top-clipped plants may be due to more uptake and translocation of glyphosate in CUT plants compared to intact plants.

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EFFECTS OF VARIATIONS IN DROP MAKEUP ON THE ABSORPTION AND TRANSLOCATION OF GLYPHOSATE IN 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 absorption and translocation of ^{14}C-methyl-labeled glyphosate (specific activity = 58.0 mCi/mM) in velvetleaf (Abutilon theophrasti Medik.). Velvetleaf plants were treated with 1-µl drops applied with a microsyringe to a median region of the second leaf of a plant at the three and one-half full leaf stage. Plants were treated with one, three, or nine drops (1 µl of each) of solution such that the total amounts of ^{14}C-glyphosate and surfactant applied to each plant were constant. ^{14}C-glyphosate was converted to the isopropylamine salt by an equimolar addition of isopropylamine in distilled water. A stock solution was prepared by adding to this solution unlabelled glyphosate acid (99.9% pure), an equimolar addition of isopropylamine, and MON 0818 (the surfactant in the commercial glyphosate formulation). The resulting stock solution contained 5.0 µg ai/µl of glyphosate (both labeled and unlabeled material), 0.15% (v/v) surfactant concentration, and 0.2 µCi/µl of ^{14}C-glyphosate. Various treatment solutions were prepared by diluting aliquots of the stock solution with distilled water. They contained 5.0, 1.7, and 0.6 µg ai/µl of glyphosate, 0.15, 0.05, and 0.017% (v/v) of MON 0818, and 0.2, 0.067, and 0.022 µCi/µl of ^{14}C-glyphosate, respectively, to simulate 1, 3, and 9x dilutions of active ingredient, surfactant, and labeled material. 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. Other treatment solutions were prepared that maintained the surfactant concentration at a constant level of 0.15% (v/v) in each drop. Further, a solution was prepared that consisted of 2.50 µg ai/µl of glyphosate, 0.075% (v/v) of MON 0818, and 0.1 µCi/µl of ^{14}C-glyphosate that was applied in three (1 µl each) droplets.

Preliminary results indicate that absorption and translocation is greater when single, concentrated drops of ^{14}C-glyphosate and surfactant are applied to the leaves of velvetleaf plants than are more dilute drops. Furthermore, if the drop concentration is decreased three- or nine-fold, and the drop number increased three or nine times to maintain the same total amount of radioactivity applied to the plant, there is a decrease in the amount of ^{14}C-glyphosate absorbed and translocated. When surfactant concentration is increased, the loss in efficacy previously exhibited by plants treated with three drops is negated. However, the increased surfactant concentration only slightly negated the loss in efficacy shown by plants treated with nine drops.

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R-25788 AS AN ANTIDOTE FOR SC-0774 IN CORN[1]

Robert M. Devlin[2]

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ABSTRACT

The herbicidal activity of the experimental compound SC-0774 on corn was offset by the herbicide antidote R-25788. Corn plants treated with 500 ppm SC-0774 had 67% less chlorophyll than control plants. In contrast, chlorophyll production was normal in plants grown from corn seeds impregnated with R-25788. Similarly, carotenoid content of corn plants was strongly reduced (68%) by 500 ppm SC-0774. Carotenoid content was not reduced by the herbicide in corn plants grown from seed containing R-25788.

INTRODUCTION

Studies by Chang et al. (2) and Pallos et al. (7) demonstrated that R-25788 (N,N-diallyl-2,2-dichloroacetamide) was an effective antidote for EPTC (S-ethyl dipropylthiocarbamate) in corn. Also it was shown that R-25788 was physiologically selective in that it protected corn and only a few other species from EPTC (2). Because of this selectivity and the high activity of R-25788 in soil, formulations of the antidote with EPTC and butylate (S-ethyl-diisobutylthiocarbamate) have been in commercial use for several years for the control of weeds in corn.

In the present study R-25788 was tested for its ability to block the herbicidal action of the experimental compound SC-0774 on corn (*Zea mays* L.).

MATERIALS AND METHOD

Corn seeds were soaked for 6 h in different solutions of R-25788 and then dried for 6 days at room temperature. The dried corn seeds were then sown in 8-cm styrofoam pots (15 seeds per pot) containing moist vermiculite and grown in a growth chamber under

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constant conditions of light (178 $\mu E\ m^{-2}s^{-1}$, 16 h light and 8 h dark) and temperature (22±2°C). Before being placed in the growth chamber each pot was treated with 500 ppm SC-0774 (7.4 ml per pot) applied as a fine spray to the vermiculite surface. After shoot emergence 30 ml of 1/2 strength Hoagland solution was applied daily to each pot. After 10 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. Before growth determinations were made the first leaf of each plant was removed for pigment analysis. The first leaf tissue was analyzed for chlorophyll and carotenoid content according to the methods of Devlin et al. (3). All experiments were replicated 4 times.

RESULTS AND DISCUSSION

Because of the short period of growth (10 days) allowed for the corn seedlings in this study and since the primary herbicidal action of SC-0774 is the inhibition of chlorophyll production, the effect of the herbicide at 500 ppm on shoot growth was minimal. Initially shoot growth is more dependent on nutrient material stored in the seed than on photosynthate supplied by the leaves. Nevertheless, a significant reduction (16%) in shoot length was observed in seedlings treated with 500 ppm SC-0774 (Table 1). This reduction in shoot length was alleviated somewhat by the addition of 1 to 10 µM R-25788 and entirely eliminated by 100 µM R-25788 (Table 1).

Table 1. Influence of R-25788 on the herbicidal effect of SC-0774 on the growth of corn shoots.

SC-0774 (ppm)		R-25788 (µM)	Length (mm)	Fresh Wgt (mg/10 pl)	Dry Wgt (mg/10 pl)
0		0	197	4971	351
500		0	165	4180	257
500		1	176	4480	287
500		10	175	4253	287
500		100	197	4840	327
500		1,000	200	5100	334
LSD	5%	---	16	818	61
	1%	---	22	1,113	84

A significant reduction in shoot fresh weight was not observed. However, there was a numerical reduction in fresh weight in those seedlings exposed to SC-0774 and a recovery when R-25788 was used with the herbicide (Table 1). The effect of SC-0774 on shoot dry weight followed the same pattern as that on shoot fresh weight. Dry weight was down 27% in seedlings treated with 500 ppm SC-0774. Recovery of shoot dry weight was observed when R-25788 was used with SC-0774 (Table 1).

Root length was not significantly reduced by 500 ppm SC-0774. However, root fresh and dry weights were significantly reduced by 500 ppm SC-0774 (Table 2). As with shoots, the reductions in root fresh and dry weights were offset with the use of increasing concentrations of R-25788 (Table 2).

Table 2. Influence of R-25788 on the herbicidal effect of SC-0774 on the growth of corn roots.

SC-0774 (ppm)	R-25788 (µM)	Length (mm)	Fresh Wgt (mg/10 pl)	Dry Wgt. (mg/10 pl)
0	0	162	4840	426
500	0	147	3902	350
500	1	154	3982	382
500	10	155	4155	353
500	100	161	4557	402
500	1,000	148	4268	400
LSD 5%	---	16	664	67
1%	---	21	903	91

Not much is known about the mode of action of SC-0774 other than its inhibitory effect on chlorophyll production. How the reduction of chlorophyll is accomplished is not known but the herbicide appears to preferentially affect chlorophyll a production. For example, the chlorophyll a:b ratio drops from 2.99 to 2.06 when the plants are treated with 500 ppm SC-0774 (Table 3). In contrast, slightly higher chlorophyll a:b ratios were observed when different concentrations of R-25788 were used with the herbicide (Table 3).

Table 3. Influence of R-25788 on the inhibition of chlorophyll and carotenoid production in corn by 500 ppm SC-0774.

SC-0774 (ppm)	R-25788 (µM)	Chl (a:b)	T Chl (µg/g)	Car (µg/g)
0	0	2.99	1,666	483
500	0	2.06	545	153
500	1	1.88	473	127
500	10	3.11	678	222
500	100	3.29	1,045	325
500	1,000	3.22	1,694	497
LSD 5%	---	--	183	46
1%	---	--	249	62

A 67% reduction of total chlorophyll content was observed in corn plants treated with 500 ppm SC-0774. This reduction was partially offset with the use of 10 µM and 100 µM R-25788 and completely eliminated by 1,000 µM R-25788 (Table 3).

The carotenoid content of corn plants treated with 500 ppm SC-0774 was reduced 68%. Again, as with chlorophyll, 1,000 µM R-25788 completely eliminated the inhibitory effect of 500 ppm SC-0774 on carotenoid production (Table 3).

Since the chemistry of SC-0774 has not been released we can only speculate as to the protective action of R-25788 when applied with the herbicide. A number of investigators have shown that R-25788 increases the level of glutathione in corn (1,4,5). Conjugation of reduced glutathione with several different herbicides has been shown and presented as a method of herbicide detoxification (1,4,5,6). It is possible that SC-0774 is rendered inactive in corn by forming a conjugate with reduced glutathione. However, proof of this conjugate forming has not been shown.

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ACYLANILIDE PERSISTENCE IN CONTINUOUSLY CROPPED SOILS

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ABSTRACT

The degradation and persistence of the herbicides alachlor and metolachlor were examined in the laboratory in fresh soil samples collected from field plots which had been treated yearly with alachlor and continuously cropped (5 yrs) with soybeans or corn. Degradation and persistence were determined by treating seived soil samples with acetone solutions of the herbicides, watering the soil to 70% of field capacity after evaporation of the acetone, and incubating the samples in the dark at 26°C. At regular intervals each soil treatment was subsampled and the subsamples were stored at -18°C until analyzed. After thawing the soil samples were extracted with a water-acetone (1:1, v/v) mixture which was then partitioned with hexane and the hexane concentrated and analyzed on a gas chromatograph equipped with a thermionic specific detector. Results of this investigation revealed that the degradation of alachlor was significantly slower in soils from fields with a continuous alachlor treatment history than in untreated control soils (Table 1), and slower in corn-cropped soils than in soybean-cropped soils. Similar results were obtained with metolachlor applied to these same corn-cropped soils.

The relative importance of microbial vs chemical degradation of alachlor appeared to be different between alachlor history and nonhistory soils. Alachlor degradation in history soils followed first order kinetics whereas alachlor degradation in nonhistory soils was characterized by a lag period followed by a period of more rapid degradation, the latter pattern being more typical of microbial degradation. This observation was further supported by data obtained on the degradation alachlor in gamma-irradiated and non-irradiated soil. Gamma-irradiation reduced alachlor degradation by only 50% of that observed in non-irradiated soil. These results suggest that alachlor degradation was a mixed chemical and microbial process which may be affected by interactions with the crop plant or other agricultural practices.

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Table 1. The effect of corn, soybean and repeated alachlor treatments on the degradation of alachlor in soil. Results are presented as % of alachlor applied.

Days after treatment	Corn: Treated 5 years with alachlor	Corn: Nontreated control	Soybean: Treated 5 years with alachlor	Soybean: Nontreated control
Duffield silt loam				
0	100.0*	100.0	100.0	100.0
9	46.2	42.0	30.7	31.7
16	30.2a**	22.2b	14.4bc	13.4c
26	14.5a	8.4b	6.0bc	4.9c
Cordorus silt loam				
0	100.0*	100.0	100.0	100.0
16	80.0	70.4	71.1	68.9
14	56.3	45.6	46.7	42.2
27	34.4a**	10.4c	25.8b	13.8c
50	13.9a	4.4c	9.2b	5.0c

* Initial concentration of alachlor in the soil was 15-17 μg/g and 21.5-23.5 μg/g for the Duffield and Cordorus soils, respectively.

** On each date, numbers followed by different letters are significantly different (p=0.5) according to Duncan's multiple range test.

GERMINATION AND GROWTH OF SOLANUM CAROLINENSE L.

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ABSTRACT

Horsenettle (Solanum carolinense L.) is becoming an extremely important major weed in conservation tillage farming and is well established in permanent pastures in the northeast, southeast, and southcentral United States. Early research on distribution of horsenettle has indicated spread primarily by vegetative propagation. This research was conducted to determine if horsenettle from diverse growing areas has a potential for dispersal by seed.

Collections of fruit from 49 locations in 21 states, Washington, D.C., and Ontario, Canada were evaluated to determine their germination and plant growth potential in greenhouse and field nursery experiments during a three-year period. Germination studies were conducted using medium sized seed (1.78 to 2.38 mm in dia.) collected from medium sized fruit (1.0 to 1.5 cm in dia.). During 1984, germination of seed collected at various locations in the eastern United States varied from 0 to 81%. Separate collections from Frederick, MD ranged from 5 to 48% germination. During 1984, the year of transplant, the average flower number for all collections ranged from 0.1 to 7.8 per plant. Collections from Beltsville and Frederick, MD and Hanover, PA produced over 7 flowers per plant. Four other collections from Frederick, MD and a collection from Windsor, CN averaged less than one flower per plant. In 1986 the same plants produced from 15.7 to 39.3 flowers per plant. The Beltsville collection which was the most prolific in 1984, produced few flowers per plant in 1986.

The percentage of plants with fruit in 1984 ranged from 11 to 86. The collection from Shenandoah, WV had the most plants with fruit. In 1986 the number of plants with fruit ranged from 49 to 100%. Average fruit number ranged from 0.5 to 56.8 per plant in 1984 and from 2.2 to 13.2 in 1986. A single plant from a Frederick, MD collection yielded 1103 fruit in 1986.

This research demonstrates that horsenettle plants from many locations are prolific fruit producers and that the seed germinate readily. Collections from different locations however, vary in their growth, fruit production, and germination patterns. Future research should be directed toward determining the importance of seed dispersal versus root propagation in the spread of this weed.

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Table 1. Horsenettle germination and growth

Coll. No.	Source	% Germination 1984	No. flowers/plant 1984	No. flowers/plant 1986	No. fruit/plant 1984	No. fruit/plant 1986
2	Monmouth, NJ	3 a[a]	3.2 abc	39.3 b	1.1 a	10.4 ab
3	Frederick, MD	31 cd	0.7 ab	38.4 ab	3.1 ab	13.2 b
4	Frederick, MD	48 ef	0.9 ab	26.3 ab	1.0 a	9.1 ab
5	Frederick, MD	39 de	0.1 a	26.7 ab	1.7 ab	6.2 ab
6	Frederick, MD	5 ab	7.4 c	18.3 ab	13.2 abc	4.6 a
7	Frederick, MD	13 b	0.9 ab	24.5 ab	4.4 abc	7.8 ab
8	Cape May, NJ	58 gh	1.4 abc	30.5 ab	0.5 a	6.7 ab
9	Hanover, PA	40 de	7.1 c	26.1 ab	17.4 bc	6.1 ab
10	Windsor, CN	<1 a	0.5 ab	16.7 ab	0.2 a	4.4 a
12	Frederick, MD	44 ef	2.7 abc	26.7 ab	9.8 abc	10.3 ab
13	Beltsville, MD	58 gh	7.8 d	15.8 a	18.7 c	4.9 a
15	Perryville, MD	81 i	2.8 bc	15.7 a	7.0 abc	2.2 a
17	Shenandoah, WV	52 fg	2.7 bc	32.7 ab	56.8 d	9.3 ab
21	Tifton, GA	23 c	2.0 abc	36.6 ab	11.9 abc	8.6 ab

[a]Duncan's Multiple Range Test at the 5% level.

EFFECT OF TEMPERATURE ON TRIAZINE RESISTANT WEED BIOTYPES

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ABSTRACT

Studies were initiated to determine the effects of different temperature regimes on triazine resistant and susceptible biotypes of common lambsquarters (Chenopodium album L. #[2/] CHEAL) and smooth pigweed (Amaranthus hybridus L. #AMACH) from different geographical locations. These studies were conducted at the North Carolina State University Phytotron facility in controlled environment growth chambers. Triazine resistant common lambsquarters biotypes from Virginia, Maryland, and Switzerland as well as a smooth pigweed biotype from Virginia were examined. Triazine susceptible biotypes of common lambsquarters and smooth pigweed were included as controls. Shoot height, weight, chlorophyll a and b content, and whole leaf fatty acid content of common lambsquarters and smooth pigweed were determined at 18°/14° C, 26°/22° C, and 36°/26° C. Measurements of shoot height were made at 30 and 63 days after planting. The shoot weight, chlorophyll a and b content, and fatty acid content was determined from plants harvested at 63 days after planting. These data indicate common lambsquarters biotypes from different geographical regions exhibited a differential response to temperature. There was no difference between triazine resistant and susceptible biotypes in response to temperature. Differences were detected between triazine resistant smooth pigweed biotypes which indicated that the susceptible biotypes were more vigorous as indicated by shoot height and weight at lower temperatures than triazine resistant biotypes of smooth pigweed.

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[2/] Letters following this symbol are a WSSA- approved computer code from Composite List of Weeds, Weed Sci. 32, Suppl. 2. Available from WSSA, 309 W. Clark St., Champaign, IL 61820.

COMPARATIVE EFFECTS OF FIVE OXADIAZOLE COMPOUNDS ON SOYBEAN LEAF CELLS

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ABSTRACT

Oxadiazon (3-[2,4-dichloro-5-(1-methylethoxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2-(3H)-one), a member of the oxadiazole class of herbicides, provides excellent control of annual grass and certain broadleaf weed in several crop plants, following premergence applications.

The effects of oxadiazon and four of its metabolites in plants designated as OXA-1 (mono-dealkylated oxadiazon), OXA-2 (di-dealkylated oxadiazon), OXA-3 (alkyl hydroxylated oxadiazon), and OXA-4 (carboxylic acid derivative of oxadiazon) on selected metabolic processes of enzymatically isolated leaf cells of soybean [Glycine max (L.) Merr. cv. Essex] were compared in time- and concentration-course studies. All five oxadiazole derivatives were tested at 0, 0.1, 1, 10, and 100 μM. Time periods included 30, 60, and 120 min. CO_2 fixation, protein synthesis, RNA synthesis, DNA synthesis, and lipid synthesis were assayed by the incorporation of $NaH^{14}CO_3$, [^{14}C]-leucine, [^{14}C]-uracil, [^{3}H]-thymidine, and [^{14}C]-acetate, respectively, into the isolated cells.

At the highest concentration of 100 μM and after 30 min of incubation time, oxadiazon inhibited $^{14}CO_2$-fixation of soybean leaf cells by 82%, protein synthesis by 81%, and lipid synthesis by 68%. The metabolites OXA-1 and OXA-3 behaved very much like oxadiazon in affecting these metabolic processes of soybean cells, but OXA-3 was totally ineffective as inhibitor of lipid synthesis. OXA-2 and OXA-4 did not inhibit CO_2-fixation of soybean leaf cells at any concentration examined. These two metabolites, however, inhibited protein and lipid syntheses of soybean leaf cells equally or more effectively than oxadiazon when used at equimolar concentrations. RNA and DNA syntheses of soybean leaf cells were the least sensitive processes to oxadiazon and its four metabolites at any concentration examined. The maginitude of the inhibition percentages caused by oxadiazon and its metabolites on soybean cell metabolic processes was not influenced by increases in incubation time from 30 to 60 or 120 min. With regard to the inhibition of lipid synthesis of soybean leaf cells by these oxadiazole derivatives, the conversions of oxadiazon to metabolites OXA-2 and OXA-4 may be considered as a bioactivation process.

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FATE OF GLYPHOSATE IN TOMATO AND BROOMRAPE

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ABSTRACT

Broomrape (Orobanche spp.), a noxious parasitic weed, causes severe losses in the yield of many economically important crops, including tomato (Lycopersicon esculentum Mill.), throughout the semiarid and some temperate regions of the world. Various control methods, including several soil-applied herbicides, tried against broomrape have proved either ineffective or injurious to crop plants. Soil sterilization by fumigation or solar heating is the only practical means of controlling broomrape, but this method is very expensive. The objectives of this research were to test the efficacy of very low rates of glyphosate (60 to 120 g/ha) for broomrape control, selectively, in tomato and to investigate the translocation and metabolic fate of the herbicide in tomato plants infected with broomrape.

In greenhouse experiments, glyphosate applied at 37.5 and 75 g/ha on the foliage of tomato (var. Rutgers) plants infected with O. aegyptiaca inhibited broomrape growth on the host plants. The higher rate of the herbicide, however, caused some injury to tomato plants, especially to the roots. Autoradiograms of plants treated with ^{14}C-glyphosate solution, applied as twelve 10-µl droplets (total 0.25 µCi/plant) on the upper leaves of tomato plants, showed that the radiolabel was translocated to all parts of the host plant and to broomrape shoots. Quantitative estimation of radioactivity by liquid scintillation spectrometry in various parts of noninfected and broomrape-infected tomato plants indicated that significantly less of the radiolabel was translocated to the apical meristem of the host plants infected with broomrape than to that of uninfected host plants. Radiolabel translocated from the leaves of tomato plants infected with broomrape appeared to accumulate in considerable amounts in the apical portions of the parasite. Thin layer chromatographic analysis of extracts from various parts of the host plant and broomrape indicated no significant metabolism of ^{14}C-glyphosate.

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RESPONSE OF TRIAZINE HERBICIDES TO VARIOUS LEVELS OF SOIL pH

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ABSTRACT

Past studies have linked reduced triazine phytotoxicity to low pH soils. The objectives of this study were to determine how the addition of various rates of lime would influence weed control in no-tillage corn by atrazine, cyanazine, and simazine applied alone or in combination with alachlor, metolachlor and pendimethalin. This study was run on the same site during the 1985 and 1986 growing seasons. Lime was applied only on April 26, 1985, at the rates of 0, 3375, 6750, and 10,125 kg/ha. Initial soil pH was 5.0 throughout the test area. All lime applications significantly increased soil pH in the upper 5 cm of soil. Addition of lime to the triazine treatments enhanced control of annual grasses, but did not affect control of redroot pigweed (*Amaranthus retroflexus*). Addition of alachlor, metolachlor, and pendimethalin to the triazines increased weed control. Corn yields were not affected by lime applications, but were inversely related to total weed yield. Response of the corn and weeds to increased soil pH will be discussed.

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WEEDY ALIEN TAXA AT HEMPSTEAD PLAINS, LONG ISLAND, NEW YORK

Richard Stalter [1] Eric Lamont [2] and Wayne Seyfert [3]

ABSTRACT

The present study presents information on the history of land use of Hempstead Plains, and the invasion of weedy alien species over a ninety-four year period, 1892-1986. Various investigators reported that alien taxa comprised 0.8% to 46% of the Plains flora. The disparity in the results of these investigators might be explained by choice of study area, disturbance e.g. plowing, dumping and vehicular traffic on the sites selected for study.

INTRODUCTION

Hempstead Plains, once encompassing approximately 60,000 acres, is located on Long Island, New York. The ecology of the Plains has been of interest and an enigma to ecologists who have studied the area. The goal of this review is to present the history of the land use of the Plains and then to interpret the floristic and vegetational changes that have occurred over the past ninety-four years based on a comparison of several floristic studies. Those who have made important contributions to the flora of the Plains include Hicks (1892), Harper (1918), Ferguson (1925), Cain et al. (1937) and Seyfert (1973). Stalter (1981, 1982) studied the ecology of the Plains in July 1980 through June 30, 1981. He recorded the phenology and abundance of taxa found in fifty, meter square quadrats at two study sites within the Hempstead Plains Nature Preserve. Stalter and Lamont studied the flora of the Plains in 1986.

The objectives in the present study are: (1) to trace the history of invasion of alien species at Hempstead Plains; (2) to present the history of land use at Hempstead Plains.

METHODS

A comparison of native and introduced flora from 1892 through 1986 was obtained by examining species lists compiled by Hicks (1892), Harper (1918), Ferguson (1925), Cain et al (1937), Seyfert (1973), Stalter (1981, 1982), and Stalter and Lamont (1986). These data are presented in Table 1. Gray's Manual of Botany (Fernald 1950) was used as a reference to identify native and introduced species. Nomenclature follows that of Fernald (1950).

DISCUSSION

Soils

Hempstead Plains are situated on outwash deposits of the last Wisconsin glacier. Two soil groups, the Haven Variant Association and Hoosic Variant Association were identified at the study sites. The Haven Variant Association occupies nearly level to gently sloping outwash plains. The soils are deep, well drained, and medium textured. They are underlain by stratified sand and gravel at depths ranging from 20 to

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36". Permeability is moderate in the upper loam material and very rapid in the underlying sand and gravel. The Hoosic Variant soils are somewhat similar to the Haven Variant soils and lie in drainage areas that dissect the Haven Variant Association in a north-south direction (U.S.S.C.S. 1976).

Hoosic Variant soils are deep, very gravelly and well drained. The upper 12" consists of sandy loam, loam or silty loam, that contain varying amounts of gravel. Subsoils extend from 20 to 30" and consist of very gravelly sandy loam that becomes very gravelly loam with depth. The substratum is stratified sand and gravel. Permeability is moderate to moderately rapid in the top soils and very rapid in the subsoil when sand and gravel are the dominant fractions (U.S.S.C.S. 1976).

Historical Information

One of the earliest descriptions of Hempstead Plains was that by Denton (1670) which was reported by Seyfert (1973). Denton describes the plains as follows:

> "Toward the middle of Long-Island lyeth a plain sixteen miles long and four broad, upon which plain grows very fine grass, that makes exceeding good Hay, and is very good pasture for sheep or other cattle; where you shall find neither stick nor stone to hinder the Horse heels, or endanger them in their races..."

By 1755, seventeen thousand acres of Plains land were held as common lands by the Town of Hempstead. Thompson (1839) in Seyfert (1973) reported:

> "Except for the great plains, much of the common lands of the town was anciently enclosed in large fields for the pasturing of different kinds of stock, and denominated according to the use intended, as the ox-pasture, the cow-pasture, etc."

The aforementioned accounts indicate that Hempstead Plains was primarily used for cattle and sheep raising from 1670 to 1869. That Hempstead Plains was thought to be unsuitable for crops can be seen by examining the account by Prime (1845) to explain the reason why the Plains was unsuited for farming. Prime (1845) states:

> "The main difficulty lies beneath the soil. The substratum is a coarse, smooth, clean gravel, that appears as if it had been screened and washed from every particle that was capable of retaining moisture, or any other vegetable nourishment, and its depth is unfathomable. The necessary consequence is, that except in few places, where there is a small mixture of loam, a coat of manure is leached off in the coarse of a year or two; and the work must be done over again."

Poor soil as a detriment to cultivation is also clearly stated by Denton (1670) in Furman (1845). Furman notes:

> "From the first settlement of the country until within about the last thirty years it was universally believed that this great tract of land could never be cultivated-that if turned up bythe plough, it was so porous, the water would at once run through it and leave the vegetation on the surface to perish from drought-that nothing would grow upon it except the tall grass which seems a native of that region."

Yet, 17,000 acres of land in the southeastern portion of Hempstead Plains were not plowed. By the 1840's several influential individuals argued that this portion of Plains land owned by the Town of Hempstead should be sold or cultivated. The chronology of those who argued for the cultivation of the Plains is presented by Seyfert (1973). In 1869, the Hempstead Town Commissioners finally gave serious thought to selling their tracts of Plains land. The Commissioners were approached by Mr. Charles Harvey, who offered to purchase the land for $42.00/acre. Later that same year, Mr. Alexander Stewart offered $55.00/acre for a 7,500-acre tract of land. The offer was increased to $60.00/acre by Col. Alfred Wood and Mr. C.B. Camp. After much bickering, the townspeople voted on the various offers and decided to sell 7,500 acres of land to Mr. Stewart for $394,350. On November 23, 1869, Mr. Stewart purchased an additional 2,000 acres of land. Additional tracts of Plains land were sold by the Town of Hempstead in 1870, 1915, and 1927. In 1934, the last tract of Hempstead Plains was sold by the Town of Hempstead (Seyfert 1973).

Most investigators (Hicks 1892, Harper 1918, Ferguson 1925, Cain et al 1937, and Seyfert 1973) are in agreement that Hempstead Plains was devoid of arboreous growth. Early descriptions of Hempstead Plains by Denton (1670) and Belknap (1780) cited by Seyfert (1973) support the treeless condition of Hempstead Plains, yet Bailey (1949) cites Burnaby (1759) who maintained that shrubs and trees grew on the Plains. Since early accounts of the original Hempstead Plains flora are contradictory the status of the original flora is uncertain.

The first floristic study of Hempstead Plains was conducted by Hicks (1892). Hicks reported that Andropogon Gerardi and Sorghastrum nutans might have been more abundant prior to his (1892) study.

The next serious study of the Plains flora of the was published by Harper (1918). Harper reported that Andropogon scoparius was the most common component of the herbaceous vegetation. Harper stated that other important components of the flora included: Andropogon Gerardi, Aletris farinosa, Antennaria plantaginifolia, Carex pensylvanica, Hypoxis hirsuta, Polygala polygama, Rhus copallina, Sorgastrum nutans, Tephrosia virginiana, and Viola pedata. Harper also noted that the following weeds were invading the once cultivated areas of the Plains including: Agrostis alba, Ambrosia artemisiifolia, Aster ericoides, Daucus carota, Digitaria sanguinalis, and Linaria vulgaris.

Ferguson's (1925) floristic study of the Plains was one of the most complete studies of the area and included a list of 251 species (Table 1).

Conard (1935) indicated that several undisturbed tracts of 100 acres still remained within the original boundary of the Plains. Conard states that Aletris farinosa, Andropogon scoparius, A. Gerardi, Aster ericoides, Baptisia tinctoria, Juncus Greenii, Solidago tenuifolia, Viola fimbriatula and a number of other species were important components of the Plains flora. Several species reported by Conard (1935) are also important components of the Plains flora today.

While Cain et al. (1937) did not conduct a floristic study of the Plains, his comments on the plant association "Andropogonetum Hempsteadii" are helpful in interpreting the ecology of the Plains. Cain writes:

> "Trees, when present, usually are stunted and short-lived. The dominants included Andropogon scoparius, Aster linariifolius, Carex pensylvanica, Aster ericoides, and Baptisia tinctoria. There are many other species

present in the association, but they are not of high density, coverage or presence."

McManus (1968) wrote that the only remaining tracts of Hempstead Plains were located at Mitchel Field comprising approximately 600 acres of land. These small remnants have been reduced still further. Stalter (1982) noted that one of his study sites at Hofstra University in the summer of 1980 had been covered by fill during the spring and summer of 1981. While small tracts of land supporting Plains vegetation remain, these tracts might eventually be developed. One portion of the original Hempstead Plains on the southern border of a Mitchell Field runway, containing 20 acres supports the best example of Plains vegetation. The vegetation of this 20 acre tract was studied by Stalter and Lamont in 1986.

The data in Table 1 indicate that over 80 percent of the species identified by Hicks (1892) were native to North America. Harper (1918), Ferguson (1925) and Cain et al. (1937) found over 95 percent of the species at Hempstead Plains were native species. Seyfert's (1973) study revealed that approximately 45 percent of the Plains flora were introduced while Stalter's (1981) data, numbering forty-eight species, indicate that 44 percent of the species found in his study quadrats were introduced. The high percentage of introduced flora in the studies of Seyfert (1973), Stalter (1981) and Stalter & Lamont (1986) suggest that the areas studied by Seyfert, Stalter and Stalter & Lamont were disturbed. The disparity in the results of these investigators might be explained by choice of study area, and disturbance e.g. plowing, vehicular traffic and dumping on the sites selected for study.

No accurate account of the flora of Hempstead Plains was known until the study by Hicks (1892). The flora observed by Hicks in 1892 was a product of over 150 years of intensive grazing; and, therefore, might have been different from the flora that existed when the region was first settled by Europeans. Hicks (1892) quotes early Dutch writers, "Hempstead is superior to all settlements on the Island, for it is very rich in cattle." A quotation by Thompson (1839) that appears in the Introduction of this paper, notes the use of Hempstead Plains for the sustenance of livestock.

Harper, (1918) recognized Hempstead Plains as a genuine prairie on Long Island. Harper (1918) believed that the Andropogon which he found to be most abundant. Andropogon scoparius was probably not the dominant grass in colonial times; but rather Andropogon furcatus, which is common on the prairies of western United States. Andropogon furcatus is not included in Hicks (1892) flora.

Harper, (1918) recognizing the significance of the Plains as genuine prairie, speculated about the origin of the Plains. Harper considered a number of factors (soil, fire, etc.) to be of critical importance in explaining the origin and perpetuation of the Plains. However, no solitary factor can individually account for the ecology of Hempstead Plains.

Investigators have suggested many factors that might have been important in perpetuating the Plains vegetation. Fire (Cain et al. 1937, Seyfert 1973), topography (Cain et al. 1937), the presence of Andropogon scoparius, a thick sod producer (Svenson 1936), the role of small mammals, soils (Svenson 1936, Stalter 1981), allelopathy (Stalter 1981) and a combination of the above factors (Stalter 1981) have been suggested to explain the presence and maintenance of the Plains vegetation.

The original 60,000 acres of Plains vegetation has now been reduced to less than 100 acres. Almost all of the remaining 100 acres has been altered by plowing, dumping, roads, pipelines, and mini-bike trails. Little or no portion of the original Plains could

be defined as in its "natural condition," although many of the species found on the original Plains still thrive there today.

TABLE 1. A comparison of native and introduced flora, on Hempstead Plains, Long Island, New York, 1892 to 1986.

COLLECTOR	TOTAL SPECIES	NATIVE SPECIES	INTRODUCED SPECIES
Hicks (1892)	126	106 (84%)	20 (16%)
Harper (1918)	123	118 (96%)	5 (4.1%)
Ferguson (1918)	251	249 (99%)	2 (0.8%)
Cain (1937)	69	67 (97%)	2 (3%)
Seyfert - Southeast (1973)	220	119 (54%)	102 (46%)
Seyfert - Central (1973)	185	103 (56%)	83 (44%)
Stalter (1981)*	48	27 (56%)	21 (44%)
Stalter & Lamont (1986)	172	107 (62%)	65 (38%)

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ACTIVITY OF ALLELOCHEMICALS IN SUSPENDED CELL CULTURES

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ABSTRACT

A study was conducted to determine the activity of two common allelochemicals, caffeic acid and t-cinnamic acid, on cell growth. Mixaploid rice cell suspension cultures were grown on MS media containing 146 mg/L glutamine, 0.1 mg/L 6-Benzyladenine and 2 x 10^{-6} M 2,4-D, and subcultured every 7th day to maintain rapid cell growth. Caffeic acid and t-cinnamic acid at 10^{-3} M and 10^{-4} M were added to the cell cultures at the time of subculturing (0 day) and three days after subculturing (3 day). The settle cell volume technique was used to measure the effect of the two phenolic acids 7 days after treatment. The 0-day addition of caffeic acid and t-cinnamic acid at 10^{-3} M resulted in a three fold reduction in cell growth compared to the methanol and distilled water controls. Caffeic acid turned the cell suspensions black and t-cinnamic acid-treated cell suspension turned white. When added 3 days after subculturing 10^{-3} M caffeic acid had no effect on cell growth whereas t-cinnamic acid resulted in a 50% reduction in cell volume. During the first 3 days after subculturing the cells were in the lag phase and rapid production of growth components, proteins and nucleic acids, occurred in preparation for the logarithmic growth phase. Caffeic acid and t-cinnamic acid were more phytotoxic to cells when added during the lag phase, suggesting that they interfered with the production of these growth components. Caffeic acid and t-cinnamic acid at 10^{-4} M had no effect on cell growth with either the 0 day or 3 day treatments.

During the first 20 h following the addition of cells to untreated media the pH of the cell suspension cultures decreased from 5.7 to 4.6 and then raised to 5.6 after 7 days. The pH of the cell suspension cultures treated with 10^{-3} M caffeic acid or t-cinnamic acid remained relatively constant throughout the 7 day growth period. Addition of 0.1 N KOH or NaOH to the media prior to subculturing the cells reversed the effects of 10^{-3} M caffeic acid on cell growth. The cell suspensions, however, still turned black. The bases had no effect on the activity of t-cinnamic acid. Caffeic acid-treated media, in the absence of cells, also turned black when KOH or NaOH was added. Perhaps caffeic acid is interfering with the flux of ions across the plasmalemma of the rice cells.

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ECOLOGICAL FACTORS IN BIOMASS PARTITIONING OF HORSEWEED

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ABSTRACT

In 1985 and 1986, field experiments were conducted at the University of Massachusetts Agricultural Experiment Station in South Deerfield to acertain what biological and/or ecological factors might be responsible for the spread of horseweed (Conyza canadensis L.) into this area. The main site studied was an experimental corn field heavily infested with horseweed in which no-till conditions had been maintained for five years. The time of germination and total number of plants/m^2 were recorded for areas with and without crop and weed residues. Peak germinations occurred in the fall and in the spring, with some germination throughout the summer. Spring germination was delayed 30 days and the number of plants/m^2 was reduced by 90% by weed and corn residue cover. The potential for future infestations was assessed in terms of seed production per plant and number of germinable seeds in the soil. Ninety percent of germinable seeds were found in the top 2 cm of soil. Throughout the growing season, biomass partitioning of horseweed was measured in terms of dry weight of leaves, stems, roots, and flowers at densities of 1, 100, 200, 300, and 400 plants/m^2, and under shade levels of 66%, 40% and 25% of full sunlight. Shade treatments reduced total biomass production to 62, 21, and 11% and seed production to 51, 11, and 4% of unshaded plants. Densities of 200 plants/m^2 had the highest seed production, 2.2×10^7 seeds/m^2. However, 1 plant/m^2 produced 10% as many seeds. Single plants growing without competition produced as many as 2×10^5 seeds.

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Soil Persistence of SC-0051 and SC-0774

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ABSTRACT

Studies to measure the presence and movement in sandy loam soil of the herbicides SC-0051 and SC-0774, were conducted during the 1986 growing season at the Eastern Shore Agricultural Experiment Station in Painter, VA. Conventional and no-till cropping systems were examined. Large crabgrass [*Digitaria sanguinalis* (L.) Scop.] was used as a bio-indicator since it is highly susceptible to these herbicides. Soil was examined from depths of 0-2.5 cm, 2.5-5.1 cm, and 5.1-7.6 cm. These studies showed that 16 wk after treatment, enough herbicide remained in the soil from April applications of SC-0774 at 1.1 to 1.7 kg ai/ha to kill or bleach large crabgrass. In no-till corn (*Zea mays* L.), the addition of 1.1 kg ai/ha of SC-0051 to 1.7 kg/ha of SC-0774, enhanced bleaching over that obtained from SC-0774 alone. Under no-till applications, all bleaching occurred in plants growing in soil taken from the top 2.5 cm. Under conventional tillage, bleaching occurred in plants growing in soil taken from the 0-2.5 cm and 2.5-5.1 cm depths. The study was repeated 22 wk after treatment and no bleaching was observed. No bleaching was observed on a rye (*Secale cereale* L.) cover crop that was planted 23 wk after application. Soil pH was 4.5 at 16 wk after treatment and 5.6 at 22 wk after treatment.

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EFFECT OF FMC-57020 ON PLANT GROWTH AND PIGMENT SYNTHESIS[1]

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ABSTRACT

FMC-57020 had little influence on the germination of wheat and radish. Only at 1 mM was germination delayed and inhibited. Under controlled environmental conditions the growth of wheat and radish was reduced by FMC-57020. Pigment synthesis (chlorophyll and carotanoids) in etiolated corn leaf sections exposed to light was inhibited by FMC-57020.

INTRODUCTION

The herbicide FMC-57020 [2-(2-chlorophenyl)methyl-4,4-dimethyl-3-isoxazolidinone] is being developed by FMC Corporation for preemergence broad-spectrum weed control in soybeans (7). Control of several annual grass and broadleaf weeds has been demonstrated by a number of investigators (1,7,8,9,). Susceptible plants are stunted in growth, lose the ability to synthesize chlorophyll and eventually die.

In the present study the influence of FMC-57020 on the germination and growth of wheat (Triticum aestivum L.) and radish (Raphanus sativus L.) was studied. Also studied was the effect of FMC-57020 on pigment synthesis in etiolated corn (Zea mays L.) leaves exposed to different periods of light.

MATERIALS AND METHODS

Wheat and radish seeds were imbibed for 6 h in solutions of FMC-57020. 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

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conditions were maintained by allowing the seeds to germinate in the dark at 25°C in an incubator. Germination was recorded on the second, third, and fourth day after planting for wheat and on the first, second, and third day after planting for radish.

The remaining 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 (white, 178 uE $m^{-2}s^{-1}$, 16 h light and 8 h dark) and temperature (22°C). After shoot emergence 25 ml of 1/2 strength Hoagland solution were applied daily to each pot. After 10 days (wheat) and 14 days (radish) 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.

The methods of Devlin and Koszanski (4) were used for pigment synthesis studies. Corn leaf sections were analyzed for chlorophyll and carotenoid content according to the methods of Devlin et al. (3).

RESULTS AND DISCUSSION

FMC-57020 had very little influence on the germination of wheat and radish seeds. Only at 1,000 uM FMC-57020 was germination delayed and inhibited for both wheat and radish. For example, at 1,000 uM germination of wheat 2, 3, and 4 days after planting was reduced 22, 16, and 12%, respectively (Table 1). At the same concentration radish seed germination 1, 2, and 3 days after planting was reduced 25, 25, and 21%, respectively (Table 1).

Table 1. Effect of FMC-57020 on the percent germination of wheat and radish seeds.

FMC-57020 (uM)	Days After Planting-Wheat 2	3	4	Days After Planting-Radish 1	2	3
0	90	93	93	100	100	100
10^{-2}	91	93	94	99	99	99
10^{-1}	87	93	95	98	98	98
10^{0}	87	92	93	98	98	99
10^{1}	83	89	92	98	98	98
10^{2}	85	92	93	95	95	96
10^{3}	68	77	81	75	75	79
LSD 5%	5	4	4	6	6	4
LSD 1%	7	5	5	8	8	5

Concentrations of FMC-57020, 1 uM and higher, significantly reduced the growth of wheat. For example, 1 uM FMC-57020 caused a 7% reduction in shoot length and a 6% reduction in root length (Table 2). Wheat shoot dry weight and root fresh and dry weight were similarly reduced. However, significant reduction (30%) of wheat

shoot fresh weight was only observed at 1,000 uM FMC-57020 (Table 2).

As with wheat, concentrations of FMC-57020 1 uM and higher significantly reduced the growth of radish (Table 3). It is apparent, however, that radish is more sensitive to the herbicide than wheat. For example, 100 uM FMC-57020 caused a 67% reduction in radish shoot elongation (Table 3) but only a 27% reduction in wheat shoot elongation (Table 2).

Table 2. Effect of FMC-57020 on the growth of wheat.

FMC-57020 (uM)		Shoots Length (mm)	Shoots Fresh Wgt (mg/10 pl)	Shoots Dry Wgt (mg/10 pl)	Roots Length (mm)	Roots Fresh Wgt (mg/10 pl)	Roots Dry Wgt (mg/10 pl)
0		173	1408	158	112	1122	103
10^{-2}		173	1470	162	108	1059	105
10^{-1}		170	1393	155	104	1053	100
10^{0}		160	1299	144	105	1031	98
10^{1}		158	1368	137	102	972	88
10^{2}		127	1301	113	97	927	81
10^{3}		94	985	84	91	826	74
LSD	5%	10	148	15	5	124	10
	1%	13	202	20	7	168	14

Table 3. Effect of FMC-57020 on the growth of radish.

FMC-57020 (uM)		Shoots Length (mm)	Shoots Fresh Wgt (mg/10 pl)	Shoots Dry Wgt (mg/10 pl)	Roots Length (mm)	Roots Fresh Wgt (mg/10 pl)	Roots Dry Wgt (mg/10/pl)
0		49	4117	255	97	618	45
10^{-2}		51	4660	274	92	585	44
10^{-1}		52	4901	294	96	670	49
10^{0}		38	2813	149	79	461	28
10^{1}		23	1026	56	70	309	15
10^{2}		16	521	34	64	289	15
10^{3}		13	396	26	57	247	14
LSD	5%	3	414	18	8	79	4
	1%	4	564	25	11	108	5

Total chlorophyll synthesis in etiolated corn leaf sections exposed to 8 h light was reduced 54% by 10 uM FMC-57020. Chlorophyll synthesis in leaf sections exposed to 14 and 32 h light and subjected to 10 uM FMC-57020 was reduced 59 and 74%, respectively (Table 4). In every case where total chlorophyll was reduced the chlorophyll a:b ratio was also reduced. For example, the chlorohyll ratio

dropped from 1.9 to 1.0 in leaf sections exposed to 8 h light and 10 uM FMC-57020 (Table 4). Thus it appears that chlorophyll a synthesis is more sensitive to the inhibitory influence of FMC-57020 than chlorophyll b.

Carotenoid synthesis was also reduced by FMC-57020 Etiolated corn leaf sections exposed to 8 h light and treated with 10 uM FMC-57020 had 30% less carotenoids than the untreated control (Table 5). Increasing exposure to light increased the inhibitory effect of FMC-57020 on carotenoid synthesis. Leaf sections treated with 10 uM FMC-57020 and exposed to 14 and 32 h light had 50 and 60% less carotenoid, respectively (Table 5).

Table 4. Effect of FMC-57020 on chlorophyll synthesis in etiolated corn leaf sections exposed to different periods of light. Total chlorophyll (TChl) is recorded in ug/g fresh tissue.

FMC-57020 (uM)		8 h light Chl a:b	8 h light TChl	14 hr light Chl a:b	14 hr light TChl	32 h light Chl a:b	32 h light TChl
0		1.9	157	2.6	247	2.7	470
10^0		1.9	130	2.5	268	2.8	392
10^1		1.0	70	1.1	102	1.3	122
10^2		0.7	62	0.6	59	0.7	71
10^3		0.7	55	0.7	62	0.6	59
LSD	5%	-	27	-	37	-	37
	1%	-	38	-	52	-	52

Table 5. Effect of FMC-57020 on carotenoid synthesis in etiolated corn leaf sections exposed to different periods of light.

FMC-57020 (uM)		8 h light (ug/g)	8 h light (%)	14 h light (ug/g)	14 h light (%)	32 h light (ug/g)	32 h light (%)
0		99	100	142	100	211	100
10^0		89	90	140	99	177	84
10^1		69	70	71	50	84	40
10^2		69	70	62	44	61	29
10^3		62	63	68	48	55	26
LSD	5%	14	-	11	-	12	-
	1%	20	-	15	-	17	-

It is difficult to determine if FMC-57020 directly causes the inhibition of carotenoid synthesis or if the loss of carotenoids is an indirect effect caused by the loss of chlorophyll. If FMC-57020 directly inhibits carotenoid synthesis then this could account, at least to some degree, for the loss of chlorophyll in plants treated with the herbicide. It has been well established that carotenoids

protect chlorophyll from photooxidation (2,6).

Duke et al. (5) suggested that FMC-57020 could have a general adverse effect on terpenoid synthesis. Since terpenoids involve both pigments (e.g., carotenoids) and plant hormones (e.g., gibberellic acid), inhibition of terpenoid synthesis could account for the numerous inhibitory effects observed in FMC-57020 treated plants.

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HIGH TEMPERATURE TRANSITION IN BARNYARDGRASS (ECHINOCHLOA CRUS GALLI (L.) BEAUV.) SEED DORMANCY

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ABSTRACT

Imbibed barnyardgrass seeds held in darkness at 30 to 40 C for about 8 days require a brief exposure to light to relieve dormancy when subsequently germinated at a 20/30 C alternating temperature. Holding imbibed seeds at > 42C for approximately 4 days, however, allows about half the seeds to germinate in darkness and only about 10 percent more respond to a light stimulus. The high temperature treatment need not be continuous, since most of the effect can be induced by periods of approximately 2 hours at 46 C. It is proposed that the high temperatures cause a transition from a light-requiring to a non-light requiring form of dormancy. The finding has considerable relevance to field behavior where temperatures near the soil surface often reach 45 to 50 C and thereby could initiate germination of buried barnyardgrass seeds in the absence of a light stimulus. Without the high temperature, the seeds would require a light stimulus for germination.

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EFFECT OF SEEDING PROCEDURES, CONTAINER AND FERTILISATION ON MILKWEED TRANSPLANTS

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ABSTRACT

As a part of a research project on milkweed (Asclepias syriaca L.) production, an experiment was initiated to study the influence of seeding procedure (direct seeding vs transplantation), container size (95 vs 125 cm^3) and fertilization (150N - 65P - 125K ppm) in single, twofold and threefold amount obtained from a 20N - 8,7P - 16,6K (%) soluble fertilizer. After five weeks, vegetative growth was not modified by seeding procedure although transplanted seedlings had greater levels of N, K and Mg but lower levels of Ca. Leaf number, shoot and root dry weight and levels of both Ca and Mg were greater for seedlings grown in the larger container. Shoot dry weight, leaf area and levels of N, P and K of seedlings increased linearly with increased fertilisation while the opposite occured for root dry weight and Mg level.

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MYCORRHIZAE AND THE TRANSFER OF GLYPHOSATE BETWEEN PLANTS

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ABSTRACT

Selectively applied, wick applications of glyphoste have been reported to cause injury in some crop plants growing adjacent to treated weeds. The reasons for this injury have not been definitively determined. The objective of this study was to determine whether mycorrhizal fungi, organisms commonly associated with the roots of plants, might mediate the transfer of glyphosate from one plant to another. Though root grafts between plants of different species are rare, mycorrhizae forming fungi are not host specific and can form direct links between plants of different species. Mycorrhizal associations between pine seedlings were established in plastic growth pouches containing a nutrient solution and a paper support for root and fungus growth. Two species of pine, Loblolly (Pinus taeda L.) and Jack (Pinus banksiana Lamb.), and two species of fungi, Paxillus involutus and Pisolithus tinctorius were used in the study. At the time of treatment, each pouch contained two pines directly connected by hyphae of a mycorrhizal fungus. ^{14}C-labelled glyphosate was applied to the leaves of one pine (the donor) in each pouch. One week after treatment the pouches were harvested. After autoradiographs of the pine-fungus-pine systems were developed, the plants were partitioned into donor and recipient leaves , stems, and roots, and analyzed through liquid scintillation counting. Autoradiographs showed that the radioactivity applied to the donor pine translocated downward to the roots, and was transferred to the fungus connecting the paired pines. The amounts transferred from plant to fungus apparently were low, because the radioactivity detectable in the fungus was slight compared to that present in the roots of the donor pine. Autoradiographs also showed some radioactivity present in the mycorrhizae surrounding the roots of the recipient pine. Because a considerable amount of labelled glyphosate leaked into the nutrient solution from the roots of the donor pines and was absorbed by the recipient pines, it was not possible to conclusively determine whether or not the radiolabelled glyphosate was actually transferred from the fungal component of the mycorrhizae to the recipient pine. If the transfer does occur, it would probably be in small amounts. Though it is unlikely that the unusual cases of injury that have occurred with the selective use of glyphosate can be accounted for by fungal translocation, the possibility has not been entirely ruled out by this study.

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HERBICIDE SAFENING EFFECTS OF PLASTIC ROW COVERS IN VEGETABLES

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ABSTRACT

The herbicide combination of chloramben plus trifluralin applied ppi or pre transplant is effective in controlling a broad spectrum of broadleaf and grassy weeds commonly associated with vegetable production. Unfortunately, this treatment often causes crop injury when the herbicides leach into the transplanted crop's root zone. Studies were conducted in 1986 at the University of Maryland Vegetable Research Farm in Salisbury, Maryland to determine the safening potential of plastic row covers for transplanted muskmelon (Cucumis melo L. 'Saticoy'), cucumber (Cucumis sativus L. 'Raider') and tomato (Lycopersicon esculentum Mill. 'Pik-Red') treated with a chloramben plus trifluralin herbicide combination. Weed species occurring in the studies include common purslane (Portulaca oleraceae L.), carpetweed (Mollugo verticillata L.), large crabgrass [Digitaria sanguinalis (L.) Scop.] and stinkgrass [Eragrostis cilianensis (All.) E. Mosher.]

Results of the studies show that with the use of clear plastic tunnels, clear plastic mulch, or black plastic mulch all crop species were not injured by the herbicide treatment of 2.0 kg/ha chloramben plus 0.56 kg/ha trifluralin applied ppi or pre transplant. This treatment did injure muskmelon and cucumber transplants which were planted on bare ground. A 25 cm wide band of latex spray mulch applied to the row middle prior to transplanting did not provide protection from herbicide injury. Excellent control of the weed species present was obtained from either a ppi or pre transplant application of the chloramben plus trifluralin herbicide treatment.

INTRODUCTION

For over twenty years plastic mulches have been used extensively in the production of transplanted vegetables (6). Clear plastic mulch has been shown to possess definite advantages over black plastic mulch due to its ability to increase in soil temperature and carbon dioxide evolution (4,5). The main disadvantage associated with the use of clear plastic mulch is its inability to control weeds. The use of dinoseb [2-(1-methylpropyl)-4,6-dinitrophenol] applied immediately prior to plastic laying but two weeks before transplanting has been shown to provide excellent weed control under clear plastic mulch (1,2,3) and has become a standard herbicide practice. Due to the recent cancellation of dinoseb's registration the use of this treatment is no longer possible. The combination of chloramben (3-amino-2,5-dichlorobenzoic acid)

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plus trifluralin [2,6-dinitro-N,N-dipropyl-4-(trifluromethyl)benzenamine] has been shown to produce acceptable control of a broad spectrum of weed species and corresponding high crop yields when muskmelons were grown under clear plastic tunnels (7). In 1986 this herbicide combination was evaluated for weed control and crop safety on muskmelon, cucumber, and tomato transplants grown on clear plastic, black plastic, and latex spray mulches, and under clear plastic tunnels.

MATERIALS AND METHODS

The three experiments in this study were conducted in 1986 at the University of Maryland Vegetable Research Farm in Salisbury, Maryland. The soil type was a Norfolk loamy sand with a pH of 6.1, cation exchange capacity of 3 meq/100g, and an organic matter content of 0.6%. Transplants of the muskmelon variety 'Saticoy', cucumber variety 'Raider', and tomato variety 'Pik-Red' were started in 'Jiffy Seven' peat pots at six weeks (tomato) and three weeks (muskmelon and cucumber) prior to transplanting. The muskmelon and cucumber plants were at the two leaf stage and the tomato plants were 15 to 20 cm tall and at the early bud stage when transplanting occurred. Four weeks prior to transplanting the test site was treated with 1,3-Dichloropropene at the rate of 150 l/ha for nematode control.

The herbicide treatments were applied on the day of transplanting using a tractor mounted sprayer which applied 234 l/ha at 267 kPa. Preplant incorporated treatments were worked with a spike toothed harrow and dragged once in both directions to a depth of 3 cm. Each experiment was arranged in a randomized block design, with 4 replications. Plot sizes were .93 X 9.1 m for muskmelon, .93 X 4.6 m for cucumber and .93 X 6.1 m for tomato. The black plastic mulch and 'Agricote' latex based spray mulch were laid down prior to herbicide application, the clear plastic mulch was laid down after herbicide application, and the plastic tunnels were laid down after transplanting. All plastic mulches were 25 μ in thickness. The latex based spray mulch was applied in a 25 cm wide band over the row middles at a rate of 318 gr/m². The clear and black plastic mulches were laid down with a commercial plastic mulch applicator and the clear plastic tunnels were laid down by hand. The clear plastic tunnel treatment was not evaluated in the tomato experiment.

RESULTS AND DISCUSSION

The herbicide treatment of chloramben at 2.0 kg/ha plus trifluralin at 0.56 kg/ha provided excellent control of heavy populations of common purslane, carpetweed, large crabgrass, and stinkgrass when applied either ppi or pre transplant (table 1). Efficacy of the pre transplant treatments in all probability benefitted from the 2 cm of irrigation that was applied within 48 hours of herbicide application. Although overall weed control was excellent in the latex spray mulch treatment, problems with weed escapes in the treated band occurred as the spray mulch broke down. The clear plastic tunnel and clear plastic mulch treatments did not reduce herbicide effectiveness.

Muskmelon transplants were noticeably stunted in the treatments where the latex spray mulch and no plastic mulch were used (table 2). This herbicide injury had a noticeable detrimental effect on total yield in these treatments

but did not have an effect on fruit weight. In the treatments where black plastic mulch,clear plastic mulch, or clear plastic tunnels were used no herbicidal injury was observed. Yields in these treatments were the highest in the test and were not significantly different from each other. Cucumber transplants were more sensitive to the herbicide treatment and severe crop injury and reductions in total yield and fruit size occurred in the bare ground and latex spray mulch treatments. No crop injury occurred in the plastic mulch and tunnel treatments and this was reflected in higher yields and larger fruit size. Cucumbers grown on black plastic mulch outyielded all other treatments in the experiment. Tomatoes proved to be tolerant of the herbicide treatment and no crop injury was observed. As a result there was no statistically significant difference in total yield or fruit weight between the bare ground and the clear and black plastic mulch treatments. The latex spray mulch appeared to have a detrimental effect on the tomato plants and total yield and fruit weight was reduced.

The experiments were conducted too late in the year (transplanting occurred on May 23) to enable the clear plastic tunnels to provide frost protection and enhance earliness. High temperatures that occurred in the tunnels in June and July may have had a detrimental effect on yield. If these experiments were conducted earlier in the year it is anticipated that higher relative yields in the clear plastic tunnel treatments would have occurred.

The increased tolerance that muskmelon and cucumber exhibited to the herbicide treatment when they were grown on plastic mulches or in plastic tunnels indicates that safening was achieved by preventing the chloramben and trifluralin from leaching into the crops' root zone. Since these plastic mulches prevent herbicide movement in the soil, it is important to the efficacy of the treatment that it is lightly incorporated.

In summary, the herbicide treatment of chloramben plus trifluralin was shown to provide excellent weed control but caused noticeable stunting and injury to muskmelon and cucumber transplants. This herbicide treatment was safened when these crops were grown on clear plastic mulch, black plastic mulch, or under clear plastic tunnels. The increase in crop safety was attributed to the plastic mulches and tunnels preventing the movement of the herbicides into the crop root zone. A banded treatment of latex spray mulch over the row middle did not provide acceptable safening and crop injury did occur. Tomato transplants were found to be tolerant of the herbicide treatment.

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Table 1. Effectiveness of 2.0 kg/ha chloramben plus 0.56 kg/ha trifluralin for the control of broadleaf weeds and grasses. (a)

		% weed control							
	herbicide	2 weeks post treatment				4 weeks post treatment			
mulch treatment	timing	POROL	MOLVE	DIGSA	ERALN	POROL	MOLVE	DIGSA	ERALN
no plastic mulch	ppi	100 a	100 a	100 a	100 a	97 a	96 a	96 a	96 a
clear plastic mulch	ppi	100 a	100 a	100 a	100 a	97 a	97 a	97 a	97 a
black plastic mulch	pre	100 a	100 a	100 a	100 a	95 a	95 a	94 a	95 a
clear plastic tunnel	ppi	100 a	100 a	100 a	100 a	96 a	96 a	96 a	97 a
banded latex spray mulch	pre	100 a	100 a	100 a	100 a	95 a	95 a	95 a	95 a
untreated - no mulch	-	0 b	0 b	0 b	0 b	0 b	0 b	0 b	0 b

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

Table 2. Crop injury and yield responses to the herbicide treatment of 2.0 kg/ha chloramben plus 0.56 kg/ha trifluralin. (a)

mulch treatment	herbicide timing	muskmelon crop injury(b)	muskmelon yield kg/ha	muskmelon average weight(kg)	cucumber crop injury(b)	cucumber yield kg/ha	cucumber average weight(gr)	tomato crop injury(b)	tomato yield kg/ha	tomato average weight(gr)
no plastic mulch	ppi	7.2 c	6081 b	1.91 a	5.8 b	3553 c	209 b	10.0 a	8090 ab	128 abc
clear plastic mulch	ppi	10.0 a	10910 a	1.57 a	10.0 a	9795 b	264 a	10.0 a	10508 a	167 ab
black plastic mulch	pre	10.0 a	9939 a	1.69 a	10.0 a	12305 a	274 a	10.0 a	11289 a	172 a
clear plastic tunnel	ppi	10.0 a	9355 a	1.67 a	10.0 a	8611 b	258 a	---	---	---
banded latex spray mulch	pre	8.8 b	7284 b	1.73 a	7.2 b	3583 c	208 b	10.0 a	4705 bc	125 bc
untreated - no mulch	-	10.0 a	1623 c	0.85 b	10.0 a	2545 c	190 b	10.0 a	1789 c	110 c

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

(b) Rated on a 1-10 scale where 10 = no injury and 1 = dead plant. Ratings taken 4 weeks after transplanting.

POSTEMERGENCE QUACKGRASS CONTROL IN MAINE POTATOES

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ABSTRACT

Strategies for quackgrass (Agropyron repens L.) control in potatoes (Solanum tuberosum L.) have traditionally ranged from summer fallow, to extensive primary tillage combined with preplant incorporated herbicides, to application of preemergence herbicides. Current methods are not practicable after crop emergence; however, development of post-emergence grass herbicides and their eventual registration for use on potatoes will alter this situation. The availability of such compounds could further lead to a "threshold approach" for quackgrass control in potatoes.

Ten replicated experiments evaluating postemergence chemical control of quackgrass were conducted at the Maine Agricultural Experiment Station in Presque Isle during 1985 and 1986. Herbicides were generally applied premergence (PE) for broadleaf weed control. Five experimental grass herbicides (fluazifop-p-butyl, sethoxydim, cloproxydim, DPX-Y6202 and BAS517) were applied at ground crack (GCK) or postemergence (POST). Quackgrass shoots were generally 10 to 20 cm high during POST applications. All compounds provided acceptable control of quackgrass shoots based on visual ratings. Fluazifop-p-butyl, BAS517, sethoxydim and DPX-Y6202 provided acceptable quackgrass control at all tested rates, while control by cloproxydim was acceptable only at 0.14 kg a.i. ha^{-1} and above. Activity of sethoxydim was improved somewhat by addition of 2.8 kg ha^{-1} ammonium sulfate. POST timings consistently resulted in better quackgrass control than GCK timings. Broadleaf weed control was better when metribuzin was utilized PE or GCK; therefore, tank-mix applications of metribuzin plus postemergence grass herbicides should probably be avoided.

Quackgrass control ratings varied among herbicides, application rates, and timings; however, no significant yield responses were associated with differential quackgrass control among these factors. In seven of ten experiments, quackgrass control did not result in yield increases when compared to treatments without control. In all three experiments where significant yield responses were observed, quackgrass populations exceeded 22 stems m^{-2}. Yield responses ranged from 2.8 to 3.4 MT ha^{-1}. An IPM approach may eventually be developed for quackgrass control using these postemergence herbicides; however, careful analysis of production components beyond yield and foliar control ratings will have to be considered. These components will include 1) effects of quackgrass populations on tuber size, quality, and crop value; 2) additional costs associated with mechanical harvesting of infested fields; 3) possible benefits resulting from early-season control compared to POST applications; 4) differential competitiveness among potato cultivars; and 5) relative costs of control measures. These factors must certainly be considered when refining choice of chemicals, rates, and timings since yield benefits among these variables have not been apparent.

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POTATO WEED CONTROL WITH METRIBUZIN AND GRASS HERBICIDES[1/]

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ABSTRACT

In a two year study conducted at the Long Island Horticultural Research Laboratory in Riverhead, New York, the effect of metribuzin used alone and in combination with several selective grass herbicides, on crop injury and weed control in potatoes (*Solanum tuberosum L.*) was conducted. The results show that as postemergence application rates of metribuzin increased to 0.56 kg/ha injury increased. Foliar injury was greater on the cultivar 'Superior' than on 'Katahdin'. The addition of DPX-Y6202, sethoxydim, or fluazifop-P-butyl did not intensify crop damage. Injury to 'Katahdin' was greater in one year than it was the other. Crop damage was not apparent from postemergence applications of fluazifop-P-butyl at 0.28 kg/ha and sethoxydim at 0.28 kg/ha. DPX-Y6202 caused very slight, but statistically significant foliar injury in 1985.

When metribuzin was used in combination with DPX-Y6202, sethoxydim, and fluazifop-P-butyl, barnyardgrass (*Echinochloa crus-galli* (L.) Beauv.) control was either enhanced or was about the same as when metribuzin was used alone. Chemical treatments had no statistically significant effect on tuber yield of 'Katahdin'. Postemergence applications of metribuzin reduced tuber yield of 'Superior'.

INTRODUCTION

Barnyardgrass is a major weed control problem on Long Island. The problem has diminished somewhat since the introduction of metolachlor (2-chloro-N- (2-ethyl-6-methylphenyl)-N-(2-methoxy-l-methylethyl) acetamide). However, dry weather at time of grass emergence can result in a number of grass escapes even when metolachlor is applied appropriately. The postemergence grass herbicides recently developed show potential for selectively controlling annual grasses in commercial potato fields. Smartweed (*Polygonum pensylvanicum L.*) is also a problem on Long Island and can result in yield reduction and/or loss of harvest efficiency. The combination of broadleaf weed killer with grass specific herbicides would be desirable to control both barnyardgrass and smartweed in commercial potato fields. It has been suggested that the combination of metribuzin (4-amino-6- (1,1-dimethylethyl)-3-(methylthio) 1-2,4-triazin-5 (4*H*)-one) and some of the grass specific herbicides results in increased phytotoxicity and/or decreased weed control. The purpose of this study was to evaluate the performance of metribuzin, alone and in combination with several selective grass herbicides, to determine if adverse effects occur when these combinations are applied to actively growing potato plants.

MATERIALS AND METHODS

Potato weed control experiments to study the effect of metribuzin in combination with grass specific herbicides were established at the Long Island Horticultural Research Laboratory, Riverhead, New York in 1985 and 1986. Potatoes were planted on a Haven sandy loam soil using a commercial potato planter. Fertilizer was applied at a rate of 1277 kg/ha of 7-18-14 at time of planting. Nitrogen was sidedressed at a rate of of 90 kg/ha when plants were approximately 10 to 15 cm tall. Herbicide treatments were applied with a hand held CO_2 pressurized sprayer delivering 374 l/ha at 2.7 kg/cm^2. The cultivar 'Katahdin' was grown in the 1985 experiment and both 'Katahdin' and 'Superior' were grown in 1986. Plot size was two rows (1.7 m) by 7.6 meters. In

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1986, one row of each variety was planted in the two row plots in a non-random pattern.Because of this, each cultivar was considered a separate experiment. Yield data were collected on the center six meters of row. Experimental design for both experiments was a 3 x 4 factorial with four replications. The 1985 experiment was planted on April 16, 1985. Dinoseb (2-(1-methylpropyl) -4,6- dinitrophenol) at a rate of 3.36 kg/ha, was applied to the entire experimental area on May 10, 1985 with a tractor-mounted PTO sprayer. The experiment was vine killed with a combination of paraquat (1,1'-dimethyl-4,4'- bipyridinium ion) and dinoseb on September 3, 1985 and plots were harvested on October 10, 1985. Postemergence applications were made on June 14, 1985. The 1986 experiment was planted on April 4. An overspray of dinoseb, at 3.36 kg/ha, was applied on May 6, 1986. Potatoes were vine killed September 8, 1986 and plots were harvested October 1 & 2, 1986. Postemergence applications were made on June 9, 1986. In both years all postemergence applications were applied in a 1% v/v dilution of Booster plus E crop oil.

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 DISCUSSION

DPX-Y6202 (2-[4-[6-chloro-2-quinoxalinyl) oxy]-phenoxy]- propionic acid, ethel ester) caused slight, but statistically significant foliar injury in 1985 on 'Katahdin' potatoes(Table 1). In 1986, the same tendency was observed on 'Superior', but the injury was not significantly different from the no-chemical treatment. Injury from DPX-Y6202 was not observed on 'Katahdin' in 1986. Postemergence applications of fluazifop-P-butyl (butyl(R) -2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propionate) or sethoxydim (2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one) when used alone did not cause crop injury in either year (Tables 2, 3).

Postemergence applications of metribuzin caused foliar injury in both years. The injury on 'Katahdin' in 1985 was slight and the plants recovered rapidly. In 1986, 'Katahdin' plants were not affected by postemergence applications of metribuzin, but 'Superior' plants were. A rate effect was apparent in both years. The addition of any of the selective grass herbicides did not have an additional phytotoxic effect . The severe foliar response on 'Superior' in 1986 could be associated with weather conditions prior to the application of metribuzin (1). Rain occurred on each of the three days prior to application, totalling 3.9 cm. Hazy skies were noted on the 4th day before application. In 1985, cloudy conditions existed 3 of the 5 days preceding application. The reason for the greater injury to 'Katahdin' in 1985 than in 1986 is not known. The effect on 'Katahdin' was considerably less than 'Superior'. Crop recovery of both cultivars was rapid. Postemergence applications of metribuzin resulted in a significantly lower tuber yield of 'Superior'. Yield of 'Katahdin' was not affected by postemergence rates of metribuzin. Yields of both cultivars were unaffected by postemergence applications of DPX-Y6202,sethoxydim, or fluazifop-P-butyl.

Barnyardgrass pressure was greater in 1986 than in 1985. Smartweed was not a major problem in either year, however, it was more prevalent in the 1985 experiment. Perfect and near-perfect control of smartweed was achieved with the 0.56 kg/ha rate of metribuzin.

Commercial control of barnyardgrass was achieved in 1985 by single applications of metribuzin at 0.56 kg/ha, DPX-Y6202 at 0.18 kg/ha and fluazifop-P-butyl at 0.28 kg/ha. Combinations of metribuzin with DPX-Y6202 at 0.15 and 0.18 kg/ha, sethoxydim at 0.28 kg/ha and fluazifop-P-butyl at 0.28 kg/ha gave acceptable ratings. In 1986, the competitive effect of cultivars was noted. Barnyardgrass was a greater problem in the early maturing cultivar, 'Superior'.

Table 1. The main effects of postemergence applications of metribuzin and DPX-Y6202 on weed control and crop injury to 'Katahdin' potatoes, Riverhead, NY, 1985.

Treatment[a]		Ratings[b]				
Chemical	Rate kg/ha)	Phytotoxicity 6/18	6/25	Weed Control BYG	SW	Yield (t/ha)
metribuzin	0	8.5	8.8	6.6	7.3	45.9
metribuzin	0.25	7.9	8.6	6.9	8.0	44.8
metribuzin	0.5	7.0	7.9	6.9	8.6	45.5
DPX-Y6202	0	8.2	8.6	6.5	7.8	45.6
DPX-Y6202	0.07	8.2	8.7	6.5	8.2	46.3
DPX-Y6202	0.15	7.7	8.4	7.0	7.8	44.6
DPX-Y6202	0.18	7.3	8.1	7.3	7.9	45.0
Significance levels						
metribuzin		(0.01)	(0.01)	(ns)	(0.01)	(ns)
DPX-Y6202		(0.01)	(0.01)	(0.01)	(ns)	(ns)
metribuzin X DPX-Y6202		(0.01)	(ns)	(ns)	(ns)	(ns)

[a]Entire area oversprayed with dinoseb at 3.36 kg/ha on 5/10/85. Treatments applied on 6/14/85 when potato plants were just beginning to flower. Few grass plants were 4 to 6 inches tall. All treatments contained Booster plus E in a 1% v/v dilution.

[b]Rating based on a scale 1 to 9; phytotoxicity 9 = no injury, 7 = moderate injury but no yield or quality reduction, 1 = all crop plants killed; weed control 9 = absence of weeds, 7 = few weeds but commercially acceptable, 1 = complete ground cover with weeds. Weed control ratings taken 8/22/86.

Commercial control in 'Superior' was achieved by sethoxydim used alone at 0.28 kg/ha, and fluazifop-P-butyl used alone at 0.28 kg/ha or in combination with metribuzin at 0.28 kg/ha. In 'Katahdin', DPX-Y6202 at 0.11 kg/ha, and all treatments containing either sethoxydim or fluazifop-P-butyl gave commercial control.

The results of this study show that metribuzin can reduce barnyardgrass problems. When metribuzin was used in combination with DPX-Y6202, sethoxydim or fluazifop-P-butyl, barnyardgrass control was either enhanced or was about the same as when used alone. Crop injury due to metribuzin was greatest on 'Superior'. This agrees with previous observations (2). Injury did not increase when grass herbicides were added to metribuzin. Weed control was not diminished by the combination of metribuzin and the selective grass herbicides tested. The performance of herbicides was improved by the competition provided by the later maturing cultivar 'Katahdin'. This observation supports previous reports (3,4).

Table 2. Main effects of postemergence applications of metribuzin and three grass specific herbicides on barnyardgrass control and crop injury to 'Superior' potatoes, Riverhead, NY,1986.

Treatment [a]		Ratings [b]				
		Phytotoxicity		BYG Control		Yield
Chemical	Rate (kg/ha)	6/12	6/14	6/5	9/2	(t/ha)
metribuzin	0	8.7	8.7	6.8	6.5	46.8
metribuzin	0.28	7.1	5.9	6.6	5.5	41.8
metribuzin	0.56	6.3	5.3	6.9	5.7	39.8
Grass herbicide						
None		7.6	6.8	7.0	4.5	44.4
DPX-Y6202	0.11	7.0	6.0	6.8	5.5	41.8
sethoxydim	0.28	7.5	6.8	6.9	6.5	41.8
fluazifop-P-butyl	0.56	7.3	6.9	6.4	7.1	42.6
Significance level						
metribuzin		(0.01)	(0.01)	(ns)	(ns)	(0.01)
Grass herbicide		(ns)	(ns)	(ns)	(0.01)	(ns)
metribuzin X grass herbicide		(ns)	(ns)	(ns)	(ns)	(ns)

a/Experimental area oversprayed with dinoseb at 3.36 kg/ha on 5/6/86. Postemergence applications were made on 6/9/86, All postemergence treatments contained Booster plus E crop oil in 1% v/v dilution.

b/See Table 1, footnote b.

Table 3. Main effects of postemergence applications of metribuzin and three grass specific herbicides on barnyardgrass control and crop injury to 'Katahdin' potatoes, Riverhead, NY,1986.

Treatment [a]		Ratings [b]				
Chemical	Rate (kg/ha)	Phytotoxicity 6/12	Phytotoxicity 6/14	BYG Control 6/5	BYG Control 9/2	Yield (t/ha)
metribuzin	0	9.0	8.9	6.8	7.2	50.9
metribuzin	0.28	9.0	8.7	6.6	6.5	49.2
metribuzin	0.56	9.0	8.7	6.9	7.0	49.1
Grass herbicide						
None		9.0	9.0	7.0	4.9	49.8
DPX-Y6202	0.11	9.0	8.4	6.8	6.3	49.6
sethoxydim	0.28	9.0	8.8	6.9	8.2	52.8
fluazifop-P-butyl	0.56	8.9	8.9	6.4	8.2	46.7
Significance level						
metribuzin		(ns)	(ns)	(ns)	(ns)	(ns)
Grass herbicide		(ns)	(ns)	(ns)	(0.01)	(ns)
metribuzin X grass herbicide		(ns)	(ns)	(ns)	(ns)	(ns)

a/See Table 2, footnote a.
b/See Table 1, footnote b.

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WEED CONTROL IN LIMA BEANS

Edwin Kee 1/

Lima beans (PHASEOLUS LIMENSIS L.) is a major vegetable crop in Delaware. Development of effective weed control programs have been a continuing challenge in this crop. The number of herbicides labeled for the crop is limited. In October, 1986, even greater limitations were induced on weed control with the ban of dinoseb by the Envirnomental Protection Agency. With that action, there are currently no preemergence broadleave weed herbicides for lima beans. Morningglory (IPOMOEA SPP.) is especially troublesome due to restrictions against seed in the processed product.

In the Spring of 1986, a herbicide evaluation in lima beans was established. The purpose of this test was to evaluate standard and new compounds for weed efficacy and phytotoxic effects to the crop.

All pre-plant incorporated treatments of trifluralin provided excellent grass control. Trifluralin provided acceptable broadleaf weed control. When dinoseb was sprayed as a premergence treatment over trifluralin, acceptable broadleaf weed control was obtained. There was no significant increase in broadleaf weed control in the trifluralin treatments when dinoseb was added.

Good grass control was obtained with preemergence treatments of metolachlor, alachlor, imazaquin, AC263499, and BASF 175659. All plots were cultivated one time.

Imazaquin, AC263499, or BASF 175659 alone or in combination with metolachlor or alachlor increased broadleaf weed control, especially morningglory.

Imazaquin at 0.065 lbs. ai/A and AC263499 at 0.08 lbs ai/A as preemergence treatments caused no injury to the crop. Higher rates did cause injury.

Imazaquin, AC263499, and aciflurfen show promise for broadleaf control as postemergence treatments. Postemergence treatments of sethoxydim and fluazifop will control grasses without injury to the crop.

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WHITE POTATO-BARNYARDGRASS COMPETITION STUDY AT VARIOUS TIMES [1/]

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ABSTRACT

A crop-weed competition study was conducted at the Soils and Crops Research Center at Adelphia, N. J., in 1986 to determine the effects of duration of weed competition and various potato planting times and weed-free maintenance periods on yields of white potatoes (cv 'Superior') and barnyardgrass (Echinochloa crus-galli (L) Beauv.). The design was split-plot with three replications, one side of the split-plot contained potatoes growing with barnyardgrass, the other side barnyardgrass alone, while the whole plot was the planting date (PD). Potatoes were planted at three different times, 2 weeks apart (April 1, 15, 30), and were either maintained weed-free for various lengths of time (2, 4, 6 wks) and then grown with the natural weed population for the remainder of the season or grown with the grass for various lengths of time (6, 8, 10 wks) and then maintained weed-free for the rest of the season.

Broadleaf weeds were controlled with dinoseb (5.0 kg/ha) applied preemergence. Barnyardgrass was removed at the planned intervals using sethoxydim at 0.56 kg/ha.

Three destructive harvests of both white potatoes and barnyardgrass were made at 6, 10 and 14 wk after planting to evaluate the effects of competition as reflected in biomass yields. Heights of the grass and number of tillers per m^2 were also recorded at the same time.

Results showed that barnyardgrass biomass increased dramatically through the season and these increases were reflected correspondingly in decreases in white potato yields.

Grass competition for the first eight weeks after planting did not reduce potato yields significantly for the earlier planting dates (April 1 and 15), while for the last planting date only the first six wk of grass competition had a similar pattern.

The initial 2 and 4 wk after planting weed-free treatments resulted in lower yields for PD_2 and PD_3, while for PD_1 only the initial 2 wk weed-free period resulted in lower yields. With respect to the various planting times, responses were correlated with grass competition, the first planting time resulted in higher potato yields.

1/ New Jersey Agricultural Experiment Station Publication No. J-15274-1-86.

2/ Weed Sci. Tech. and Res. Prof. of Weed Sci., respectively, Dept. of Soils and Crops, N. J. Agr. Agr. Exp. Sta., Cook College-Rutgers University, New Brunswick, N.J. 08903.

WEED INTERFERENCE IN CARROT PRODUCTION IN QUEBEC

Diane L. Benoit[1]/, M. Lapointe and A.K. Watson[2]/

ABSTRACT

In 1985 field trials were established at the Ste-Clotilde Experimental Farm of Agriculture Canada in Quebec to determine the critical period of weed interference in carrots (Daucus carota L. var sativa DC 'Gold Pack') grown in muck soil. Carrots were sown in 45 cm rows at 66 seeds/m on May 13. Plots with four rows (5 m long) were arranged in a RCB design with three replicates. Treatments consisted of plots which were either kept weed-free or weed-infested for all season or for the first 2, 3, 4, 5, 6 or 8 weeks after carrot emergence. Weed removal was done by hand to avoid soil disturbance. At the time of weed removal, two quadrats (25 by 50 cm) were placed randomly in each plot and dry weight and density for each weed species present were recorded. Plots were harvested on Sept. 20, after 16 weeks of growth. Total fresh weight of both root and shoot of carrots as well as their number were recorded. Carrots were also graded to estimate marketable yield.

Weed biomass at the time of removal reflected the duration of weed interference. The most important weeds were wallflower mustard (Erysimum cheiranthoides L.), hairy galinsoga (Galinsoga ciliata (Raf.) Blake J), common purslane (Portulaca oleracea L.), marsh yellowcress (Rorippa islandica (Oeder) Borbas J), common lambsquarters (Chenopodium album L.) and redroot pigweed (Amaranthus retroflexus L.). Both root and shoot biomass of carrots responded to weed interference while carrot density and % marketable yield were not significantly affected by the treatments. Plots which were kept weed-free for the first five weeks or longer had significantly greater yields than those which were kept weed-free for only the first three weeks after carrot emergence. Significant lower yields occurred when plots were weed-infested for at least the first six weeks. These results indicated that the critical period of interference in carrots lies between five and size weeks after carrot emergence.

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Effect of weed interference as measured by weed density and dry weight at the time of removal on the density and fresh weight of carrots 'Gold Pack' grown in muck soil in Quebec in 1985.

	At time of removal		At harvest	
	Weed		Carrot	
Weed-removal treatment	Density #/m^2	Dry wt g/m^2	Density #/m^2	Fresh wt kg/m^2
Weed-free				
First 2 weeks	268	709	95	5.1 ab†
First 3 weeks	375	365	81	5.8 abc
First 4 weeks	127	183	75	6.7 abcd
First 5 weeks	25	13	82	7.7 de
First 6 weeks	13	4	76	7.8 de
First 8 weeks	5	§	112	8.8 e
All season	0	0	64	8.7 e
Weed-infested				
First 2 weeks	910	3	68	8.0 de
First 3 weeks	672	60	89	8.0 de
First 4 weeks	1112	175	78	7.1 cde
First 5 weeks	607	164	85	6.8 bcd
First 6 weeks	747	520	84	5.0 a
First 8 weeks	563	629	101	2.7 f
All season	115	1143	99	1.7 f

§ Very small weight

† Different letters in same column denote significant differences (P 0.05) by DMRT

INFLUENCE OF TILLAGE SYSTEMS ON WEED POPULATIONS & YIELD OF POTATOES

R.W. Wallace*, R.R. Bellinder and D.T. Warholic[1]

Tillage and hilling are important practices in the management of potatoes (Solanum tuberosum), however, in several areas of the United States, potatoes have been successfully grown using reduced tillage techniques. With this in mind, a field study was initiated to evaluate the influence of reduced tillage on weed populations and potato yields and quality. Grain rye was planted in the fall of 1985 and prior to potato planting it was chemically killed with glyphosate (1.1 kg a.i./ha). Mainplot treatments were conventional (moldboard plow and disc) and rye mulch reduced tillage (direct plant) systems. Metribuzin (0.56 kg a.i./ha) was applied to all plots ten days after planting. Subplots (1.8 by 9.1 m) consisted of hilled and nonhilled treatments. Weed population data was collected within the subplots from randomly placed 0.5m^2 quadrats. Weeds were counted and tagged at four intervals during the season to determine emergence and survival. Potatoes were harvested from the two center rows of each four-row subplot and yields were subsequently graded, weighed, and evaluated for tuber greening.

Prior to hilling, a difference in weed emergence was observed between tillage systems. Twenty-one weeds emerged in the rye mulch reduced tillage (RT) treatments compared with 69 in the conventionally tilled (CT) plots. Hilling greatly increased weed emergence. In hilled, RT plots, weed emergence counts increased from 27 (prior to hilling) to 163 weeds per quadrat, while in non-hilled treatments weeds increased by 13. Hilling also increased weed emergence in CT plots, but to a lesser extent than in the RT system. Final counts just prior to harvest showed that hilled RT plots contained an average of 140 weeds, while hilled CT plots contained just 71 weeds per quadrat. Non-hilled conventional and reduced tillage plots contained 18 and 20 weeds per quadrat, respectively.

Total yields of RT and CT potatoes did not differ where hilling was included in the production system. When hilling was omitted, yields of RT potatoes decreased significantly while yields of CT potatoes remained unchanged. Tuber greening decreases crop quality and constitutes a potential yield loss. Although hilling significantly increased quality in potatoes of both CT and RT systems, quality enhancement was greater in RT. Percent greening decreased from 68 to 23 and 40 to 20 in RT and CT systems, respectively. The evidence indicates that CT and RT production systems produce potatoes of comparable quality and yield potentials are equivalent when a hilling operation eight weeks after planting is a component of both systems.

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CONTROL OF WEEDS IN MUCK ONIONS WITH DIETHATYL-ETHYL, METOLACHLOR AND PENDIMETHALIN

D.T. Warholic*, L.A. Ellerbrock and R.R. Bellinder[1]

Today, most onion (Allium Cepa) growers on high organic matter soils are without legal, safe, and effective preemergence or at-emergence herbicides. They need a replacement for CDAA which will provide both annual grass and broadleaf weed control for a five- to six-week period following onion planting. After this time, materials such as oxylfuorfen and fluazifop-p-butyl are available.

In 1986 eight herbicide trials were conducted encompassing all major muck areas of New York State, in a search for a CDAA replacement. This research centered on the herbicides pendimethalin, diethatyl-ethyl, and metolachlor. We looked at two weed situations: general preemergence broadleaf control of such common weeds as lambsquarters (Chenopodium album L.), common purslane (Portulaca oleracea L.), and redroot pigweed (Amaranthus retroflexus L.); and the control of and prostrate spurge (Euphorbia humistrata Engelm. ex Gray).

When applied preemergence or at onion emergence pendimethalin at 2.0 - 3.0 lbs(ai)/A was safe and provided excellent control of lambsquarters, good control of prostrate spurge and common purslane, and poor control of redroot pigweed. At the same timings 6-8 lbs (ai)/A of diethatyl-ethyl provided acceptable control of prostrate spurge and common purslane, but was ineffective against lambsquarters and redroot pigweed. At one site 6 lb (ai)/A of diethatyl-ethyl reduced onion stand by 30%. At all other sites diethatyl-ethyl appeared safe.

Metolachlor at 2 lb (ai)/A applied preemergence was active on prostrate spurge but not without considerable and unacceptable onion injury. In addition, general broadleaf weed control was poor. At two other sites, one or two sprays of 2 lbs(ai) of metolachlor did not injure onions having at least two fully developed leaves.

PREEMERGENCE

Table 1. Onion Weed Control - 1986, Canastota, New York

Chemical	Rate lb/A	Percent Weed Control (By Count) IPHHT	AMARE	CHEAL	POROL	ECHCG
1. propachlor	6.0	33	22	59	65	--
2. diethayl-ethyl	6.0	82	15	51	45	86
3. pendimethalin	2.0	85	37	99	88	--
4. metolachlor	2.0	68	0	47	62	36

Treatments were applied on May 15, six days after onion planting.

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Yellow Nutsedge Control in Onions Grown on Mineral Soil[1]

A.F. Senesac[2] and J.B. Sieczka[3]

ABSTRACT

Dry bulb onion production is a significant, but low acreage alternative for potato and other vegetable growers on Long Island. One major factor which prevents greater production is the inability to adequately control yellow nutsedge. Onions, which require a long growing season, can often be overwhelmed by light nutsedge infestations because of their poor competitive abilty.

In 1986, field studies were conducted at two locations on Long Island to examine the efficacy and crop tolerance of post emergence applications of metolachlor, bentazon and oxyfluorfen. A site at the Long Island Horticultural Research Lab was chosen for phytotoxicity and yield data where there was no known yellow nutsedge infestation. An identical study was established in a grower's field that was known to have a heavy nutsedge infestation. Both studies were seeded with hybrid Yellow Globe onions (Allium cepa 'Rocket ') in multi-row raised beds in early April on Haven loam soil with a pH of 6.0 and 2 percent organic matter. Postemergence applications of metolachlor at 1.7, 2.2 and 3.4 kg/ha were applied in late May at the two true leaf stage and four weeks later at the six-eight leaf stage. Bentazon and oxyfluorfen, alone and in sequential combination with metolachlor were applied as late postemergence treatments in mid-July.

Full season nutsedge control was achieved with sequential applications of all rates of metolachlor. Single applications at the two leaf stage provided adequate early, but not full season control. Bentazon provided fair late season supression only if it was preceded by metolachlor early in the season. Oxyfluorfen was less effective at this timing. At the nutsedge-free location, significant yield reductions occurred only when metolachlor was applied in a granular formulation at a rate of 3.4 kg/ha. At the site infested with nutsedge, the yield was reduced by this treatment as well as in plots where the weeds were not adequately controlled by the herbicides.

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INTERFERENCE RESPONSES OF ANNUAL WEEDS AND SNAP BEANS

Philip E. Neary & Bradley A. Majek[1]

ABSTRACT

An annual weed competition study was conducted in snap beans (**Phaseolus vulgaris** L.) at the Rutgers Research & Development Center at Bridgeton, NJ, in 1986. Treatments consisted of snap beans grown in weed free plots and in plots with heavy natural populations of an annual grass or broadleaf weed. Weed free plots were maintained by a preemergence application of 0.07 kg ai/ha imazaquin plus 1.7 kg ai/ha metolachlor, supplemented by weekly hand weeding. The weed populations were maintained as monocultures by hand weeding.

Bean plants were sampled three, five, seven, and nine weeks after planting. Fresh and dry weights were recorded for each destructive harvest. Bean yields were obtained by hand harvesting a 1.0 m^2 area in the center of each plot.

Weed densities ranged from 139 plants per m^2 to 3,013 plants per m^2 and yields were reduced by 10 to 78 percent. Giant foxtail (**Setaria faberi** Herrm.) was the most competitive annual grass and fall panicum (**Panicum dichotomiflorum** Michx.) was the least competitive annual grass. A mean giant foxtail population of 2,492 plants per m^2 reduced snap bean yields 77 percent. A mean fall panicum population of 2,867 plants per m^2 reduced yields over 10 percent. Common cocklebur (**Xanthium strumarium** L.) was the most competitive annual broadleaf weed and jimsonweed (**Datura stramonium** L.) was the least competitive annual broadleaf weed. A mean common cocklebur population of 480 plants per m^2 reduced snap bean yields 78 percent. A mean jimsonweed population of 212 plants per m^2 reduced yields 14 percent.

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IMAZAQUIN AS A HERBICIDE FOR EDIBLE LEGUME CROPS

Philip E. Neary & Bradley A. Majek[1]

ABSTRACT

Imazaquin alone and in combination with annual grass herbicides were evaluated for phytotoxicity and efficacy in snap beans (**Phaseolus vulgaris** L.) in 1985 and 1986 and in lima beans (**Phasseolus lunatus** L.) and peas (**Pisum sativum** L.) in 1986. Control of 11 annual grass and broadleaf weeds with imazaquin was evaluated in an established weed nursery.

No crop injury was observed when 0.07 kg ai/ha and 0.14 kg ai/ha imazaquin were applied preemergence, however, 0.28 kg ai/ha imazaquin resulted in crop injury and subsequent yield reduction of snap beans and peas in 1986. The injury was characterized by a temporary stunting of plant growth, which delayed maturation and resulted in reduced yields at harvest.

Imazaquin at 0.07 kg ai/ha controlled jimsonweed (**Datura stramonium** L.), smooth pigweed (**Amaranthus hybridus** L.), and common lambsquarters (**Chenopodium album** L.). Velvetleaf (**Abutilon theophrasti** Medik.) was controlled by 0.14 kg ai/ha of imazaquin. Weeds not adequately controlled by imazaquin included common cocklebur (**Xanthium strumarium** L.), common purslane (**Portulaca oleracea** L.), common ragweed (**Ambrosia artemisiifolia** L.), large crabgrass [**Digitaria sanguinalis** (L.) Scop.], barnyardgrass [**Echinochloa crus-galli** (L.) Beauv.], fall panicum (**Panicum dichotomifluorum** Michx.), and giant foxtail (**Seteria faberi** Herrm.). Imazaquin in combination with an annual grass herbicide effectively controlled a broad spectrum of weeds.

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NEW HERBICIDES FOR PUMPKINS

M. D. Orzolek, D. W. Grenoble and P. A. Ferretti[1/]

ABSTRACT

Compared to the standard recommended treatments of chloramben or dinoseb preemergence applications for weed control in pumpkin, FMC 57020 (dimethazone), diethatyl + chloramben and chloramben + metachlor resulted in generally better weed control throughout the growing season, higher yields and larger fruit. Diethatyl alone resulted in poorer but acceptable weed control than chloramben or dinoseb but less fruit and smaller size. Both post-emergence grass materials controlled all grasses in the plots but fruit yield and size was reduced because of increased annual broadleaf competition. The highest number and weight of pumpkins was harvested from the hoed check treatment which was hand weeded 4 times.

INTRODUCTION

There are approximately 3,000 acres of face pumpkins (Cucurbita pepo L.) and 2,500 acres of processing squash (Cucurbita maxima Duchesne) grown in Pennsylvania. Since both of these crops mature between 90 and 115 days from planting, season-long weed control is essential for optimum yields and fruit quality. In addition, several weed species if not controlled, serve as reservoirs for a number of viruses which infect pumpkins and result in as much as a 50 percent yield reduction.

The recommended herbicides in Pennsylvania are chloramben (3-amino-2,5-dichlorobenzoic acid) which has a residual effect between 3 and 6 weeks and bensulide [O, O-diisopropyl phosphorodithioate 5-ester with N-(2-mercaptoethyl) benzenesulfonamide] which must be incorporated to a depth of 2 to 4 inches. Since neither of the recommended herbicides alone provide season long weed control in pumpkins, a combination of materials provides acceptable weed control although does not control established annual weeds. Materials which effectively extend weed control throughout the growing season currently are not labeled for pumpkin weed control.

The objective of this study was to evaluate methachlor [2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl) acetamide], FMC 57020 [2-(2-chlorophenyl)methyl-4,4-dimethyl-3-isoxazolidinone], diethatyl [N-(chloracetyl)-N-(2,6-diethylphenyl)glycine], Fluazifop [(±)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]phenoxy] propionate] and sethoxydim [2-[1-(ethoxyimino) butyl 1]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one] alone and in combination as to their potential to control weeds without causing any phytotoxic effect and yield reduction in pumpkins. The treatments were compared to the standard recommended herbicides as well as a hoed and weedy check.

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8' x 20' LONG

MATERIALS AND METHODS

This study was conducted at the Rock Springs Horticulture Research Farm of The Pennsylvania State University on a Hagerstown silt loam soil. The pumpkin cultivar 'Big Tom' was planted on June 4, 1986 on 2 row beds 2.4 m apart. Plots were 6.1 m long with 1.5 m between blocks in a randomized complete block design with 3 replications. Time of application and conditions are given in Table 1. All treatments were applied using a backpack CO_2-propelled sprayer.

Dominant weed species in this study included; lambsquarter (Chenopodium album L.), redroot pigweed (Amaranthus retroflexus L.), yellow foxtail [Setoria glauca (L.) Beauv.], fall panicum (Panicum dichotomiflorum Michx.) and chinese cabbage [Brassica campestris L., ssp. pekinensis (Lovr.)]. The volunteer chinese cabbage, which had been planted the previous year was generally confined to the 1st replicate and very difficult to control. Additional pest control and culture recommendations were taken from the Pennsylvania Commercial Vegetable Production Guide, 1985-1986.

RESULTS AND DISCUSSION

The FMC 57020, diethatyl + chloramben and chloramben + metachlor treatments provided the best weed control in pumpkins compared to the standard recommended herbicides of chloramben or dinoseb. They also had much better weed control than the weedy check and comparable control to the hoed check (Table 2). However, diethatyl when applied alone resulted in lower but still acceptable weed control compared to the standard and check treatments. Weed control with the postemergent grass materials, fluaziflop and sethoxydim, overall was unacceptable; however, annual grass control was excellent with no control of annual broadleaf weeds. Generally all preemergence treatments caused some stand reduction and/or phytotoxicity of pumpkin seedlings with FMC 57020 at 1.12 kg a.i./ha resulting in early bleaching of the oldest true leaves to normal appearance (approximately 3 weeks). No phytotoxicity or stand reduction was observed with the application of the postemergence grass materials. This is in agreement with Diffenderfer et al. (1984). The combination treatment of metachlor and FMC 57020 at the reduced rate (0.84 kg a.i./ha) resulted in less phytotoxicity to the emerging pumpkins. The stand and vigor rating of the diethatyl + chlorambem treatment was based on the observed stunting of the plants instead of plant phytotoxicity or stand loss. There was no observable stunting in the chloramben treatment alone, although there was a slight reduction in the stand. The dinoseb stand and vigor rating at first appearance is high, but was skewed because the front part of the field was extremely wet after application of the dinoseb. If the rating of the 1st replicate is thrown out, the stand and vigor rating for dinoseb would have been less than 2.

Yield, on the basis of weight, was highest with the hoed check followed by the chloramben + metachlor, FMC 57020 and diethatyl + chloramben. All treatments had higher yields than the standard herbicides chloramben and dinoseb alone as well as the hoed check. Kupatt et al. (1983) reported that the best yield of winter squash was obtained from the application of chloramben at 2.24 kg a.i./ha. The lower yield of pumpkin in this study may be due to the higher rate of chloramben.

Table 1. Environmental conditions of preemergence and postemergence herbicide applications on pumpkins, Rock Springs, Pa.

Preemergence Treatments:	
Date Applied: June 5, 1986	
Pressure: 24 psi	Gal./A: 25
Air Temp: 78°F	Wind Speed: 5 to 10 mph
Soil Surface: Moist	Soil Moisture: 50%
Sky: Cloudy	
Posttreatments:	
Date Applied: July 1, 1986	
Pressure: 24 psi	Gal./A: 25
Air Temp.: 64°F	Wind Speed: 5 mph
Soil Surface: Dry	Soil Moisture: 50%
Sky: Partly Cloudy	

Results of this study indicate that extended or season long weed control, especially of annual grasses, in pumpkin is possible with a combination of chloramben or dinoseb with FMC 57020, diethatyl or metachlor.

LITERATURE CITED

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2. Kupatt, C., R. D. Ilnicki and D. B. Vitolo. 1983. Weed Control in Winter Squash with Some Old and New Herbicides. 37:145-149.

Table 2. The effect of preemergence herbicides on weed control, stand, and yield of 'Big Tom' pumpkin at the Horticulture Research Farm, Rock Springs, PA.

Treatment	Rate kg a.i./ha	Stand+ Vigor Rating[a]	Weed Control Rating[b]	Yield: Fruit Number Mat.	Yield: Fruit Number Immat.	Yield: Total	Weight kg	Percent Mature of Total	Avg Fruit Size-kg
Weedy check	--	1.0	2.0	7.7	4.0	11.7	34.0	65.8	4.4
Hoed check	--	1.0	8.0	18.7	8.7	27.4	100.5	68.2	5.4
Chloramben	3.36	3.2	9.7	16.3	2.7	19.0	63.2	85.8	3.9
Dinoseb	5.04	3.7	9.0	15.0	3.7	18.7	70.6	80.2	4.7
Metachlor	2.24	2.7	9.2	16.3	4.0	20.3	63.3	80.3	3.9
FMC 57020 (Dimethazone)	1.12	5.2	10.0	13.7	8.0	21.7	78.0	63.1	5.7
Diethatyl	4.48	4.5	7.7	7.3	2.7	10.0	27.1	73.0	3.7
Metachlor + FMC 57020	1.12+0.84	4.0	9.5	14.7	5.0	19.7	71.7	74.6	4.9
Diethatyl + Chloramben	4.48+2.24	3.7	10.0	14.3	3.7	18.0	77.0	79.4	5.4
Chloramben + Metachlor	2.24+1.12	3.3	10.0	18.7	2.0	20.7	97.4	90.3	5.2
Fluazifop-butyl + Oil	0.22	1.3	2.0	12.0	3.3	15.3	42.1	78.4	3.5
Sethoxydim + Oil	0.28	1.0	4.3	12.0	6.0	18.0	40.9	66.7	3.4

Data taken on June 23, 1986 when pumpkin plants had 2 expanded leaves.

a/ Stand and vigor rating: 1 = no injury and complete stand
10 = dead plants and no stand

b/ Weed control rating made on June 23, 1986: 1 = no weed control
7 = commercially acceptable control
10 = complete weed control

TERBACIL EVALUATION FOR SEEDED WATERMELON

C. Edward Beste[1/]

ABSTRACT

Watermelon (Citrullus lanatus (Thumb.) Matsum. & Nakai 'Crimson Sweet', 'Jubilee', 'Charleston Gray') was 3 - 5 fold more tolerant to terbacil, preemergence, than cantaloupe (Cucumis melo L. 'Jumbo Hale's Best') or cucumber (Cucumis sativus L. 'Poinsett 76'). The large-seeded varieties 'Charleston Gray' and 'Jubilee' tolerated about 20% higher terbacil rates than the small-seeded variety 'Crimson Sweet'. Terbacil, preemergence, at 0.16 and 0.26 lb/A in combination with diclofop 1.0 lb/A provided acceptable weed control and watermelon yields and quality equal to the handweeded control.

INTRODUCTION

Weed control in watermelon will increase yield and also quality as larger watermelons which receive premium prices. Bensulide (O,O-bis(1-methylethyl)S-[2-[(phenylsulfonyl)amino]ethyl]]phosphoro-dithioate) plus naptalam (2-[(1-naphthalenylamino)carbonyl]benzoic acid) preplant incorporated or preemergence (pre) provide 75 to 90% weed control but may fail to control late season weeds. Dinoseb (2-(1-methylpropyl)-4,6-dinitrophenol) 0.5 to 0.75 lb/A, preemergence (pre) plus naptalam 1.5 to 2.0 lb/A is widely used on watermelon and dinoseb provides early suppression of many large-seeded broadleaf weeds such as morningglory (Ipomoea spp.); however, late-season control is usually inadequate without numerous cultivations. Terbacil at 1.0 lb/A pre, was efficacious with an activated carbon barrier on the soil surface over seeded watermelons (1). The objective of this study was to determine if marginal watermelon tolerance to terbacil could be utilized with reduced terbacil rates as an efficacious treatment.

MATERIALS AND METHODS

All studies were conducted at the University of Maryland Vegetable Research Farm on a Norfolk loamy sand (0.6%). Logarithmic rates of terbacil, pre, were applied from 1.0 to 0.03 lb/A, pre, with half-rate changes at 15 ft intervals with 100 GPA spray volume. Control ratings were made six weeks after treatment in 1984 and 1985 for watermelon, cucumber, cantaloupe, common lambsquarters (Chenopodium album L.), common purslane (Portulaca oleracea L.), ivyleaf, tall and entireleaf morningglory (Ipomoea hederacea, I. purpurea (L.) Roth and I. hederacea var. integriuscula Gray), common ragweed (Ambrosia artemisiifolia L.), carpetweed (Mollugo verticillata L.) large crabgrass (Digitaria sanguinalis L.), goosegrass (Eleusine indica (L.) Gaertn.) and

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Acknowledgements: The establishment and harvest of the 1986 plots by William A. Johnson and staff, Univ. of Maryland and the growth and weed control ratings by John Teasdale, USDA-ARS are greatfully acknowledged.

stinkgrass (Eragrostis cilianensis (All.) E. Mosher). In 1984, planting was made on June 13 and treated on June 15 and in 1985, the study was planted on June 7 and treated June 8. Pertinent rainfall is shown in Table 1. The ratings are an average of two replications.

In 1986, two watermelon varieties 'Crimson Sweet' and 'Charleston Gray' were each planted in 30 ft length rows 7.5 ft apart. The two row plot size was 15 by 30 ft in a randomized complete block design with three replications. Watermelon was seeded on May 5 at a 1 inch depth with 4 seeds/ft of row and sprayed preemergence on May 6. Rain or irrigation in the five weeks after planting were as follows: May 6 - 1 in irrig., May 12 - 1 in irrig., May 19 - 1 in irrig., May 20 - 1.29 in rain, May 21 - 0.07 in rain, May 22 - 0.08 in rain, May 29 - 1 in irrig., June 2 - 0.18 in rain, June 2 - 1 in irrig., June 12 - 0.11 in rain. The following treatments were evaluated: bensulide, 4.0 lb/A; bensulide plus dinoseb plus naptalam, 4.0, 0.75, 1.5 lb/A, respectively; diclofop (±)-2-[4-(2,4-dichlorophenoxy]propanoic acid) plus terbacil, 1.0 plus 0.26 lb/A, respectively and diclofop plus terbacil, 1.0 plus 0.16 lb/A, respectively. Weed control was rated on May 23 and July 23 for common lambsquarters, annual morningglory as ivyleaf, tall and entireleaf and grasses as goosegrass, large crabgrass and fall panicum (Panicum dichotomiflorum Michx.).

All the plots were cultivted on May 26 and June 2, 11 and 30. Fertilizer was applied as follows: 500 lb/A of 10-10-10 on May 26, 150 lb/A of ammonium nitrate on June 11 and 30. Watermelon plants were thinned to a 3 ft spacing in the row on June 2. Harvest was on August 7 and 19 and each melon was weighed.

RESULTS AND DISCUSSION

Watermelon is uniquely 3-5 fold more tolerant to terbacil than cucumber or cantaloupe (Table 1). In 1985, a comparison of the large-seeded varieties 'Jubilee' and 'Charleston Gray' with the small-seeded variety 'Crimson Sweet' showed a trend for greater terbacil tolerance of the large-seeded watermelon varieties. Terbacil at 0.03 lb/A or less provided complete control of common lambsquarters, common purslane, common ragweed and carpetweed. Large crabgrass and stinkgrass would probably be inadequately controlled by terbacil at rates tolerated by watermelon. Goosegrass was controlled by terbacil at 0.09 lb/A or less. Rainfall in 1985 was less after treatment than in 1984, however, the growth responses were similar.

Replicated plots in 1986, showed the large-seeded variety'Charleston Gray' was more tolerant to terbacil at 0.16 lb/A only compared to 'Crimson Sweet' (Table 2). Terbacil 0.26 lb/A appeared to reduce the early yield of 'Charleston Gray', however, acceptable yields and quality were obtained with terbacil 0.16 and 0.26 lb/A for both 'Crimson Sweet' and 'Charleston Gray' (Table 3). Diclofop was combined with terbacil to provide complete grass control without influencing broadleaf weeds or watermelon growth (unpublished data) in order to provide an optimum evaluation of terbacil efficacy. Dinoseb in combination with naptalam plus bensulide caused slight vigor reduction of both varieties; however, this combination significantly reduced the early yield and melon size of 'Crimson Sweet' compared to the handweeded control. Bensulide 4.0 lb/A, pre provided acceptable yields of watermelon with less weed control than the terbacil treatments which indicated watermelon could compete with the late season weeds in this study. Four cultivations, without

Table 1. Growth response of several vine crop and weed species to preemergence terbacil in a logarithmic rate study on Norfolk loamy sand(0.6% O.M.).

	Terbail as lb/A, preemergence, to elicit the observed percent control[1/]							
Plant % Control:	100 %		90 %		50 %		none	
Species Year:	1984	1985	1984	1985	1984	1985	1984	1985
Watermelon:								
Crimson Sweet	0.24	0.30	0.15	0.20	0.10	0.18	0.070	0.15
Jubilee	---	0.52	---	0.37	---	0.26	---	0.186
Charleston Gray	---	0.37	---	0.28	---	0.20	---	0.184
Cantaloupe:	0.09	0.079	0.04	0.065	<0.03	0.058	---	0.050
Cucumber:	<0.03	0.055	---	0.05	---	<0.03	---	---
Common Lambsquarters:	<0.03	<0.03	---	---	---	---	---	---
Common Purslane:	<0.03	<0.03	---	---	---	---	---	---
Annual Morningglory:	0.034	0.096	<0.03	0.044	---	0.040	---	<0.03
Common Ragweed:	<0.03	<0.03	---	---	---	---	---	---
Carpetweed:	<0.03	<0.03	---	---	---	---	---	---
Crabgrass,:Large	0.25	---	0.086	---	0.062	---	<0.03	---
Goosegrass:	<0.03	0.09	---	<0.03	---	---	---	---
Stinkgrass:	0.27	0.05	0.11	<0.03	0.06	---	<0.03	---

1/ Terbacil rate range from 1.0 to 0.03 lb/A and <0.03 lb/A indicates the growth response would occur at a rate less than the lowest rate.

Varieties: Watermelon - small seeded var. - Crimson Sweet (1984 & 1985), large seed var. - Charleston Gray and Jubilee (1985).
Cantaloupe - Jumbo Hale's Best (1984 & 1985)
Cucumber - Poinsett 76 (1984 & 1985).

Planted: June 13, 1984, June 7, 1985

Depth: 1984 - 3/4 inch, 1985 - 1 inch

Rainfall:

1984
Planted: June 13, 1984
Treated: Pre - June 15, 1984

Date	Inches	DAT*
June 16	0.66	1
June 17	0.61	2
June 19	0.07	4
June 24	0.27	9
June 25	0.06	10
June 26	0.10	11
June 29	0.08	14
June 30	1.25	15

1985
Planted: June 7, 1985
Treated: Pre - June 8, 1985

Date	Inches	DAT*
June 8	0.21	0 (sprayed after rain)
June 11	0.14	3
June 12	0.01	4
June 13	0.31	5
June 16	0.04	8
June 18	0.34	10
June 21	0.75	13
June 24	0.50	16

*Days after treatment.

herbicides, were inadequate to prevent significant yield and quality loss of watermelon from weed competition. Terbacil controlled late season morningglories (Table 2).

Additional studies are needed to determine if terbacil would be beneficial for more-competitive late-season weeds like ragweed. In 1985, terbacil at 0.26 and 0.52 lb/A significantly reduced the watermelon population but upon replanting 3 weeks after treatment, acceptable growth and yield was obtained (unpublished data). The organic matter of 0.6% in this study represents the lowest range in soils of the watermelon growing area of Delmarva and greater organic matter content may improve terbacil selectivity. Morningglory control would be uniquely beneficial because morningglory leaf imprints on the rinds from shading the watermelon reduces the market value as a blimished melon. Continued evaluation of terbacil for watermelon appears to have merit.

LITERATURE CITED

1. Glaze, N.C., S. C. Phatak and E. D. Threadgill. 1979. Spot application of activated charcoal to increase herbicide selectivity on watermelon. HortScience 14:632-633.

Table 2. Weed control and watermelon growth on a Norfolk loamy sand (0.6% O.M.) with preemergence herbicide treatments.

Preemergence Treatment 1/		May 26, 1986					July 23, 1986	
		% Reduction of Growth		% Control 2/			% Weed Cover	
Herbicide	Lb/A	Crimson Sweet	Charleston Gray	Lambs-quarters	Morn-ingglory	Grass	Within Rows	Between Rows
1. Weedy Control	---	0	0	0	0	0	90	15
2. Handweeded	---	0	0	0	0	0	4	12
3. bensulide (4E)	4.0	0	5	86	0	96	73	18
4. bensulide + naptalam(2S)+ dinoseb (3E)	4.0+ 1.5+ 0.75	13	10	100	81	100	70	18
5. diclofop (3E)+ terbacil(80W)	1.0+ 0.26	60	73	100	94	100	1	1
6. diclofop + terbacil	1.0+ 0.16	27	12	100	86	100	3	4

1/ All treatments were cultivated on May 26, June 2, 11 and 30.
2/ Common lambsquarters, ivyleaf, tall and entireleaf morningglory mixture, grasses were goosegrass, large crabgrass and fall panicum.

Table 3. Yield and quality of 'Crimson Sweet' and 'Charleston Gray' watermelon with several herbicide treatments on a Norfolk loamy sand (0.6% O.M.) in 1986.

Preemergence Treatment[1/]		CRIMSON SWEET				CHARLESTON GRAY			
		Yield[2/] (1000 Lb/A)		Melon Size		Yield[1/] (1000 Lb/A)		Melon Size	
Herbicide	Lb/A	Early	Total	Lb/Melon	No. per A >20 Lb	Early	Total	Lb/Melon	No. per A >20 Lb
1. Weedy Control	---	7.0 a	25.6 a	19.8 ab	580 ab	9.4 a	29.3 a	21.6 a	970 a
2. Handweeded	---	25.8 c	40.0 b	21.4 b	1030 ab	20.2 bc	49.7 b	22.9 ab	1550 a
3. bensulide (4E)	4.0	21.9 bc	38.5 b	20.4 ab	900 ab	28.5 c	40.2 ab	24.1 ab	1420 a
4. bensulide + naptalam(2S)+ dinoseb (3E)	4.0+ 1.5+ 0.75	11.9 ab	31.0 ab	17.6 a	320 a	13.8 abc	39.6 ab	23.5 ab	1290 a
5. diclofop (3E)+ terbacil(80W)	1.0+ 0.26	21.8 bc	37.3 b	19.3 ab	580 ab	10.0 ab	38.0 ab	23.9 ab	1420 a
6. diclofop + terbacil	1.0+ 0.16	23.9 bc	42.6 b	21.5 b	1230 b	20.1 bc	39.4 ab	24.5 b	1420 a

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

1/ All treatments were cultivated on May 26, June 2, 11 and 30.

2/ Early yield was obtained on August 7 and the total yield is the combined harvest of August 7 plus August 19.

CINMETHYLIN FOR WEED CONTROL IN VEGETABLE CROPS

Bradley A. Majek[1]

ABSTRACT

Cimethylin was applied posttransplant to peppers (**Capsicum annuum** L.), tomatoes (**Lycopersicum esculentum** Mill.), endive (**Lactuca sativa** L.), and cole crops (**Brassica oleracea** L.) and preemergence to direct-seeded snap beans (**Phaseolus vulgaris** L.) and cole crops. No crop injury was observed at a rate up to 2.0 kg ai/ha in peppers, tomatoes, endives, or snap beans. Phytotoxicity was variable in cole crops when cinmethylin was applied posttransplant or preemergence to direct-seeded stands. The weed control observed when cinmethylin was applied at rates between 1.0 and 2.0 kg ai/ha was superior to the weed control obtained with any currently registered herbicide.

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HERBICIDE PROGRAMS FOR PEPPERS ON CLEAR PLASTIC

R.R. Bellinder and D.T. Warholic[1]

Use of clear plastic mulch to hasten crop maturation is expanding in New York and demand for information concerning herbicide performance under plastic has increased proportionately. This project was designed to generate information for growers and the choice of herbicides was governed by the need to control hairy galinsoga and yellow nutsedge in peppers. The following herbicides, applied alone or in combination, were evaluated for efficacy and phytotoxicity to peppers: diethatyl-ethyl (2.2, 4.4 kg/ha), diphenamid (2.2 kg/ha), metolachlor (2.2 kg/ha), napropamide (1.5 kg/ha), oxyfluorfen (0.30 kg/ha) and trifluralin (0.85 kg/ha). All treatments were applied preplant incorporated or pretransplant, prior to plastic laying.

With the exception of oxyfluorfen, and to a lesser extent metolachlor, control of lambsquarters, redroot pigweed, hairy galinsoga and barnyardgrass decreased with single herbicide treatments. Combinations resulting in superior, season-long control of all species included trifluralin plus metolachlor, trifluralin plus oxyfluorfen, diphenamid plus diethatyl-ethyl (2.2, 4.4 kg/ha), and diethatyl-ethyl (2.2 kg/ha) plus oxyfluorfen.

Injury was assessed as degree of stunting or decreased vigor at four, six, and eight weeks after planting. Diethatyl-ethyl and metolachlor, alone and in combination with treflan caused 11 and 29% initial injury, respectively. All other treatments resulted in less than 11% injury. Injury generally decreased with time. Despite reduced weed control in plots receiving single herbicide treatments, yields were not significantly different. Examination of the yields at different harvest dates did not reveal any evidence of delayed maturity.

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TIMING OF APPLICATION FOR NEW PEPPER HERBICIDES

M. D. Orzolek and P. A. Ferretti[1/]

ABSTRACT

Several new herbicides were evaluated at different times of application on commercial pepper (Capsicum annuum L.) transplants at the Horticulture Research Farm, Rock Springs, PA. Generally posttransplant and layby treatments with chloramben granular resulted in more effective weed control for a longer period of time than the postemergence treatments. Early control of annual weeds after transplanting was critical for optimum pepper yields. Combinations of diphenamid, napropamide and chloramben with diethatyl resulted in the cleanest pepper plots with highest fruit yield in the study. The highest rate of diethatyl 3.36 kg/ha, resulted in the best weed control but reduced the yield of peppers compared to the lower rate of diethatyl.

Weed species uniformly distributed in the plots were; purslane (Portulaca oleracea L.), lambsquarter (Chenopodium album L.), redroot pigweed (Amaranthus retroflexus L.), yellow foxtail (Setaria glauca) and fall panicum (Panicum dichotimiflorum Michx.). Weed species not uniformly found in all treatments but of significance were; morningglory (Ipomoea purpurea L.), Canada thistle (Cirsium arvense L.), black nightshade (Solanum nigrum L.) and ground cherry (Physalis heterophylla L.). Within any plot, annual broadleaf weeds were predominant with only moderate infestious of annual grasses.

Among the postemergent grass herbicides evaluated, BAS 51702H + oil concentrate at 0.56 kg/ha and Fluazifop + oil concentrate at 0.21 kg/ha not only provided 100 percent grass control but also a degree of broadleaf suppression, especially purslane. Lack of broadleaf weed control suppressed pepper yields. Apparent suppression of purslane by the postemergence grass herbicides may have actually been the effect of the oil concentrate.

There was no phytotoxic effects or vigor reduction of pepper transplants from any of the herbicide treatments.

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Table 1. The effect of timing and applications on the injury, weed control and yield of pepper transplants at the Horticulture Research Farm, Rock Springs, PA.

Treatment	Rate (kg ai/ha)	Application[a/]	Injury[b/] Rating	Weed Control 7/1/86	Weed Control 7/23/86-Grasses		Fruit Yield Number	Fruit Yield Weight-kg	Avg. Fruit Weight-grams
Diethatyl	1.12	PT	1.0	8.3	4.7		55.0	6.0	110.6
Diethatyl	2.24	PT	1.0	7.0	3.3		40.7	3.8	93.6
Diethatyl	3.36	PT	1.0	8.5	5.7		45.6	4.5	99.2
Diethatyl + diphenamid	2.24+2.24	PT	1.0	8.0	5.3		49.3	6.0	121.9
Diethatyl + diphenamid	3.36+3.36	PT	1.0	8.8	6.3		50.7	5.8	113.4
Diethatyl + napropamide	2.24+1.12	PT	1.0	7.2	5.2		43.0	4.9	113.4
Diethatyl + napropamide	3.36+2.24	PT	1.0	9.1	7.0		50.7	6.1	119.1
Diethatyl + chloramben	2.24+3.36	PT+L	1.0	9.5	8.2		49.3	6.4	130.4
Napropamide + chloramben	1.12+3.36	PT+L	1.0	8.8	5.2		38.7	4.7	121.9
Chloramben	3.36	L	1.0	9.0	6.8		58.0	6.2	107.7
Diethatyl + FMC 57020	2.24+1.12	PT+PE	1.0	9.7	5.8		41.0	4.3	104.9
FMC 57020	0.56	PE	1.0	9.0	4.0		45.4	4.9	107.7
FMC 57020	1.12	PE	1.0	9.9	5.3		42.4	4.8	113.4
BAS 51702H + Oil Concentrate	0.112+1%	PE	1.0	5.3	2.7	10.0	48.6	4.7	96.4
BAS 51702H + Oil Concentrate	0.56+1%	PE	1.0	5.7	2.7	10.0	49.7	5.4	110.6
BAS 51702H	0.56	PE	1.0	4.7	2.7	10.0	48.0	5.1	104.9
Sethoxydim + Oil Concentrate	0.224+1%	PE	1.0	2.7	1.7	10.0	41.7	4.0	96.4
Fluazifop + Oil Concentrate	0.14+1%	PE	1.0	2.7	3.3	9.0	34.0	3.4	99.2
Fluzaifop + Oil Concentrate	0.21+1%	--	1.0	4.3	3.3	10.0	47.4	5.6	119.1
Check, weedy	--	--	1.0	2.3	2.0	4.0	37.6	3.7	99.2

[a/] Application code: PT = post transplant, L = layby, and PE = post-emergence.

[b/] Injury rating: 1 = no injury to 10 = dead plants.

[c/] Weed control rating: 1 = no weed control, 7 = commercially acceptable control and 10 = complete weed control.

RESPONSE OF EARLY-MATURING CABBAGE (BRASSICA OLERACEA L.) VARIETIES TO METOLACHLOR

R.R. Bellinder*, A.F. Senesac, D. Wilcox-Lee, and D.T. Warholic[1]

Metolachlor is known to cause early stunting in cabbage, particularly under cool, wet conditions. However, it has also been observed that this early stunting has a negligible impact on the final yields of long season cabbage varieties. This study was designed to assess the effect of metolachlor on the early maturing varieties, 'Prime Time' and 'Tastie'. Due to the climatic and edaphic differences occurring within New York State the study was conducted at two locations: Freeville, in central New York, and at Riverhead on Long Island. Metolachlor was applied both pre and post-transplant at 2.2 and 4.4 kg ai/ha at Freeville and post-transplant at 1.1 and 1.7 kg ai/ha at Riverhead. The postemergence treatments were applied 48 h after transplanting at both locations.

At Freeville, metolachlor applied prior to transplanting caused injury ranging from 15 to 40% and total yields of both varieties were significantly reduced with both rates. Responses to post-transplant metolachlor treatments were variable between varieties and among harvest dates. First harvest yields of 'Tastie', the earlier maturing variety, were significantly reduced by both rates of metolachlor. Yields from these treated plots increased at subsequent harvests and final yields did not differ from those of the untreated controls. Yields of untreated 'Prime Time' cabbage peaked at the second harvest and the postemergence treatments did not alter the maturation pattern nor reduce total yields.

At Riverhead, reduction in vigor of both varieties, irrespective of treatment, was less than or equal to 17%, however, this had no impact on individual head weights or yields. Sequential and/or total yields of both varieties did not differ significantly from hand-weeded control plots.

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WEED CONTROL IN TRANSPLANTED COLE CROPS [1/]

E. Prostko, R. D. Ilnicki, and A. Enache [2/]

ABSTRACT

A field study was conducted at the Soils and Crops Research Center, Adelphia, N. J., in 1986 to evaluate the effect of oxyfluorfen, alone and in combination with cinmethylin, metolachlor, or BAS 517 02H, at different rates and times of application in transplanted cabbage, broccoli, and cauliflower. Preplant incorporated applications were made on August 19 and the following day the cole crops were transplanted. Preemergence, early postemergence, and late postemergence applications were made on August 22, 25 and September 15, respectively. Approximately 3 weeks after the late postemergence applications, crop injury and weed control ratings on common lambsquarters (*Chenopodium album* L.), common chickweed (*Stellaria media* (L.) Vill.), and johnnyjumpup violet (*Viola kitaibeliano* R & S. var. *rafinesquil* (Greene) Fenn.) were obtained. Common lambsquarters was present in all three crops while common chickweed and johnnyjumpup violet were present only in the cabbage and broccoli.

Crop injury was recorded on cabbage and cauliflower following an early postemergence application of oxyfluorfen at 0.28 kg/ha. Crop injury was also recorded on cabbage following an early postemergence application of cinmethylin at 1.12 kg/ha. This crop injury was further manifested by a subsequent decline in yields of all three crops following the above mentioned application.

Oxyfluorfen, alone as a preemergence application and followed by either an early postemergence application of cinmethylin or a late postemergence application of BAS 517 02H, provided excellent control of the three weed species evaluated. The preemergence applications of the combinations of oxyfluorfen and metolachlor also provided excellent control of these weeds. Cinmethylin applied as an early postemergence application at 0.84 and 1.12 kg/ha in cauliflower and at 0.84 kg/ha in broccoli did not provide effective control of lambsquarters.

1/ New Jersey Agricultural Experiment Station Publication No. J-15472-1-86.

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WEED CONTROL IN SWEET CORN WITH BROMOXYNIL COMBINATIONS [1/]

R. D. Ilnicki and A. Enache [2/]

ABSTRACT

Bromoxynil may be an additional effective herbicide for use in sweet corn (Zea mays saccharata L.) when applied early postemergence particularly when normally-used preemergence herbicides fail to perform because of dry weather or for other reasons. It was the objective of this study to evaluate bromoxynil alone and in combination with other herbicides for weed control in three popular sweet corn cultivars representing three maturity seasons.

Aztec (68 days), Merit (86 days), and Biqueen (92 days) cultivars were planted May 21, 1985, in a Sassafras loam soil and on May 27, 1986, in a Freehold sandy loam soil. Metolachlor at 1.68 kg/ha was applied after planting to reduce grassy weeds to obtain a better assessment of the control of broadleaf weeds by the bromoxynil combinations.

When sweet corn was in the 6- to 8-leaf stage, applications of bromoxynil were made alone and in combination with atrazine, dicamba, cyanazine, and 2,4-D. In addition the latter four herbicides were applied alone and served as checks in addition to the untreated check. Weeds in the 1985 site included common lambsquarters (Chenopodium album L.), common ragweed (Ambrosia artemisiifolia L.), and fall panicum (Panicum dichotomiflorum Michx.). These weeds were present in 1986 and also included redroot pigweed (Amaranthis retroflexus L.).

Bromoxynil applied alone was effective on broadleaf weeds and combinations with atrazine, cyanazine, or dicamba improved control. Increases in fall panicum control improved only with additions of atrazine or cyanazine.

In 1985, there were no reductions in yield of Aztec and Biqueen with any of the treatments; there was a slight decrease in yield of Merit with treatments that included dicamba. In 1986 no yield reductions were recorded for any treatments on any of the cultivars with the exception of those containing dicamba. All cultivars were affected by these treatments.

From this study it was determined that bromoxynil can be used safely in sweet corn and that the spectrum of weeds controlled may be increased by combining bromoxynil with other herbicides.

1/ New Jersey Agricultural Experiment Station Publication No. K-15472-1-86.

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EFFECTS OF WEED CONTROL ON APPLE TREE GROWTH

W. C. STILES[1]

ABSTRACT

Relationships of weed control to growth of newly planted apple (Malus domestica Borkh. "Empire/MM 111") trees were examined in an herbicide trial conducted in 1984. The soil at the site is classified as Galen fine sandy loam, pH 6.2. Herbicides were applied on May 17, approximately 2 weeks after planting, to 22.9 by 1.8 m plots. A total of 27 plots, each containing six trees, were available for study. Except for the herbicided strips, weed growth between rows was controlled by periodic cultivation throughout the summer. Total weed control and prevalence of each individual seed species was evaluated visually on July 3 and again on August 7. These data were converted to percentiles of total treated area for analysis. Length of the current-season extension shoots produced by the leader plus 3 additional primary scaffold limbs and trunk circumference at a point 15 cm above the graft union were measured on four trees per plot on November 14.

Total shoot growth and final trunk circumference were positively related to total weed control as evaluated on July 3 and August 7. Multiple regression analyses indicated that early-season weed control ratings (July 3) were more closely related to both measurements of tree growth than were later season (August 7) ratings. The July 3 ratings indicated that annual broadleaf weeds and yellow nutsedge (Cyperus esculentus L.) exerted significant adverse effects on tree growth while annual grasses were less influential. The August 7 ratings indicated negative effects of all three weed-types on growth but these were of smaller magnitude.

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ABSTRACT

Killed Sod Effects Upon Young Peach Trees

William V. Welker, Jr., and D. Michael Glenn[1/]

Orchard floor management has a significant impact upon the growth of newly planted peaches. We have found that planting peaches in a killed sod of Kentucky 31 tall fescue resulted in signficantly greater growth of the peach tree during the first three years than the conventional method of planting in tilled soil. The present study is to determine whether the grass species used in killed sod planting impacted on the peach tree response. In the fall of 1982, we planted 5 different grasses: Orchard grass (Dactylis glomerata L.); Perennial ryegrass (Lolium perenne L.); Kentucky bluegrass (Poa pratensis L.); Kentucky 31 tall fescue and Falcon fescue (Festuca arundinacea Schreb). Two bare soil treatments were also included. In the spring of 1985, the grasses were treated with glyphosate at a rate of 2 lb ai/A to kill the grass. Two weeks after treatment, the cultivar 'Red Haven' on 'Halford' rootstock was planted in hand-dug holes. A residual herbicide treatment was applied to the killed grass plots as well as one of the bare soil plots. The second bare soil plot was maintained with cultivation. All plots were maintained weed-free in 1986 with the same treatments as in 1985.

Data collected included trunk diameter, tree height, and canopy width. Greater growth was obtained by all trees planted in killed sod when compared to the conventional bare soil planting method. Planting in killed sods of perennial ryegrass and orchard grass resulted in the greatest growth (24% increase over cultivated); while those trees planted in the killed sod of the fescues showed the least increase in growth (15% increase over cultivated). Although the differences in growth of the peach trees between grass species is not great, they are increasing with time.

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PHYTOTOXICITY OF GLYPHOSATE APPLIED TO APPLE ROOT SUCKERS

Bradley A. Majek & Winfred P. Cowgill, Jr.[1]

ABSTRACT

Glyphosate was applied to apple (**Pyrus malus** L.) root suckers in early July, August, or October 1984. A 2 percent solution was applied to the drip point at each treatment date. Apples growing on two rootstocks, M-26 and M-9, were treated. The effects on the suckers and the rest of the tree were evaluated in 1984 and 1985. Yields were recorded in 1985. Glyphosate controlled apple root suckers in all treatments for the duration of the experiment. No injury was observed in 1984. Apples growing on M-9 rootstock treated in October, 1984 were injured, causing yield reductions in 1985, while those treated in July or August were not injured. Apples growing on M-26 rootstock were not injured at any treatment date.

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HERBICIDE PERFORMANCE IN A FIRST YEAR APPLE ORCHARD

W. C. STILES[1]

ABSTRACT

An experiment was conducted to evaluate effectiveness of dinoseb at 3.36 kg/h and oxyfluorfen at 1.12 kg/h applied alone or in tank-mixed combinations with napropamide at 3.75 kg/h, oryzalin at 3.75 kg/h or pendamethalin at 3.75 kg/h. Treatments were applied to 22.9 by 1.8 m plots on May 17, 1984, approximately two weeks after planting, using a back-pack sprayer calibrated to deliver 375 l/h with a single OC06 nozzle. One half of the plot area was sprayed from each side of the row to minimize contact with the tree trunks. A non-ionic surfactant was included in all treatments at 0.25% v/v. A randomized complete block design was employed with four replications. The soil at the site is classified as a Galen fine sandy loam, pH 6.2. Total weed control and prevalence of individual weed species were estimated visually on July 3 and again on August 7. All data were converted to percentiles of total treated area for analysis.

At the July 3 evaluation total weed control effected by dinoseb alone amounted to only 10 percent of total treated area while all other treatments ranged from 74 to 94 percent total control. Analysis of main effects showed that oxyfluorfen provided significantly (P=0.01) better control of both annual grasses and annual broadleaved weeds than did dinoseb. Napropamide, oryzalin, and pendamethalin were comparable in terms of total weed control. Control of annual grasses was statistically better with pendamethalin than with oryzalin (P=0.01) while napropamide did not differ significantly from either pendamethalin or oryzalin. Control of annual broadleaved weeds was better with pendamethalin than with napropamide (P=0.05) while oryzalin did not differ from either pendamethalin or napropamide.

At the August 7 evaluation, only the tank-mixed combinations of oxyfluorfen with napropamide, oryzalin, or pendamethalin provided significant total weed control (71, 70, and 58%, respectively). Pendamethalin provided slightly better (P=0.01) control of annual grasses than did oryzalin, while napropamide did not differ from either of these. Best control of annual broadleaved weeds was provided by tank-mixed combinations of oxyfluorfen with either oryzalin or pendamethalin.

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REDROOT PIGWEED COMPETITION STUDY IN REDUCED TILLAGE POTATOES

R.W. Wallace*, R.R. Bellinder and D.T. Warholic[1]

During the summer of 1986 a study was conducted to evaluate the competitive ability of redroot pigweed (Amaranthus retroflexus L.) in reduced tillage potatoes. Potatoes were planted directly into a chemically-killed rye mulch. Two weeks after potato emergence populations of 0, 11, 22 and 43 plants/m^2 were established and allowed to grow for periods of 2, 4 and 8 weeks. Tubers were harvested from the center two rows of four-row plots measuring 1.8 by 9.1 m. Fresh and dry weights of potato vine sub-samples were taken to supplement tuber yield data.

Pigweed populations of 22 and 43 plants/m^2 significantly reduced yields when allowed to cohabit with potatoes for 10 weeks. Concomitantly, vine dry weights decreased with these densities and exposures. At lesser time periods these higher densities did not significantly reduce yields. Eleven plants did not decrease yields regardless of the cohabitation period nor were potato vine weights adversely affected.

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1964 to 1986 Simazine Treatments on a Weikert-Berks Complex Orchard Soil

Roger S. Young[1/]

ABSTRACT

The experiment initiated 1964 in an apple orchard on a Weikert-Berks soil complex had twenty annual simazine applications at the rates of 4.48 and 8.96 kg ai·ha^{-1}. The orchard floor vegetation made up of 70% grasses and 30 % broadleaf plants had 63 identified weed species. Weed control ratings, when the herbicide was applied in the spring, averaged throughout the experiment 89.3 and 98 for the 4.48 and 8.96 rate of application respectively. Two and a third years following the last herbicide application, the weed control rating was reduced to 7.0 and 50.0 for 4.48 and 8.96 kg·ha^{-1} applications respectively. Three and a third years followin the last application the control ratings had dropped to 0.5 and 5 for the low and high rate of simazine.

INTRODUCTION

Simazine has been an effective herbicide for orchard weed control for many years. Under some soil and environmental conditions and depending upon the rate of simazine applied, it may persist in the soil for some months and some of the simazine metabolites for a number of years(1, 2, 3). The persistence of simazine in a soil is of greater concern with annual crops than with the perennial apple tree except when planting of new trees in the treated area.

MATERIALS AND METHODS

This experiment was initiated in 1964 for the purpose of observing the response of simazine applications under droughty orchard conditions using apple [Malus domestica (Borkh.) 'Golden Delicious'/seedling] planted in 1954. The orchard site selected was in the low rolling foothills and lower mountain slopes of Hampshire County near Augusta, West Virginia in the soil association known as Berks-Weikert. The Weikert-Berks complex is about 45% Weikert shaly silt loam and 40 % Berks channery silt loam. Both of these soil types were formed in acid material weathered from shale, siltstone, and sandstone. The surface layer of about 13 cm (5 inch) is a brown channery (thin, flat fragments as much as 6 inches in length of sandstone, limestone or schist) shaly silt loam with a yellowish-brown, friable very shaly channery type silt loam subsoil extending for 13 to 25 cm (5 to 10 inch) and a substratum of yellowish-brown very shaly silt loam underlain by shale bedrock. Permeability is moderately rapid. Since available water capacity is very low, many small springs develop when rainfall approaches 2.5 cm (1 inch) in a 24-hour period. The soil is also low in natural fertility.

Annual applications of 4.48 and 8.96 kg ai·ha^{-1} of simazine [2-chloro-4,5-bis(ethylamino)- s-trazine] were applied as a square to a 13m^2 area (3.6m on a side) under the tree canopy from 1964 to and including 1983 with the exception of the year 1978 when no herbicide was applied. Applications were made with flat fan nozzles on a boom mounted to a 4-wheel drive Jeep and calibrated to deliver 280 liter·ha^{-1} spray. Ten trees were treated at the low rate and four trees at the higher rate with ten non-herbicide treated trees used for the control. Amitrole (3-amino-s-triazole) at the rate of 2.24 kg·ha^{-1} was applied as a tank mix with simazine from 1964 to 1967 and at 1.12 kg·ha^{-1} from 1968 to 1971. The time of the applications ranged from

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April 12 to May 18. Paraquat (1,1'- dimethyl-4,4'-bipyridinium ion) at the rate of 0.56 $kg \cdot ha^{-1}$ plus an adjuvant was applied as a tank mix with simazine from 1972 to 1983 (except for 1978). The time of these applications ranging from May 18 to June 29. Weed control information was recorded from the entire sprayed area (13m^2) in late September to early October of each year and again at the time of herbicide application in the spring. Weed control (WC) rating is based upon 0 to 100, where 0 is no control (ground area completely covered with live vegetation) and 100 is complete control (no live vegetation).

Previous treatment of the ground cover in the orchard was mowing with the mowed material being raked and placed under the tree canopy giving a light mulch. This mowing and mulching practice was continued through 1968, when the orchard was sold. The vegetation on the orchard floor consisted of 70% grasses and 30% broadleaf plants. Before herbicide treatments were initiated, the following identified plants (63) were found under the canopy of the apple trees and throughout the orchard: orchardgrass (Dactylis glomerata L.) 50%, large crabgrass [Digitaria sanguinalis (L.)Scop.] 7%, purpletop [Tridens flavus (L.) A.S.Hitchc.] 7%, dandelion (Taraxacum officinale Weber in Wiggers) 4%, poison-ivy (Rhus radicans L.) 4%, Virginia pepperweed (Lepidium virginicum L.) 3%, nimblewill (Muhlenbergia schreberi J.F.Gmel.) 3%, smallflower geranium (Geranium pusillum L.) 2%, dovefoot geranium (Geranium molle L.) 1%, smooth crabgrass [Digitaria ischaemum (Schreb. ex Schweig.) Schreb. ex Muhl.] 1%, heath aster (Aster ericoides L.) 1%, Silene spp. 1%, red sorrel (Rumex acetosella L.) 1%, yellow toadflax (Linaria vulgaris Mill.) 1%, shepherdspurse [Capsella bursa-pastoris (L.)Medik.] 1%.

The remaining 14% include: green and yellow foxtails [Setaria virdis (L.)Beauv. and S. glauca (L.)Beauv.], downy brome (Bromus tectorum L.), bluegrasses (Poa spp.), quackgrass [Agropyron repens (L.)Beauv.], broadleaf dock (Rumex obtusifolius L.), curly dock (R. crispus L.), bouncingbet (Saponaria officinalis L.), horsenettle (Solanum carolinense L.), broadleaf plantain (Plantago major L.), buckhorn plantain (P. lanceolata L.), common vetch (Vicia sativa L.), common yarrow (Achillea millefolium L.), black medic (Medicago lupulina L.), asparagus (Asparagus officinalis L.), common ragweed (Ambrosia artemisiifolia L.), common chickweed [Stellaria media (L.) Vill., clammy groundcherry (Physalis heterophylla Nees), trailing blackberry (Rubus spp.), prostrate knotweed (Polygonum aviculare L.), common mallow (Malva neglecta Wallr.), common pokeweed (Phytolacca americana L.), common lambsquarters (Chenopodium album L.), red clover (Trifolium pratense L.), Virginia creeper [Parthenocissus quinquefolia (L.) Planch.], hedge smartweed (Polygonum scandens L.), yellow woodsorrel (Oxalis stricta L.), common speedwell (Veronica officinalis L.), wild garlic (Allium vineale L.), redroot pigweed (Amaranthus retroflexus L.), tumble pigweed (A. albus L.), field pennycress (Thlaspi arvense L.), horseweed [Conyza canadensis (L.) Cronq.], Canada goldenrod (Solidago canadensis L.), common milkweed (Asclepias syriaca L.), hemp dogbane (Apocynum cannabinum L.), field bindweed (Convolvulus arvensis L.), wild carrot (Daucus carota L.), black nightshade (Solanum nigrum L.), chicory (Cichorium intybus L.), spotted spurge (Euphorbia maculata L.), common tansy (Tanacetum vulgare L.), timothy (Phleum pratense L.), meadow campion (Lychnis flos-cuculi L.), catnip (Nepeta cataria L.), fall panicum (Panicum dichotomiflorum Michx.), common burdock [Arctium minus (Hill)Bernh.], Carolina geranium (Geranium carolinianum L.).

Precipitation was recorded on a 24-hour basis at the orchard site during the months of April through September during the years of the experiment (Table 1). The six month mean precipitation (19.98 inch) calculated from the orchard record was near normal of the Weather Bureau Climatological data for Romney, West Virginia. Many of the monthly rainfall amounts appear to have been sufficient for adequate moisture during the month to maintain uniform fruit growth. However, over the 22 year period, 22% of the recorded rainfall periods had precipitation amounts of 1.0 to 5.0 inches. The interval between precipitations of at least 0.25

inch per 24-hour period ranged from zero days to 27 days. The average interval was 7.6 days with a standard deviation of 6 days. With the low water holding capacity of the soil a quantity of water was not retained by the soil, thus, resulting in less fruit and vegetative growth due to insufficient moisture throughout a portion of the month.

Table 1. Monthly precipitation (inch) and total for the six month period with departures from normal (19.98") based upon measurable precipitation of 0.01 inch and greater recorded for each 24-hour precipitation period.

Year	April	May	June	July	August	September	Total(departure)
1964	5.12	0.56	2.39	4.76	2.60	5.25	20.68 (+0.69)
1965	3.04	1.77	2.75	2.58	2.84	1.79	14.77 (-5.21)
1966	4.19	2.18	1.02	1.73	2.19	6.43	17.74 (-2.24)
1967	2.10	4.99	1.44	6.44	3.12	2.29	20.38 (+0.39)
1968	1.09	6.18	2.27	0.88	3.28	2.06	15.76 (-4.22)
1969	1.04	1.45	4.25	6.63	2.44	3.32	19.13 (-0.85)
1970	4.05	1.59	5.75	4.69	2.44	2.62	21.14 (+1.15)
1971	2.33	3.52	4.22	3.14	5.41	4.75	23.37 (+3.38)
1972	1.68	5.20	12.41	3.45	1.70	1.18	25.62 (+5.63)
1973	5.99	3.11	4.26	3.07	6.00	1.55	23.98 (+3.99)
1974	2.31	2.85	6.53	1.50	2.27	2.20	17.66 (-2.32)
1975	2.16	4.37	4.81	2.75	5.91	9.68	29.68 (+9.69)
1976	0.95	2.70	3.74	1.14	4.90	4.50	17.93 (-2.05)
1977	2.75	1.25	1.97	2.29	3.55	0.90	12.71 (-7.27)
1978	1.29	5.71	1.71	7.40	3.35	3.92	23.38 (+3.39)
1979	1.95	4.34	4.56	5.12	2.83	4.57	23.37 (+3.38)
1980	2.07	3.64	3.19	5.33	1.98	3.92	20.13 (+0.14)
1981	2.87	4.19	4.07	3.75	1.28	5.95	22.11 (+2.12)
1982	1.57	1.36	4.85	3.40	0.83	3.82	15.83 (-4.14)
1983	4.40	5.03	3.40	0.55	2.52	1.10	17.00 (-2.98)
1984	5.02	2.15	1.76	4.57	5.07	1.32	19.89 (-0.09)
1985	1.07	5.72	3.14	3.87	3.30	0.26	17.36 (-2.62)
Mean	2.68	3.36	3.84	3.59	3.17	3.34	19.98

RESULTS

The trees treated with 8.96 $kg \cdot ha^{-1}$ of simazine had a 95.0 to 99+ weed control rating throughout the life of the treatment applications and at the time of the May 26, 1983 application and the fall observation on September 26, 1983 the treated area had one bramble plant, one poison-ivy plant, and several dandelion and apple root sprouts for a 95 weed control rating The September observation for the year of no herbicide application (1978) the 8.96 $kg \cdot ha^{-1}$ treated trees had an average rating of 80.0 with the following vegetation present: orchardgrass seedlings 30%, red sorrel 30%, dandelion 20%, and [purpletop, bramble, tumble pigweed, fall panicum, redroot pigweed] 20%. The 95.0 WC rating in the 8.96 $kg \cdot ha^{-1}$ simazine treatment observed on September 26, 1983, following the last herbicide application of May 26, 1983 was reduced to 50.0 as observed in September 1985 (2.34 years after last application) and to 5.0 in September 1986 (3.34 years after the last application). Weeds present at the observation in 1986 were: downy brome 30%, bramble 20%, orchardgrass 15%, yellow woodsorrel 10%, and [dandelion, red sorrel, field pennycress, horsenettle, horseweed, prostrate knotweed, green foxtail, lambsquarters, poison-ivy, buckhorn plantain, ragweed, Canada goldenrod, red clover, common vetch, and meadow campion] 25%.

Weed control in the 4.48 kg/ha^{-1} simazine treatments varied more from year to year than did

the 8.96 kg·ha^{-1} treatment (Table 2). Each year that the 4.48 kg·ha^{-1} simazine was applied under the tree canopy the weed control rating averaged 89.3 with a standard deviation of 4.2. The eight years when amitrole was tank mixed with simazine the rating averaged 89.6 with a standard deviation of 3.9. The twelve years of the paraquat/simazine mixture had an average rating of 89.1 with a standard deviation of 4.6. The two mixtures were equally effective in weed control. For the five years when the mulch was placed under the tree limb spread the average weed control rating was 90.4.

Variation in the vegetation control under the canopy of the herbicide treated trees is difficult to associate with the precipitation patterns or the timing of the application.

Table 2 Weed control ratings for the 4.48 kg·ha^{-1} Simazine treatment as observed in late September-early October period from 1964 through 1986.

Year	WC rating	Year	WC rating	Year	WC rating
1964	87.4	1972	82.7	1979	90.4
1965	88.9	1973	88.1	1980	94.7
1966	92.8	1974	94.5	1981	95.1
1967	95.7	1975	90.3	1982	80.7
1968	87.4[a]	1976	87.3	1983[d]	89.2
1969	84.8	1977	85.8	1984	58.8
1970	86.2	1978[c]	61.4	1985	7.0
1971	93.6[b]	1979	90.6	1986	0.5

a. Last mulch applied
b. Last amitrole application
c. No herbicide applied in 1978.
d. Last year herbicides were applied.

Following the eight years of amitrole + 4.48 kg·ha^{-1} simazine applications, the vegetation population in the treated area (September 1971) consisted of the following: red sorrel 40%, clammy goundcherry 20%, yellow foxtail 10%, tumble pigweed 10%, and [hemp dogbane, purpletop, horsenettle, spotted spurge, orchardgrass, common vetch,, bouncingbet, and Virginia creeper] 20%. The average weed control rating at the 1971 September observations was 93.6.

Following the twelve paraquat and twenty 4.48 kg·ha^{-1} simazine applications, the vegetation, as observed September 26, 1983 (124 days after the last herbicide application), consisted of: red sorrel 30%, yellow toadflax 20%, purpletop 10%, poison-ivy 5%, bramble 5%, dandelion 5%, and [hemp dogbane, nimblewill, spotted spurge, bouncingbet, orchardgrass, chicory, smallflower geranium, and apple sprouts] 25%. The average weed control rating in September 1983 for the paraquat-simazine applications was 89.2.

The average weed control rating under the control (non-herbicided) trees on September 26, 1983 was 8.0 with a standard deviation of 6.3. The slight weed control for the non-herbicided trees is most likely associated with the shading effect as the trees became older. The vegetation under the canopy of the non-herbicided trees included: orchardgrass 40%, downy brome 10%, red sorrel 10%, white campion 5%, heath aster 5%, bramble 5%, ragweed 5%, poison-ivy 5%, smallflower geranium 5%, and [broadleaf dock, dandelion, horsenettle, red clover, hedge smartweed, purpletop, bluegrass, nimblewill, Canada goldenrod, common mallow, garlic, chickweed, Virginia pepperweed] 10%.

The excellent weed control rating resulting during the twenty annual spring applications of 4.48 kg·ha simazine was reduced to a weed control rating of 58.8 to 7.0 and to 0.5 at 1.34, 2.3, and 3.3 years respectively following the last application. The vegetation in the 4.48 kg·ha simazine treated

area at 3.3 years following the last application icluded the following: orchardgrass 17%, purpletop 17%, downy brome 16%, bramble 12%, oison-ivy 10%, yellow toadflax 5%, red sorrel 5%, nimblewill 4%, yellow woodsorrel 2%, red clover 1%, Canada goldenrod 1%, and [smallflower geranium, broadleaf dock, black medic, heath aster, lambsquarters, buckhorn plantain, dandelion, common ragweed, yellow and green foxtail, Virginia creeper, redroot pigweed, meadow campion, bladder campion, hedge bindweed, common vetch, horsenettle, pokeweed, field pennycress, timothy, horseweed, prostrate knotweed, large crabgrass] 10%. The vegetation under the canopy of the non-herbicided trees include: orchardgrass 20%, downy brome 19%, nimblewill 9%, horsenettle 7%, purpletop 6%, poison-ivy 6%, red sorrel 6%, yellow woodsorrel 3%, bramble 2%, dandelion 2%, smallflower geranium 1%, field pennycress 1%, broadleaf dock 1%, lambsquarters 1%, heath aster 1%, yellow toadflax 1%, meadow and bladder campion 1%, and [red clover, common ragweed, hemp dogbane, common vetch, pokeweed, timothy, redroot pigweed, tumble pigweed, horseweed, buckhorn plantain, Canada goldenrod, hedge bindweed, large crabgrass, prostrate knotweed] 13%.

The year, 1978, when no herbicide was applied and observations were made in September for the 4.48kg·ha^{-1} simazine treatments, resulted in a drop from an average weed control rating of 89.3 to 57.2 with a standard deviation of 20.4. The 32.1 rating reduction in effectiveness of weed control resulted in a considerably less than a satisfactory weed control rating going into the winter months which could result in a greater chance for a higher vole population to become more active near the trunks of some of the trees. The vegetation population in the treated area was: fall panicum 15%, Virginia pepperweed 12%, smallflower geranium 10%, red sorrel 10%, purpletop 8%, yellow foxtail 7%, orchardgrass 5%, dandelion 5%, common vetch 3%, [buckhorn plantain, red clover, bramble, prostrate knotweed, redroot pigweed, common chickweed, broadleaf dock, tumble pigweed, hedge smartweed, horsenettle, poison-ivy, yellow toadflax, heath aster, Carolina geranium, catnip] 25%.

The 8.96 kg·ha^{-1} simazine treatment observed in September 1978 had 80% weed control with the following vegetation present: downy brome 35%, red sorrel 20%, dandelion 20%, orchardgrass 10%, and [purpletop, tumble pigweed, redroot pigweed, fall panicum, bramble] 15%.

The non-treated area under the tree canopy had a 0 weed control rating (1978) with the following vegetation present: orchardgrass 40%, lambsquarters 10%, poison-ivy 5%, white campion 5%, red sorrel 5%, horsenettle 5%, heath aster 5%, ragweed 5%, broadleaf dock 3%, yellow toadflax 3%, curly dock 2%, hedge smartweed 2%, and [asparagus, dandelion, bramble, smallflower geranium, common burdock, clammy groundcherry, red clover, Virginia pepperweed, prostrate knotweed, buckhorn plantain, goldenrod, common chickweed, Virginia creeper, common tansy] 10%.

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WEED CONTROL IN LOWBUSH BLUEBERRIES WITH ATRAZINE

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ABSTRACT

Atrazine applied to a commercial lowbush blueberry (Vaccinium angustifolium) field at 4.5 or 9 kg/ha controlled grasses and herbaceous weeds but woody weeds were not adequately controlled at the 18 kg/ha rate. Significant injury to blueberries was observed at 18 kg/ha atrazine but not at the lower rates. The number of blueberry stems and flower buds increased with atrazine application up to 9 kg/ha but decreased at the 18 kg/ha rate. Regression analysis of yield data indicated that 6 kg/ha would maximize blueberry yield. Atrazine in combination with hexazinone did not increase efficacy over hexazinone alone.

INTRODUCTION

Atrazine (6-chloro-N-ethyl-N'-(methylamino)-1,3,5-triazine-2,4-diamine) has been widely used since the 1960's for selective control of broadleaf weeds and grasses in field crops and conifer plantations and at higher rates as a nonselective herbicide in non-crop land (2). Trevett and Durgin (6) indicated that atrazine at 0.6 to 5.6 kg/ha did not adequately control grass and sedge and was not as effective as terbacil (5-chloro-3-(1,1,dimethylethyl)-6-methyl-2,4(1H,3H)-pyrimidinedione) for controlling herbaceous weeds found in established lowbush blueberry stands. However, Jensen (4) in Canada reported that atrazine controls numerous herbaceous weeds at 4 to 12 kg/ha with a positive response in blueberry stand and yield. Atrazine is not registered for use in lowbush blueberry fields in Maine.

Hexazinone (3-cyclohexyl-6- (dimethylamino) -1-methyl-1,3,5-triazine -2,4 (1H,3H-dione)) was registered for use in Maine in 1973 and is effective in controlling many herbaceous and woody weeds in lowbush blueberry fields (4,7). In fields where woody weeds are not a problem, atrazine would provide control of herbaceous weeds and grasses (4).

The objectives of this study were to determine the effectiveness of atrazine for the control of herbaceous and woody weeds common to lowbush blueberry fields and determine injury to or any influence on growth and yield of lowbush blueberries.

MATERIALS AND METHODS

Experiment I

Atrazine was applied preemergent, after pruning by fire, to a commercial lowbush blueberry field in Aurora, ME at 0, 4.5, 9.0, or 18.0 kg/ha ai in 189 L/ha water at 276 kPa pressure on 12 May 1982. Plot size was 3 by 30 m. Experimental design was a randomized complete block (RCB) with 8 replications of 4 treatments. Ratings of blueberry injury and phytotoxicity to weeds were made on 16 July 1982 using a 0 to 10 scale, where 0 = alive and 10 = dead. In the fall of 1982, blueberry stems were cut to the ground level from two

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0.1m^2 quadrats per plot. Stems were counted, and the number of flower buds per stem was recorded. Yield data were obtained by raking plots with hand held rakes in August 1983. Data were analyzed by analysis of variance using orthogonal contrasts to determine trends and an F test at a single degree of freedom was used to determine significance (5).

Experiment II

Hexazinone at 0, 1.1, or 2.2 kg/ha in combination with atrazine at 0, 5 or 10 kg/ha were applied preemergent, after pruning by fire in Cooper, ME on May 1983. Experimental design was an RCB with 9 treatments replicated 8 times. Plot size was 3 by 15 m. Weed control, injury ratings and blueberry stem samples were evaluated as in Experiment I. Yield estimates were obtained by hand harvesting 4 replicates in August 1984. Data were analyzed as in Experiment I.

RESULTS AND DISCUSSION

Experiment I

Increasing the rate of atrazine from 0 to 18 kg/ha decreased all weed species rated except rose (*Rosa virginiana*) (Table 1). Grasses, cinquefoil (*Potentilla simplex*), and goldenrods (*Solidago* spp.) were suppressed at 4.5 kg/ha and completely controlled at 18 kg/ha atrazine. Of the woody species rated, meadowsweet (*Spiraea latifolia*) was suppressed the most followed by aspen (*Populus tremuloides*) and sweetfern (*Comptonia peregrina*) (Table 1).

Table 1. Percentage of weeds controlled by atrazine - Aurora 1982.

Atrazine Rate kg/ha	Grass (%)	Goldenrod (%)	Cinquefoil (%)	Meadowsweet (%)	Rose (%)	Sweetfern (%)	Aspen (%)
0	0	0	0	0	0	0	0
4.5	9	86	76	43	0	1	28
9	93	81	86	59	8	9	63
18	100	100	100	94	18	56	75
F test Sig.	**	**	**	*	NS	**	**
Trend	Q	Q	Q	Q		L	L

L = Linear, Q = Quadratic, NS = Non Significant, * = 5 % level, ** = 1 % level

Necrosis and chlorosis of the blueberry leaves and stems on the treated sites was noted early in the season as blueberry stems were emerging. Injury ratings were converted to percent for discussion purposes. Ratings taken in July were less than 10 % for 4.5 and 9.0 kg/ha atrazine, but increased to 40 % at the 18 kg/ha rate (Table 2). Total number of blueberry stems, total flower buds (Table 2) and yield (Figure 1) exhibited a quadratic response to

increasing rates of atrazine. Stem numbers per $0.1m^2$ increased from 50 on the untreated area to 70 and 71 at the 4.5 and 9.0 kg/ha atrazine rates, but declined to 55 at the 18 kg/ha rate. The number of laterals per $0.1m^2$ increased in a linear manner from 24 without atrazine to 77 at the 18 kg/ha rate. Although the number of flower buds per stem did not increase with an increase in atrazine rate, total flower buds per $0.1m^2$ increased from 63 without treatment to 88 and 91 at 4.5 and 9.0 kg/ha atrazine but declined to 65 at 18 kg/ha (Table 2).

Table 2. Effect of atrazine on blueberry - Aurora 1982.

Atrazine Rate kg/ha	Injury (%)	Stems/ $0.1m^2$	Laterals/ $0.1m^2$	Flower buds/ Stem	Flower buds/ $0.1m^2$	Yield kg/ha
0	0	50	24	1.3	63	1423
4.5	0	70	32	1.4	88	1950
9	0	71	48	1.4	91	1840
18	40	55	77	1.4	65	1286
F test						
Sig.	**	**	**	**	NS	**
Trend	L	Q	L	Q		Q

L = Linear, Q = Quadratic, NS = Non Significant, ** = 1 % level

Jensen (4) reported that the number of buds per shoot, percentage of branched stems and number of shoots per plot increased with atrazine applications. He indicated that yield increases were related to increases in the number of flower buds per shoot as well as increases in the number of fruiting shoots. The increase in yields for this study are attributed to the increase in the number of stems which produced a greater number of flower buds per unit area, thus resulting in a greater overall yield for the treated plots. The mean yield was largest (1950 kg/ha) with an application of 4.5 kg/ha atrazine. However, regression analysis indicated the yield would be maximized at 1990 kg/ha with 6 kg/ha atrazine (Figure 1). The decline in yield above the 6 kg/ha rate is attributed to injury to the blueberry plant stand caused by the high rate of the herbicide.

Experiment II

Atrazine alone controlled grasses and goldenrod and suppressed meadowsweet in the year of application (Table 3). Hexazinone controlled both herbaceous and woody weeds and the addition of atrazine did not increase efficacy. No significant injury to blueberries was observed for either herbicide.

Total numbers of buds (PR>F=0.11) and yield (PR>F=0.08) were not significantly different for the treatments, but lack of significance is attributed to poor plant stand and variable plant cover (Table 3).

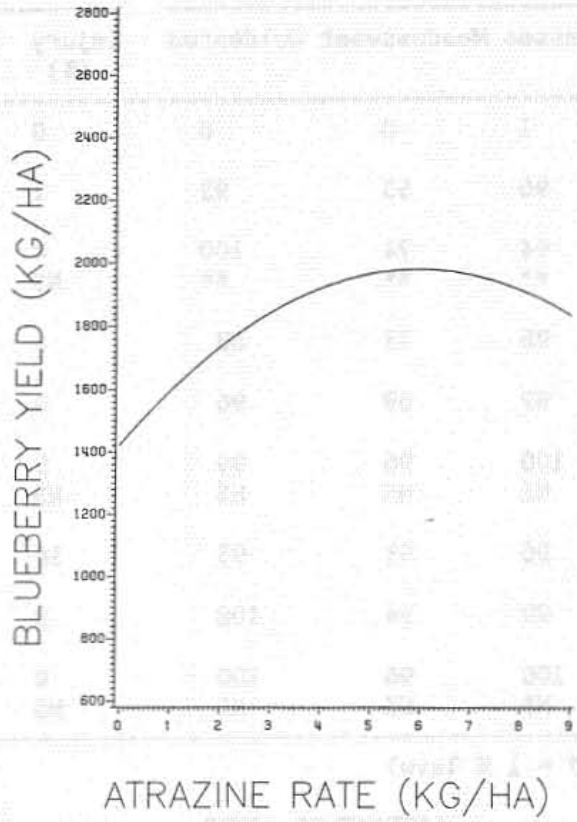

Figure 1. Effect of atrazine on blueberry yield
Quadratic response significant at the 1 percent level

Most agricultural crops require from 2 to 4 kg/ha atrazine for selective weed control (2). Higher rates of atrazine are needed in lowbush blueberry fields because of the acidic nature of the soil (pH of 5.0 on the test site), the high organic matter (OM = 12 % on test site) and the types of weed species occuring in lowbush blueberry fields. Atrazine has been shown to be less effective on acid sites (3). It has a half life of over 7 months at a pH of 7 but its half life is reduced to 42 days at a pH of 5 (1). However, the higher organic matter, cool temperatures, and sandy soils found in Maine's blueberry fields should tend to slow this degradation (1) and thereby may provide more residual control than is obtained by hexazinone.

Atrazine rates up to 9 kg/ha were effective in controling grasses and several herbaceous weeds with beneficial effects to blueberry growth and productivity. However, atrazine is not as effective as hexazinone in controlling the woody weeds found in lowbush blueberry fields. In fields where grasses and herbaceous weeds are the primary weed problems, atrazine could offer an effective complement to hexazinone in a herbicide rotation.

Table 3. Effect of atrazine and hexazinone on weeds and on blueberries
Crawford 1983

Rate (kg/ha)		Percent control			Blueberry			
Hexazinone	Atrazine	Grasses	Meadowsweet	Goldenrod	Injury (%)	Stems ($0.1m^2$)	Buds ($0.1m^2$)	Yield kg/ha
0	0	1	0	0	0	40	78	621
0	5	96	53	93	1	41	118	1614
0	10	94	74	100	4	35	124	1532
Significance		**	**	**	NS	NS	NS	NS
1.1	0	96	73	83	6	35	93	1976
1.1	5	99	89	96	9	41	118	1905
1.1	10	100	96	99	5	28	86	1297
Significance		NS	NS	NS	NS	NS	NS	NS
2.2	0	96	93	93	18	36	109	1470
2.2	5	99	94	100	9	46	164	1557
2.2	10	100	96	100	9	39	132	1352
Significance		NS	NS	NS	NS	NS	NS	NS

NS = Non Significant, ** = 1 % level

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METHODS FOR BASAL BARK, CUT-SURFACE, AND SOIL HERBICIDE APPLICATIONS

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ABSTRACT

Numerous techniques are available for application of industrial and forestry herbicides as basal bark, cut-surface, and soil treatments. Unfortunately, the terms used to describe these techniques often are used interchangeably and incorrectly. This can result in verbal and written miscommunication. In order to clarify these terms, definitions and descriptions of these application techniques are presented. When preparing herbicide-oil mixes for basal bark treatments, oils suitable for use as diluents include diesel oil, fuel oil, and kerosene. Other oils may also be used as recommended by their manufacturer.

Streamline: Application of 20 to 30 percent herbicide mixed with oil to 1 or 2 sides of woody stems at ground level or the line dividing juvenile from mature bark. This technique can be used during the dormant or the growing season to control or suppress unwanted hardwoods less than four inches in diameter for release of young conifers.

Thinline: Application of herbicide in an even pencil-thin stream to all sides of the stems about six inches above ground line. The treated area will expand to about a two inch width and, except for smooth-barked plants, little run-down will occur. This technique can be used during the dormant or the growing season to control woody plants with stems less than six inches in diameter.

Low-volume banding: Application of 35 to 50 percent herbicide in an oil diluent to all sides of the woody stems in a 3 to 4 inch wide band at any height up to three feet above ground line. The treated area will expand to about a six inch width and, except for smooth-barked plants, little run-down will occur. This technique can be used during the dormant or the growing season to control woody plants with stems less than six inches in diameter.

Low-volume basal: Application of 20 to 30 percent herbicide in an oil diluent to all sides of the lower 12 to 15 inches of stems, including the root collar. Apply in a manner which adequately wets the stem, but not to the point of runoff. This technique can be used during the dormant or the growing season to control woody plants with stems less than six inches in diameter.

Conventional basal: Application of 1 to 3 percent herbicide in oil to all sides of the lower 12 to 15 inches of stems, including the root collar. Thorough wetting of the indicated area and spraying to the point of runoff is necessary. This technique can be used during the dormant or the growing season to control woody plants with stems less than six inches in diameter.

Cut surface: Application of herbicide to freshly cut surfaces which may be stumps, frills or girdles, or injection wounds. The objective is to apply herbicide to the cambium area of the target plant and not to the point of runoff. This technique can be used during the dormant or the growing season to control woody plants of all diameters.

Cut stubble: Broadcast application of herbicide mixed in water to cut stumps and exposed ground following mowing operations. Several ground spray methods can be utilized to evenly distribute the herbicide mixture over the treated area. This application technique can be used year-round, except when the ground is frozen or completely saturated with water, to control woody plants of all diameters.

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LOW-VOLUME BASAL APPLICATION OF PICLORAM AND TRICLOPYR

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ABSTRACT

Numerous herbicide treatment methods are available to control brush in utility rights-of-way. These include aerial, ground foliar, soil and basal applications. Basal herbicide applications provide a means for selectively removing undesirable woody vegetation without affecting desirable woody and herbaceous species.

Conventional basal application involves treating the lower 12 to 15 inches of a woody stem with 1 to 3 percent herbicide mixed in diesel oil, fuel oil, or kerosene. Thorough wetting of the indicated bark and spraying to the point of runoff are necessary. Since 1980, triclopyr ester has effectively controlled numerous woody plant species when applied at 4 to 8 lb ae/100 gallons of spray mix. Recently, a product combining the ester forms of triclopyr and picloram also has been very effective when applied using the conventional basal technique.

A new technique, low-volume basal, is gaining acceptance as an alternative to conventional basal application. Low-volume basal treatment involves application of 20 to 30 percent herbicide concentration in diesel oil, fuel oil, kerosene, or other basal bark diluent to all sides of the lower 12 to 15 inches of stems, including the root collar. The mixture should be applied in a manner which adequately wets the indicated area, but not to the point of runoff. Low-volume basal application, when compared to conventional basal application, requires less total spray volume per stem which results in savings of time and material.

Dormant and growing season trials were established in 1984 in Connecticut, Delaware, Maine, Maryland, Pennsylvania and West Virginia to determine the efficacy of several herbicide concentrations and diluents using the low-volume basal technique. All treatments were applied with a backpack sprayer equipped with a low-volume wand and adjustable solid cone nozzle. Herbicides tested were triclopyr ester (4 lb ae/gallon) and a product combining picloram ester (1 lb ae/gallon) and triclopyr ester (2 lb ae/gallon). Major species treated included black birch (*Betula lenta* L.), gray birch (*Betula populifolia* Marsh.), white birch (*Betula papyrifera* Marsh.), black cherry (*Prunus serotina* Ehrh.), choke cherry (*Prunus virginiana* L.), red maple (*Acer rubrum* L.), red oak (*Quercus rubra* L.), aspen (*Populus* sp. Michx.), sassafras (*Sassafras albidum* Trew.), white oak (*Quercus alba* L.), and black locust (*Robinia pseudoacacia* L.).

Second year results are presented in Table 1. Each treatment provided at least 85 percent control of most species. The picloram/triclopyr combination slightly improved control when compared to triclopyr alone. Black locust was the only species which demonstrated any resprouting following herbicide application. These results are comparable to those obtained with conventional basal applications and demonstrate that low-volume basal application is a viable tool for controlling undesirable woody plants.

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TABLE 1 - MEAN CONTROL OF VARIOUS TREE SPECIES FOLLOWING LOW-VOLUME BASAL APPLICATION. RESULTS FROM SIX SITES (CT, DE, ME, MD, PA, WV). DORMANT AND GROWING SEASON TREATMENTS ARE COMBINED.

	PERCENT DEFOLIATION TWO YEARS AFTER TREATMENT										
HERBICIDE TREATMENT	BLACK BIRCH	GRAY BIRCH	WHITE BIRCH	BLACK CHERRY	CHOKE CHERRY	RED MAPLE	RED OAK	ASPEN	SASSAFRAS	WHITE OAK	BLACK LOCUST
Picloram/Triclopyr + Arborchem* (33:67)[a]	--	--	--	88 (5)[b]	--	98 (22)	94 (7)	--	100 (6)	--	100/5[c] (14)
Picloram/Triclopyr + Arborchem (25:75)	--	99 (25)	--	100 (13)	100 (4)	99 (97)	100 (34)	100 (28)	99 (37)	100 (3)	100/2 (20)
Picloram/Triclopyr + Arborchem (20:80)	--	--	--	90 (21)	--	100 (16)	98 (6)	--	100 (17)	--	--
Picloram/Triclopyr + Arborchem (15:85)	100 (14)	--	--	100 (9)	--	100 (9)	100 (10)	--	100 (6)	100 (5)	100/1 (11)
Picloram/Triclopyr + Kerosene (25:75)	--	93 (13)	--	100 (10)	--	100 (10)	100 (10)	--	--	100 (3)	100/5 (10)
Triclopyr + Arborchem (33:67)	--	--	--	75 (21)	--	100 (3)	100 (2)	--	95 (2)	--	--
Triclopyr + Arborchem (25:75)	99 (44)	--	92 (25)	97 (36)	100 (13)	99 (60)	100 (45)	100 (15)	98 (111)	100 (5)	100/4 (21)
Triclopyr + Arborchem (20:80)	--	--	--	78 (20)	100 (3)	100 (11)	80 (4)	--	100 (2)	--	--
Triclopyr + Kerosene (33:67)	--	--	--	94 (10)	--	100 (11)	100 (12)	--	80 (3)	--	--
Triclopyr + Kerosene (25:75)	100 (11)	91 (22)	98 (43)	87 (36)	89 (48)	99 (67)	81 (129)	96 (17)	96 (66)	--	--
Triclopyr + Kerosene (20:80)	--	100 (18)	92 (17)	90 (21)	87 (7)	100 (25)	90 (10)	100 (90)	100 (11)	--	--

-- = not tested
a; V/V ratio of herbicide formulation and diluent
b; number in ( ) represents number of treated stems
c; numerator = percent defoliation/denominator = number of treated stems which sprouted
* Arborchem = Arborchem Basal Oil, manufactured by Arborchem Products Company.

PICLORAM AND TRICLOPYR INJECTION - RESULTS AND FOLLOWUP

Lawrence W. Jackson[1/]

ABSTRACT

An upland northern hardwood site in Albany County, New York established (1981) was subdivided in four plots with picloram 4 amino-3,5,6,-trichloropicolinic acid) and triclopyr (e.5,6-trichloro-2-pyridinyloxy acetic acid) amine and ester mixed injected by Hypohatchet into tall-growing trees. Trees died over a two-year period with only white ash (Fraxinus americana L.) and beech (Fagus grandifolia), in the mixes with triclopyr predominant, succumbing the first year. Other species killed were sugar maple (Acer saccharum Marsh.), hemlock (Tsuga canadensis L.) and white pine (Pinus strobus L.). Post-leaf emergent applications (June) were more effective than pre-leaf applications (April). Both pre-leaf applications involved esters while both post-leaf applications employed amines, however, past experience indicates time of application rather than formulation affected these results.

Understudy response varied only slightly within and between plant subgroups on all plots. Delayed kill and removal of overstory on plot 4 may have allowed goldenrods (Solidago sp.) and (Rubus sp.) to suppress tree growth, at least temporarily.

INTRODUCTION

Stem injection of chemicals to control undesirable trees has been an accepted practice in timber stand improvement for many years (Brinkman, 1970; Voeller and Holt, 1973; Holt, 1975 and Ferguson and Lawson, 1975). Following the ban on 2,4,5-triclorophenoxyacetic acid for forest and right-of-way use in 1978, Geyer and Chandler (1979) found triclopyr (3,5,6-trichloro-2-pyridinyloxyacetic acid) and picloram (4-amino-3,5,6-trichloro-picolinic acid) most effective when used in combination during the growing season. Furthermore, Warren (1980) found triclopyr (amine) effective in controlling hardwoods for conifer release.

Objectives of this study were to determine: 1) if effectiveness of kill varied, pre and post-leaf emergence for triclopyr and picloram injected in differing ratios in water; 2) understory response following treatment and 3) management implications of stem injecting triclopyr and picloram in combination.

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PROCEDURES AND METHODS

The selected site contained four adjacent plots (each 50'x50') on a northwest slope (1970' elevation). Rainfall (35" to 40" annually) and silty clay soil with 2' to 3' depth to shale bedrock characterize this northern hardwood site. Grazing occurred from mid 1800's to about 1940. Trees range from 15' to 40' high and up to 35 years of age.

A Hypohatchet was used to inject a 50-to-50 mix of chemical and water as follows:

Plot #	Date of Application	Formulation	Mix Ratio of Ingredients	Total Chemical Used (oz.)	No. Stems Injected	Actual Application Time (Minutes)
1	4/24/81	Water	1/2			
		Picloram	1/8	12.5	117	24
		Triclopyr ester	3/8			
2	6/18/81	Water	1/2			
		Picloram	1/8	11.0	78	21
		Triclopyr amine	3/8			
3	6/18/61	Water	1/2			
		Picloram	3/8	9.0	106	25
		Triclopyr ester	1/8			
4	4/24/81	Water	1/2			
		Picloram	3/8	11.5	99	23
		Triclopyr ester	1/8			
Total				44.0	400	93

RESULTS

Effectiveness of treatment and vegetation response are presented separately as follows:

Effectiveness

After two years (1983) effects were:

Table 1. Treatment Effectiveness

Plot #	Treatment	No. stems Treated	% Stems/ Complete Top Kill	% Stems Killed[1/]
1	Pre-leaf emergence	117	62	62
2	Post-leaf emergence	78	91	91
3	Post-leaf emergence	106	92	92
4	Pre-leaf emergence	99	36	28

1/ Determined by incision and cambium examination.

Since all stems were cut for firewood in early 1984 no subsequent data was available. A comparison of the treatment results (Table 1) reveals that both post-leaf emergent treatments were highly effective (over 90% stem kill). The remaining stems evinced partial kill with the likelihood that some of those stems would likewise eventually die. Post-leaf treatment results were significantly different at the 95% confidence level (Chi square) from both pre-leaf treatments. While both post-leaf treatments employed the triclopyr amine and the pre-leaf treatments involved an ester, previous studies (Jackson, 1986 a and b) indicate results are not likely to be significantly different given comparable sites, age classes, and species composition.

Plot 4 results, where stem kill was significantly less than the top kill, are indicative of what happens where treatment results are marginal. Furthermore, in this study, up to 20 % of the injected trees died in the second year following treatment.

50-66 percent of the conifers were killed, all in plot 3. Sugar maple, the predominant species on all plots, which has been shown to be more effectively killed by picloram than triclopyr (Jackson, 1986 a and b) was equally effective on plots 2 and 3 even though the ratios of the two chemicals were reversed.

Vegetation Response

Response is summarized by year and plant group component as follows:

Table 2. Understory Response

Vegetation Composition by Year
(% Total Ground Area)

Plant Group	Plot and Year											
	Plot 1						Plot 2					
	81	82	83	84	85	86	81	82	83	84	85	86
Bare	100	92	80	25	5	1	100	80	70	30	10	5
Fern & Moss	0	0	1	1	1	1	0	0	1	1	1	1
Grass & Sedge	0	5	11	42	35	28	0	2	5	8	10	3
Forbs	0	1	5	27	42	42	0	3	5	18	25	19
Shrubs	0	0	0	1	10	20	0	0	5	18	26	37
Trees	0	2	3	4	7	8	0	15	14	25	28	35
Total	100	100	100	100	100	100	100	100	100	100	100	100
	Plot 3						Plot 4					
	81	82	83	84	85	86	81	82	83	84	85	86
Bare	100	85	65	30	10	5	100	97	97	45	5	1
Fern & Moss	0	0	3	1	<1	1	0	0	0	0	1	1
Grass & Sedge	0	3	10	29	23	23	0	1	1	8	13	8
Forbs	0	1	7	10	33	29	0	<1	<1	30	55	55
Shrubs	0	0	0	<1	4	9	0	0	1	12	20	32
Trees	0	11	15	30	30	33	0	2	1	5	6	3
Total	100	100	100	100	100	100	100	100	100	100	100	100

Vegetation response to release was generally comparable on all four plots. Trees and shrubs increased gradually over five years (except plot 4), but the shrub increase didn't begin until the third year and the major shrub component was Rubus sp. Forbs increased dramatically in the third year but declined gradually thereafter. Ferns and mosses maintained a low percentage of ground cover over the study (1-3%) as total ground cover increased from 0 in 1981 to 95-99% in 1986. Application times/plot ranged from 21 to 25 minutes and averaged 4.3 minutes/tree.

DISCUSSION AND CONCLUSIONS

After injecting picloram and triclopyr in all seasons (this study and Jackson, 1986 a and b), there is no question that with water as a carrier, the best time to inject is post-leaf emergence after hardening. The amine and ester of triclopyr are equally effective used in combination with picloram and rates as low as 2-3 oz. of picloram or triclopyr (in combination) with 9-12 oz. of water killed sugar maple, white ash, beech, white pine and hemlock. Evidence for sugar maple is conclusive but, due to small samples, the remaining species should be included in replicate applications.

While ground cover response after treatment was generally consistent, some variations are noteworthy. On plots 2 and 3 tree seeding and sprout response was more than double the response on plots 1 and 4. Since most trees were killed the first year on plots 2 and 3, both seedlings and saplings may have become established earlier on the exposed mineral soil. Interestingly, forb ground cover in the 3-5 years after treatment was less than on plots 1 and 4 suggesting that trees were successfully competing with forbs in those years. Also there was more bare ground on plots 2 and 3 (5% vs 17% on plots 1 and 4) in 1986 with trees filling open niches more rapidly in years 2-3 post-treatment.

Plot 4 is of interest not only because treatment effectiveness was so poor, but the fact that tree envasion was slower than other plots and % tree cover even dropped in 1986. Forbes, particularly goldenrods and Rubus sp. have dominated the plot for three years and are apparently suppressing tree growth. Other factors such as more available sunlight and moisture (Plot 4 is down slope in the northwest quadrat of the site) may have encouraged forbs. Future confirmation of this phenomena is planned.

MANAGEMENT IMPLICATIONS

This study confirms indications from earlier studies (literature cited) that injection is a viable technique in localized sensitive situations. Application time and cost in such areas are not limiting factors. Water is an effective carrier of chemicals if used in the summertime and applied according to standard injection techniques. Sugar maple is effectively controlled (90%+ kill) through use of picloram alone or in combination. Where several species are involved, a combination of herbicides will undoubtedly produce better overall results. While

picloram and triclopyr in combination killed some white pine and hemlock, control was not effective (55-66%) and is not recommended since conifers are easily cut and do not sprout.

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Multiflora Rose Control with Metsulfuron

Jeffrey F. Derr[1]

ABSTRACT

Experiments were conducted to evaluate the control of multiflora rose (Rosa multiflora Thunb. ex Murr.) with foliar and spot gun applications of metsulfuron. Spot gun applications were made in April of 1986. Four and 8 ml of a 1/8 ounce per gallon metsulfuron solution and a 4 ml application of a 1/4 ounce per gallon solution per five foot of rose canopy diameter provided inadequate (< 70%) multiflora rose control. Eight ml of a 1/4 ounce per gallon solution and 4 ml of a 1/2 ounce per gallon solution resulted in 80-89% rose control. Metsulfuron at 8 ml of a 1/2 ounce per gallon solution resulted in essentially complete rose kill as did an 8 ml application of a 25 ounce per gallon tebuthiuron solution. Foliar applications of 0.021 (1/3 ounce) and 0.063 (1 ounce) lb per acre metsulfuron resulted in essentially complete rose control when applied in May of 1986. An application of 2,4-D at 2.0 lb/acre plus 1.0 lb/acre dicamba also resulted in complete rose kill. Foliar and spot gun treatments of metsulfuron were also made in August of 1986. Damage to multiflora rose was evident, especially with foliar applications. The onset of leaf fall prevented further evaluations. Treatments will be evaluated in 1987 to determine the long-term effectiveness of 1986 applications.

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ABSTRACT

A Precision Sprayer for Highway, Forestry and Industrial Weed and Brush Control

After just one year of commercial availability, the RADIARC[1] Sprayer has found it's place in a variety of industrial applications. It has been successfully used in broadcast vegetation control programs, ranging from selective weeding on golf courses to brush control along highways and railroad rights-of-way. Components of the RADIARC include a 12 Volt motor, a cam and two parallel spray discs each holding eleven small brass tips which come in a variety of sizes. The 12 Volt, 5 amp motor operates the cam to rapidly oscillate the spray discs approximately one-half inch.

Each spray tip produces a solid, straight stream of solution. When the discs oscillate, these streams break into uniformly sized droplets. Droplet dimensions are determined by the size of the spray tip used. Tips are available in sizes ranging from 0.03 inches up to 0.101 inches. The larger the tips used, the higher the standard spray volume produced.

By producing relatively large droplets, with low spray pressures (typically 40 PSI or less), the RADIARC has resulted in excellent mechanical drift control abilities. Without the mists or fines produced by more common spray devices, the RADIARC's spray swath remains even, without any rough edges or skips.

The sprayer's versatility and ease of mounting have increased it's utilization. All that's needed to put the sprayer into operation is an ON/OFF control box, with rheostat to control the speed of disc oscillation, and a solenoid valve to prevent dripping after the sprayer is switched off. Simply clamp the sprayer to the truck or tractor, make a few simple electrical connections and attach the sprayer feed line. Mountings of the RADIARC system have been completed in as little as one hour.

One benefit of the sprayer's low-volume application is improved production. With less total volume being applied per acre, there is a reduction in the amount of time spent by crews refilling the spray tank and mixing chemicals. One way to aid sprayer efficiency is the use of industrial or agricultural sprayer controls and chemical injection systems.

The newest of these sprayer controls available to industrial users is the RAVEN[2]. With the ability to use three preset, plus manual volume control, only the amount of spray volume needed is used on varying brush densities. The chemical injection system can be added to reduce over application on light brush and weeds, or under spraying of high densities.

[1] RADIARC, a registered trademark of Waldrum Specialties, Inc., Ambler, Pennsylvania.

[2] RAVEN, a registered trademark of Raven Industries, Inc., Sioux Falls, South Dakota.

Highway weed and brush control programs are the largest user of the RADIARC to date. However, as more managers and applicators realize the benefits gained when using the sprayer, it is sure to become more utilized. With this increased use will come improved sprayer configuration and more diverse field applications, making the RADIARC Sprayer standard equipment for many industrial brush and weed control applicators.

AC 263,222 - A NEW HERBICIDE FOR INDUSTRIAL WEED CONTROL

T. Malefyt*, E. M. Lignowski, and M. Los[1/]

ABSTRACT

AC 263,222, [2-(isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-5-methyl nicotinic acid], is a new broad-spectrum herbicide with low mammalian toxicity that is being developed as an industrial herbicide by American Cyanamid Company. Extensive field testing has shown that AC 263,222 controls a wide spectrum of grasses, sedges, and broadleaf weeds under a variety of environmental conditions and soil types. This compound has its greatest activity when applied preemergence or early postemergence to weeds at rates ranging from 0.28 to 1.2 kg/ha. AC 263,222 has excellent soil residual activity for 6-18 months depending upon rate and local environmental conditions. Field results indicate excellent activity on many important perennial species such as field bindweed (*Convolvulus arvensis* L.), johnsongrass (*Sorghum halepense* (L.) Pers.), trumpetcreeper (*Campsis radicans* (L.) Seem. ex Bureau), and yellow nutsedge (*Cyperus esculentus* L.). AC 263,222 is being tested for total vegetation control on railroad tracks and other industrial situations. In addition, preliminary results have shown potential for AC 263,222 in release of certain perennial grasses along roadsides and utility rights-of-way.

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HERBICIDES FOR CONTROL OF ORIENTAL BITTERSWEET

John F. Ahrens [1/]

ABSTRACT

Control of Oriental bittersweet (Celastrus orbiculatus Thunb.) and associated woody species was evaluated following foliar sprays in September of glyphosate, triclopyr, imazapyr and sulfometuron. The spray volume was 1057 L/ha (113 gal/A) which was sufficient to thoroughly wet the leaves of all plants. A year after treatment triclopyr butoxyethyl ester at 2.53 kg ae/ha and imazapyr at 1.27 kg/ha gave essentially complete control of Oriental bittersweet. Glyphosate isopropylamine salt gave approximately 90% control at 10.12 kg ai/ha and 73% control at 2.53 or 5.06 kg ai/ha. Sulfometuron at 0.21 or 0.42 kg ai/ha gave poor control of Oriental bittersweet. All treatments gave excellent control of brambles (Rubus spp.) and fair to excellent control of several other woody species.

INTRODUCTION

Oriental bittersweet, an escaped ornamental vine, has become a serious pest along roadsides and woodlands in Connecticut. Its climbing and root suckering habits and rapid growth enable it to overtop and literally strangle desirable trees and shrubs on woods edges, abandoned fields, and cutover forests. It often forms impenetrable thickets that impede access and forest seedling regeneration. Dreyer [2/] and Peters [3/] have reported effective control of Oriental bittersweet with foliar sprays of glyphosate [N-(phosphonomethyl) glycine] and triclopyr [(3,5,6-tricloro-2-pyridinyl)oxy]acetic acid], but none of the commonly used brush control herbicides is labeled for its control. Late season applications of herbicides, when effective, are advantageous in populated areas such as Connecticut because herbicidal effects are rarely noticed when they immediately precede autumn coloration and leaf fall. The purpose of this work, therefore, was to evaluate late season sprays of glyphosate, triclopyr and two newer woody plant herbicides for the control of Oriental bittersweet.

MATERIALS AND METHODS

A fairly uniform, low growing (1-2 m) infestation of Oriental bittersweet was located in a recently harvested red pine stand in Litchfield, Connecticut. The soil was a sandy loam with 10% organic matter. Fourteen herbicide treatments and an untreated control were assigned at random to 60 plots each 3.3 by 3.3 meters separated by 1.5 meter borders. The herbicides were applied with a hand-held single nozzle boom and knapsack sprayer, delivering 0.98 liters of solution on each plot, equivalent to 1057 L/ha (113 gal/A). This volume was sufficient

1/ Plant Physiologist, The Connecticut Agricultural Experiment Station, Valley Laboratory, Windsor 06095.

2/ Dreyer, G. 1986. Ecology and control of Oriental bittersweet. Connecticut Arboretum, New London, CT 06320.

3/ Peters, R.A. 1985. Personal Communication.

to thoroughly wet the foliage and any exposed soil in the plots. The treatments included varying dosages of glyphosate, triclopyr, imazapyr (2[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2yl]-3-pyridine carboxylic acid), sulfometuron (2-[[[[(4,6-dimethyl-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl] benzoic acid), and combinations of glyphosate with triclopyr, imazapyr and sulfometuron (Table 1). All treatments contained 0.5% v/v X-77 surfactant.

The treatments were applied on September 17 and 18, 1985, about 1 month before the first killing frost. The first rainfall (1.3 cm) occurred on September 24, 1985 and 8.6 cm of rain fell in the month following treatment.

Other woody plants occurring frequently in the plots included brambles (Rubus spp.), Virginia creeper (Parthenocissus quinquefolia (L.)Planch.), poison ivy (Rhus radicans L.), tatarian honeysuckle (Lonicera tatarica L.) and barberry (Berberis spp.). The prevalence of bittersweet and the other species in each plot was evaluated at treatment. Control of each species was rated on October 10, 1985, June 3, 1986 and September 10, 1986, on a scale of 0 to 10, with 0 as no control and 10 as 100% control.

RESULTS AND DISCUSSION

Ratings of control of Oriental bittersweet and other species are given in Table 2. Ratings of brambles, Virginia creeper and poison ivy are given when at least two of the four treated plots had significant infestations at the time of treatment. In some plots these species grew beneath the larger canopy of bittersweet at treatment which may have contributed to inconsistent results.

Triclopyr and imazapyr, at the lowest rates tested, both gave excellent control of bittersweet and other woody plants including tatarian honeysuckle and barberry when they occurred in treated plots. With triclopyr about 70% foliar kill of bittersweet and other woody plants was observed one month after treatment, whereas with the other herbicides very little injury was observed until the following spring. Both triclopyr and imazapyr appeared to have killed most of the treated bittersweet a year after treatment, but some regrowth from seed occurred in triclopyr plots.

Glyphosate at the highest rate (2.53 kg ai/ha or 2% v/v of product) gave about 80% control of bittersweet a year after treatment, with regrowth from seed evident in the plots. Most bittersweet vines treated with glyphosate had small strap-shaped leaves and greatly suppressed growth but they remained alive a year after treatment. Glyphosate at all rates gave 90% or better control of brambles, Virginia creeper, poison ivy and tatarian honeysuckle a year after treatment.

Sulfometuron at 0.21 kg ai/ha (4 or 8 oz product/A) gave fair control of bittersweet the following June, but poor control in September. However, sulfometuron gave fair to excellent control of the other woody species including tatarian honeysuckle and barberry.

The glyphosate combinations with sulfometuron gave better control of bittersweet than sulfometuron alone, but not better than glyphosate alone. There seems little advantage to combining glyphosate with triclopyr or imazapyr because triclopyr and imazapyr alone were highly effective.

Evaluations of percentage ground cover a year after treatment showed that plots treated with glyphosate at all rates and the two lower rates of triclopyr had 70% to 80% cover of many weeds. American burnweed (Erechtites hieraciifolia

(L.)Raf.ex DC.) and various ferns were common in the triclopyr plots. With triclopyr at 10.11 kg ae/ha the ground cover was sparse (26%) with common speedwell (Veronica officinalis L.) and ferns often present. Imazapyr plots had 36% cover at 1.27 kg/ha and 13% cover at 2.53 kg/ha with American burnweed and crabgrasses (Digitaria spp.) predominant. Sarsaparilla (Aralia spp.) was found in plots treated with imazapyr at 1.27 kg/ha. The predominant species in sulfometuron plots was bittersweet, but stonecrop (Sedum spp.) and seedling maples (Acer spp.) also were found.

Triclopyr has an advantage over imazapyr or glyphosate for control of bittersweet in that it has little effect on desirable grasses that are common on roadsides.

ACKNOWLEDGEMENTS

The author is indebted to Gordon Loery of the White Memorial Conservation Center and Keith Cudworth of the White Memorial Foundation of Litchfield, CT for their assistance in the project.

Table 1. Herbicide treatments applied for control of Oriental Bittersweet.

No.	Active ingredient	Formulation	Grams or ml product per liter of spray	kg ai or ae/ha 1/	Equivalent product(s) per acre 1/
1.	glyphosate	isopropylamine	5 ml	2.53 ai	2.26 qts
2.	glyphosate	salt 4 lb ai/gal	10 ml	5.06 ai	4.52 qts
3.	glyphosate	(480 g ai/L) 2/	20 ml	10.12 ai	9.04 qts
4.	triclopyr	butoxyethyl ester	5 ml	2.53 ae	2.26 qts
5.	triclopyr	4 lb ae/gal	10 ml	5.06 ae	4.5 qts
6.	triclopyr	(480 g ae/L 3/	20 ml	10.12 ae	9.0 qts
7.	glyphosate+		2.5+2.5 ml	1.26+1.26	1.13+1.13 qts
8.	triclopyr		5+5 ml	2.53+2.53	2.26+2.26 qts
9.	imazapyr	2 lb/gal	5 ml	1.27 ai	2.26 qts
10.		(240 g ai/L) 4/	10 ml	2.53 ai	4.5 qts
11.	glyphosate+ imazapyr		5 ml+5 ml	2.53+1.27	2.26+2.26 qts
12.	sulfometuron	75% DF 5/	0.26 g	0.21 ai	0.25 lb (4 oz)
13.			0.52 g	0.42 ai	0.5 lb (8 oz)
14.	glyphosate+ sulfometuron		5 ml+0.26 g	2.53+0.21	2.26 qts+0.26 qts

1/ Based on applying 0.98 L of spray/plot. All treatments contained 0.5% v/v X-77 surfactant.

2/ Roundup; 3/Garlon 4; 4/ Arsenal 2E; 5/ Oust 75 DF

Table 2. Control of Oriental Bittersweet and other plants at two dates in 1986 following sprays in September 1985.

No.	Herbicide	kg ai or ae/A	Bitter-sweet June	Bitter-sweet Sept	Rubus June	Rubus Sept	Virginia creeper June	Virginia creeper Sept	Poison ivy June	Poison ivy Sept
1	glyphosate	2.53	8.0	7.3	9.9	9.0	6.0	9.0	10.0	9.0
2.		5.06	9.0	7.3	10.0	9.5	8.3	9.2	10.0	9.0
3.		10.12	9.3	8.9	10.0	9.3	-	-	10.0	8.8
4.	triclopyr	2.53	9.8	9.9	9.5	9.2	10.0	9.9	-	-
5.		5.06	9.9	9.8	10.0	9.2	8.5	7.5	9.7	9.2
6.		10.12	10.0	9.6	10.0	9.9	8.0	6.5	9.5	9.0
7.	glyphosate+	1.26+1.26	9.9	9.5	10.0	9.7	9.8	9.0	10.0	9.0
8.	triclopyr	2.53+2.53	10.0	9.8	10.0	9.6	9.5	9.5	9.5	9.5
9.	imazapyr	1.27	9.7	9.7	10.0	9.2	-	-	-	-
10.		2.53	9.9	9.9	10.0	9.5	9.3	9.7	10.0	10.0
11.	glyphosate+ imazapyr	2.53+1.27	9.9	9.9	10.0	10.0	9.5	9.5	10.0	9.9
12.	sulfometuron	0.21	6.1	0	10.0	9.3	8.0	7.0	-	-
13.		0.42	7.6	3.3	9.8	9.0	8.7	9.0	8.0	9.3
14.	glyphosate+ sulfometuron	2.53+0.21	8.8	5.6	10.0	10.0	9.0	9.3	10.0	9.8

CROWN STRUCTURE MODIFICATION WITH FLURPRIMIDOL IN DECIDUOUS SPECIES AT DIFFERENT GROWTH STAGES

J. P. Sterrett and T. J. Tworkoski[1/]

ABSTRACT

Flurprimidol, a gibberellin biosynthesis inhibitor, suppresses shoot elongation of white ash (*Fraxinus americana* L.), and black walnut (*Juglans nigra* L.) saplings when applied to the root collar. The objective of this research was to determine the structural and temporal effects of flurprimidol on crown development of four deciduous species.

Eleven-year-old (4.5 to 7.6 m tall) pin oak (*Quercus palustris* Muenchh.), red maple (*Acer rubrum* L.), white ash, and black walnut were grown in a Duffield silt loam near Frederick, MD. Root collars of these trees were treated in 1985 with 250 ml of 50% wettable powder formulations of flurprimidol (2 or 4 g/tree) during (1) rapid growth in June, (2) reduced growth in August, or (3) the onset of dormancy in October. Crown development was evaluated during 1986 in terms of terminal leader and lateral branch growth, leaf area and fresh weight, and rachis length of species with compound leaves. Treatments were replicated 5 times in a randomized complete block design.

Terminal growth of all species was inhibited at least 51% by all treatments except for white ash treated in August or October. Lateral shoot growth of pin oak and red maple was inhibited at least 75% by the June and August treatments, and white ash was inhibited by only the June treatment (60%). Lateral growth of black walnut was unaffected by flurprimidol. Most treatments reduced leaf area of all species except white ash. However, the rachis length of white ash leaves was significantly reduced by treatments in June and August. Only red maple displayed a decrease in leaf weight as a result of flurprimidol treatment. Inhibition from treatments in October was generally less than in June and August. Growth inhibition was not improved by increasing the flurprimidol rate from 2 to 4 g/tree.

As a result of differential inhibition of terminal and lateral shoots, crown structure was altered in pin oak, red maple, and black walnut. Pin oak and red maple displayed a greater lateral shoot than terminal shoot inhibition accentuating an excurrent growth form. The reverse inhibition trend enhanced a decurrent growth habit in black walnut. White ash was unaffected by flurprimidol.

These results indicate that gibberellin biosynthesis inhibitors do not uniformly inhibit all meristems of deciduous trees and that crown structure may be significantly altered. It remains to be determined if whole plant net photosynthesis or assimilate distribution are similarly altered.

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EFFICIENCY AND EFFICACY OF FOUR BASAL APPLICATION TECHNIQUES

by Robert C. Freyman and Shepard M. Zedaker[1/]

ABSTRACT

Four basal application techniques, two carriers, and two herbicides were used on two powerline right-of-ways, one near Lynchburg, VA and one near Blacksburg, VA. The following treatments were applied at the Lynchburg site:

1. Thinline= 100% herbicide using a #5700 mulTEEJET TIP ASSEMBLY with 000050 orifice, solid thin stream.
2. Band= 20% herbicide in kerosene using a #5700 mulTEEJET TIP ASSEMBLY with 800067 orifice, flat spray of fine mist-like particles applied in a 4 inch band.
3. Band= 20% herbicide in Asplundh oil, same tip as in treatment 2.
4. Modified basal= 10% herbicide in kerosene using a #5500 adjustable CONEJET tip adjusted to produce a fine mist applied to 18 inches of stem, no run-off.
5. Modified basal= 10% herbicide in Asplundh oil, same tip as in treatment 4.
6. Standard Basal= 2% herbicide in kerosene using a #5500 adjustable CONEJET tip adjusted to produce a course spray applied to 18-24 inches of the stem to run-off.
7. Control= no treatment, these trees were measured around the periphery of the replications.

Only treatments 1, 2, 4, and 6 were used at the Blacksburg site, (no Asplundh oil was used). At the Lynchburg site the herbicide was a mixture of picloram at 17.1% ai and triclopyr at 32.5% ai, and at the Blacksburg site the herbicide was 61.6% ai triclopyr, all as ester formulations.

Application times differed among methods. The 4 inch band using 20% herbicide was the fastest method at both sites. The thinline using 100% herbicide was next, followed by the modified basal using 10% herbicide, with the standard basal using 2% herbicide taking the longest time for application. The relationship among methods for total spray volume applied was standard basal > modified basal > 4 inch band > thinline. However, herbicide usage was much greater with the thinline method. The 4 inch band and modified basal used about the same amount of herbicide. The standard basal used the least herbicide. Though not always statistically significant at the 5 percent level, there was a consistent trend of increasing hardwood control with increasing total spray volume used.

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SIGNIFICANCE OF HEXAZINONE RESIDUES IN A FOREST SOIL

R.L. Geier[1/], J.C. Feng[2/] and R.A. Campbell[1/]

ABSTRACT

The persistence of hexazinone was studied in a heavy-textured boreal forest soil in northern Ontario. The study was conducted in a recently cutover site that had a gently rolling terrain with moderately well to imperfectly drained soils. The soil texture ranged from a clay to silty clay with a surface Fibrimor humus layer extending from 5 to 15 cm in depth. Hexazinone was applied at 4.0 kg ai/ha by helicopter using a spray volume of 35L/ha. Two plots of 2 ha were treated, each plot contained four sample points.

Hexazinone residues were found to dissipate but over a period of several years (Table 1). To determine the biological significance of these residues a bioassay was conducted to study the relationship between soil residues and the survival and growth of germinating seedlings. Soil was collected from treated and untreated portions of the forest site gathering only the upper layer of soil (10 cm average depth) which consisted of humus or a mixture of humus and clay. Soil lots containing hexazinone residues of 0.07, 0.14, 0.28, 0.56, 1.12, 2.23 and 4.46 ug/g were prepared by spraying the appropriate amount of hexazinone on the soil surface and then thoroughly mixing the soil. Results of chemical analysis of the treated soil lots agreed well with actual soil concentrations of hexazinone. Soybean (Glycine max L. Merr. 'Maple Arrow'), oat (Avena sativa L. 'OAC Woodstock') and tomato (Lycopersicon esculentum Mill. "FM6203") were used for the bioassay. Three flats of each species were planted at each rate. Eight flats of each species were planted in soil treated 894 days previously. Chemical analysis of this soil determined the hexazinone residue to be 0.19 ug/g. Tomato and oat seedlings were harvested after 4 weeks and soybeans after 5 weeks. Shoot and root fresh weight and plant stand reduction were determined.

The tolerance to hexazinone varied with plant species; soybean was most tolerant followed by oats, with tomato being the most sensitive. The effective concentration of hexazinone in the forest soil to reduce shoot fresh weight by 50 percent (EC_{50}) for soybean, oat and tomato was 2.06, 0.88 and 0.25 ug/g respectively. None of the three species was adversely affected by soil which had been treated with 4 kg/ha 894 days previously. Results of the bioassay indicate that, following a hexazinone application of 4 kg/ha, certain tolerant plant species such as soybean and perhaps other legumes, would be able to become re-established on the site as early as two months following treatment without any observable effects on their growth and survival. Less tolerant species, such as oats and perhaps other grasses, could not become established until the next year. Whereas, very sensitive species such as tomato, would be adversely affected until the end of the third growing season after application. Although the species used in the bioassay were agricultural plants, it is a logical assumption that a similar variation in hexazinone tolerance exists among wild species.

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Table 1. Hexazinone Persistence in a Heavy-Textured Boreal Forest Soil [1/] in Northern Ontario.

Sampling Date (Day/Month/Year)	Days After Application	Hexazinone Residue Level [2/] in Upper 15 cm of soil ug/g [3/]
21/05/83	0	1.82
27/05/83	6	2.41
07/06/83	17	1.42
21/06/83	31	2.20
05/07/83	45	1.03
03/08/83	74	0.90
06/09/83	108	0.47
22/10/83	154	0.72
16/05/84	360	0.48
16/10/84	514	0.40
08/10/85	871	0.17

1/ Located in Lamplugh Township, Ontario. Longitude 79° 52'W, Latitude 48°N, Elevation 275 m.

2/ Samples from 15 to 30 cm soil depth contained only trace amounts or non-detectable levels of hexazinone.

3/ ug of hexazinone per g oven dried soil.

EFFICACY OF BASAL APPLICATIONS OF TRICLOPYR IN CONJUNCTION WITH CONIFER SPACINGS

David I. Maass 1/

ABSTRACT

Efficacy of low-volume and thin-line applications of triclopyr were evaluated one year after application. The purpose of the study was to determine if basal applications of triclopyr could be applied efficiently to control hardwoods in softwood stands older than 20 years that would be thinned (spaced) manually. The application and the efficiency were reported by Maass and Arsenault 2/. One year after application, the thin-line applications had a slightly lower efficacy. Both methods adequately killed or controlled the growth of aspen (Populus spp.) and pin cherry (Prunus pensylvanica L.) in the stand, except that thin-line applications in August killed fewer trees. There were too few red maples (Acer rubrum L.) in the 16 plots to draw conclusions, although the thin-line applications in July killed a high percentage of the trees treated. Neither method in any of the three months significantly affected the growth of yellow birch (Betula alleghaniensis Britton [Betula lutea Michx. f.]), gray birch (Betula populifolia Marsh.) and especially white birch (Betula papyrifera Marsh.) as evidenced by fully developed crowns with no or slight tip burn on the leaves. Because of the lack of a suitable level of control on the birches, neither method would be recommended to be used to control hardwoods in conjunction with conifer spacings.

1/ Research Forester, Scott Paper Company, Mountain Avenue, Fairfield, Maine.

2/ Maass, David, and Dennis Arsenault. 1986. Testing Basal Applications of Triclopyr in Conjunction with Conifer Spacings. Proceedings of the Northeastern Weed Science Society. 40:213-216.

USE OF METSULFURON METHYL IN MAINE FORESTRY - A FOLLOW-UP

David I. Maass 1/

ABSTRACT

Metsulfuron methyl was used at rates of one-half, one, and two ounces per acre in June; and one-half and one ounce in July and August, 1985, on 1/100th-acre plots to treat competing vegetation in a jack pine, red pine and black spruce plantation and a Japanese larch plantation. Observations were made in July and August, 1986. Mortality was observed on Rubus, pin cherry, elderberry and willow. No control was observed on white and yellow birch in the plots. Topkill was achieved on red and sugar maple and aspen. Mortality was observed at all times to red pine and Japanese larch. August and June applications indicated less injury to natural balsam fir than the July treatments. Jack pine, black and red spruce, had little apparent injury in the August treatments, while they experienced some damage earlier.

INTRODUCTION

The objectives of the timing and rate study of metsulfuron methyl (Methyl 2-{{{{(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino}-carbonyl}amino}sulfonyl}-benzoate) were to compare the efficacy on competing hardwoods and determine the level of injury to the desirable softwoods over the growing season. The study was applied on an area converted from a hardwood stand to softwood by harvesting, mechanical site preparing, planting of softwood species and releasing with one herbicide treatment. The site was prepared and planted in 1980 to jack pine (Pinus banksiana Lamb.). Red pine (Pinus resinosa Ait.), and black spruce (Picea mariana (Mill.) B.S.P.) were planted amongst the jack pine in 1981. The area was treated with glyphosate (N-(phosphonomethyl) glycine) at the rate of 2 pounds per acre in August, 1980. Japanese larch (Larix leptolepis (Sieb. and Zucc.) Gord.) was planted in 1981, on a nearby site. The preliminary results were reported by Maass and Prouty (1). This paper reports the results one full growing season after the application.

APPLICATION METHODS

For each treatment rate and date, two circular 1/100th-acre plots on the two sites were selected based on the competing vegetation and the presence of desirable softwood. That is, a total of four plots were treated per treatment. Treatments were on a product basis (60% active ingredient) as follows: June 4, 1985: one-half, one and two ounces per acre; July 16, 1985: one half and one ounce per acre; August 28, 1985: one-half and one ounce per acre. The herbicide for the two plots was mixed with water and Surfactant WK at .25% v/v. The plots were well covered. The treatments were rated on July 11, 1986 in the larch plantation, and on August 26, 1986 in the red and jack pine plantation.

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RESULTS AND DISCUSSION

Table 1 indicates the results observed in 1981, including both the vegetation control and injury to the desirable softwood. The meaning of the code is as follows: "D" means that all of the treated trees were apparently dead. "D1", "D2", "D3", etc. mean that one, two or three years leader growth had died or had been severely injured. "G" means that there was new growth on the conifers. "N" means that there was no new growth. "T" means that there was topkill on the treated stem. "R" means that stems were resprouting or refoliating. "S" means that new germinants were evident. "O" means that there was no apparent affect on the stems. "1A" means that one of the stems were apparently affected. "N" means there were shorter than normal needles evident. "C" means that the needles were chlorotic.

TABLE 1: ONE-YEAR RESULTS OF METSULFURON METHYL APPLICATION

		6/4/85		7/16/85		8/28/85	
	½ Oz.	1 Oz.	2 Oz.	½ Oz.	1 Oz.	½ Oz.	1 Oz.
Weed Control:							
Rubus	T-R,S	D-S	D-S	D-S	D-S	D-S	D-S
Red Maple	D	T-R	D	T-R	T-R	D	D
Aspen	T-R	D		T-R	T-R	D-T	D
White Birch	O	O	O	1A	O	1A	O
Yellow Birch				O	O		O
Sugar Maple				T-R		T-R	T-R
Pin Cherry	D-S	D	D	D	D	D-S	D
Willow	T-R	D		D	D	D	
Elderberry	D	D		D	D		D
Injury to Plantation Species:							
Japanese Larch	D	D	D	D	D	D	D
Red Pine	D	D2	D	D	D	D	D
Jack Pine	D3-N	N	D3-N	D4-N	D	D1-G	D1
Black Spruce		D2-N					O
Injury to Natural Conifers:							
Balsam Fir	D1-N	D1-G	D3-N	D2-N	D4-N	D1-G	D1-G
Red Spruce	D1-N			D3-N	D2-N	O	C- N

The one-year results of this trial indicate that metsulfuron methyl provides excellent control of raspberries (Rubus spp.) throughout the growing season, but new germinants are evident in the plots. Topkill of red maple (Acer rubrum L.) is quite good at all rates, but resprouting occurred at rates of one-half and one ounce in June and July. The best control was achieved in August. Pin cherry (Prunus pensylvanica L.), willow (Salix spp.), and elderberry (Sambucus pubens Michx.) were killed at all rates throughout the growing season. Aspen (Populus spp.) was about as difficult to control as red maple with the best control achieved in August. Sugar maple (Acer saccharum Marsh.) was more difficult with greater amounts of resprouting occurring. Little or no control of the white (Betula papyrifera Marsh.), or yellow birch (Betula alleghaniensis Britton [Betula lutea Michx f.]) was achieved.

One year after application, it is quite clear that red pine and Japanese larch are susceptible to metsulfuron methyl injury. The June and July applications over jack pine caused injury to leader growth of three or four years with no new growth in 1986. Injury was substantially less in the August applications and these individuals may fully recover next year. Injury to planted black spruce and natural red spruce (Picea rubens Sarg. [Picea rubra (Du Roi) Link.] also decreased in the August treatments. More injury on balsam fir (Abies balsamea (L.) Mill.) occurred in July, with lessor amounts in June and August.

Generally, it appears that metsulfuron methyl could be applied safely at the end of the growing season over jack pine or black spruce plantations or natural stands of balsam fir and spruce. At that time of year, silviculturally effective weed control appears to be achieved on common hardwoods and broadleaf competitors except the birch species.

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FENURON CONVERTS LOW-GRADE HARDWOODS TO JAPANESE LARCH

R. D. Shipman[1]

ABSTRACT

The survival, growth and yield of Japanese larch [Larix leptolepis (Sieb. and Zucc.) Gord.] seedlings planted beneath the canopy of a low-quality 55 to 60-year-old oak-maple-hickory stand was related to differences in rate, species susceptibility, and method of applying pelleted fenuron (3-phenyl-1,1-dimethylurea) herbicide. Pellets were placed on the soil surface by hand in grid, strip, and broadcast patterns two weeks after planting at a 6 by 6 foot spacing. Highest yields of larch after 16 years were obtained with pellets applied in a grid pattern at 11.2 and 8.9 lbs a.i./A, yielding 1072 ft^3 and 867 ft^3 per acre respectively. On untreated (control) plots only 94 ft^3 of larch was grown per acre.

INTRODUCTION

According to a recent survey (2) the recommended treatment on 9 percent of the 16 million acres of commercial forest land in Pennsylvania was stand conversion. Approximately half of this convertible forest area is in the oak-hickory forest type. These "fair" hardwood sites (SI 55 to 64) are characterized with soils capable of producing approximately 2600 cubic feet (32 cords of wood per acre at age 60). It is on these fair to low-quality sites that conversion offers the 490,000 small, private, Pennsylvania woodland owners (1 to 40 acres) an opportunity to increase productivity and to derive additional fuelwood, recreational, wildlife and aesthetic values from their woodlots.

This paper reports the 16-year results obtained by treating a marginal, low quality oak-hickory stand in central Pennsylvania with pelleted fenuron, a soil-applied herbicide to deaden, debark, and subsequently recover "cured-on-the-stump" fuelwood, while simultaneously releasing underplanted, deer proof, high yielding Japanese larch and improving the wildlife food and cover habitat during the stand conversion process.

MATERIALS AND METHODS

In May, 1965 two-year-old Japanese larch seedlings were hand-planted at a 6 by 6 foot spacing beneath the canopy of a 50 to 60-year-old low-grade mixed oak-hickory stand (Site Index 55 for oaks) located on State forest lands near Philipsburg, Pennsylvania. The bed-run, unimproved genetic seedling stock was grown at the Penn Nursery, Centre County, Pennsylvania.

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A dominant hardwood overstory consisted primarily of pole-sized or larger white oak (Quercus alba L.), scarlet oak (Quercus coccinea Muench.), red oak (Quercus rubra L.) and chestnut oak (Quercus prinus L.), with occasional hickories (Carya spp.), red maple (Acer rubrum L.) and sassafras [Sassafras albidum (Nutt.) Nees]. The principal understory shrubs were witch hazel (Hamamelis virginia L.) and dogwood (Cornus florida L.). Elevation above sea level at the conversion site is approximately 1900 feet, and locally, the topography is gentle to rolling. The predominant soil series is a highly acid, well-drained Hazleton sandy loam, a member of the loamy-skeletal, mixed, mesic family of Typic Dystrochrepts developed mostly from underlying sandstone and shale.

Approximately three weeks after underplanting, sixteen 0.1 acre (.04 ha) plots were assigned at random and treated with soil-applied, pelleted fenuron (3-phenyl-1, 1-dimethylurea), formerly marketed under the trade name "Dybar,"[2] containing 25% a.i. fenuron per pound. The herbicide was applied directly to the soil surface with a measuring cup and cardboard container at rates ranging from 1.2 to 13.1 pounds a.i. per acre by broadcast, strip and grid methods. Two plots, untreated and planted were designated as controls.

The fenuron treated plots were designed to permit statistical evaluation by analysis of variance. To facilitate the analysis, treatments were paired a priori according to similarity in rate and method of application. This resulted in a model having nine treatment levels (including controls) with two replications each. In addition to analysis of variance, the means obtained were separated employing the Waller-Duncan K-ratio significant difference T-test (1).

RESULTS AND DISCUSSION

The 16-year survival, total height, diameter, cubic foot volume growth and residual spacing after treatment for Japanese larch is summarized in Table 1. As anticipated, the average survival on broadcast treated plots was significantly poorer than the remaining treatments, including the controls. Broadcast treatments at 3.7 and 7.5 lbs/A averaged 39 and 28 percent survival respectively, a significant difference. Grid and strip methods provided for precise pellet application at least 3 feet from the root zone, resulting in higher survival; at approximately 3 lbs/A the average survival was 73 percent. However, survival dropped to 53 percent employing the strip method.

Average total height and cubic foot volume growth on plots treated with the 11.2 lb/A rate applied in a grid (6 x 6 ft.) pattern (1072 ft^3/A) was significantly higher than all other treatments. However, the second highest treatment (6 by 6 ft.) grid method produced 867 ft^3/A at a 3.9 lb/A rate, only 19% less (205 ft^3/A) than the highest rate. Although this difference in cubic foot volume is significantly

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[2] Product manufacture discontinued 1973 by E. I. Dupont de Nemours and Company (Inc.).

Table 3. Sixteen-year survival, volume growth and residual spacing of underplanted and released Japanese larch by rate and method of herbicide applied.[a]

Treatment Method Spacing	Rate[b] lbs/A	Survival[c] %	Residual Spacing (ft.)	Total Height (ft.)	d.b.h. (in.)	Volume ft^3/A
Grid (6 x 6')	11.2	59.0 cd	8.6 x 8.6	34.2 a	4.0 a	1072 a
Strip (6 x 6')	7.5	55.2 d	8.9 x 8.9	31.1 b	3.5 c	801 b
Grid (6 x 6')	3.9	60.0 c	8.5 x 8.5	30.2 bc	3.6 bc	867 b
Grid (12 x 12')	3.4	74.0 ab	7.7 x 7.7	28.1 cd	3.2 d	815 b
Strip (12 x 12')	3.7	72.5 ab	7.8 x 7.8	26.4 d	3.0 de	740 b
~~Broadcast (a)~~	~~7.5~~	~~27.0 f~~	~~12.7 x 12.7~~	~~31.0 b~~	~~3.8 ab~~	~~443 c~~
Grid (12 x 12')	1.7	73.5 a	7.7 x 7.7	20.7 e	2.0 f	324 c
Broadcast (b)	3.7	39.0 e	10.6 x 10.6	23.0 e	2.7 e	316 c
Control	0.0	65.0 bc	8.2 x 8.2	10.3 f	1.0 g	94 d

[a] Planted May 5, 1965, herbicide applied June 10, 1965.

[b] 25% a.i. (active ingredient) fenuron pellets.

[c] Means for duplicate plots not followed by the same letter are significantly different from each other ($p \leq .01$).

different, the 3.9 lb/A grid-applied rate is recommended, having produced only slightly less volume but with 65% (11.2 vs. 3.9 lb/A) or 7.3 lbs/A less herbicide.

The basal area reduction (kill) of overstory hardwoods according to species susceptibility for combined plots is shown in Table 2. Red and white oaks were significantly more susceptible to fenuron than the remaining species. Red maple, chestnut oak, and hickory were respectively less susceptible. Hickory was significantly more resistant to fenuron than all others except chestnut oak. The changes occurring in the basal area of sassafras, which was also found on the study plots, were not analyzed due to insufficient representation. However, measurements indicated a 30 percent increase in basal area, suggesting, at least, that sassafras is not markedly susceptible to this herbicide. Witch hazel, although not measured, appeared to be resistant to fenuron treatment.

Table 2. Basal area kill using combined data from all treatment combinations of low quality overstory hardwood species five years after applying fenuron herbicide.

Species	Percent basal area killed[a]
Red oak	81.1 a
White oak	78.8 a
Red maple	49.3 b
Chestnut oak	35.5 bc
Hickory	11.6 c

[a] Means not followed by the same letter are significantly different from each other ($P \leq .01$).

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ABSTRACT

A Tree Injection System for Regulation of Tree Growth

Paclabutrazol, tradenamed CLIPPER 20UL Tree Growth Retardant,[1] was granted Federal EPA Registration in January, 1986. Currently four major electrical utilities have operational programs on their properties using paclabutrazol via stem injections.

Manufactured by ICI Americas, paclabutrazol has gained much interest from utility managers and arborists throughout the country. Paclabutrazol is a gibberellic acid inhibitor. Gibberellins are plant hormones responsible for cell elongation. By blocking these gibberellins, paclabutrazol results in reduced growth in the meristematic regions of limbs, effective on wide variety of hardwood and coniferous tree species.

What this means to utility foresters is reduced sprout growth, especially important following routine trimming operations. Less growth requires less frequent trimming. With the two to four year residual (depending on species) action of paclabutrazol, this growth reduction could mean the doubling of many trimming cycles. Of course, these results may not become evident or show signs of cost effectiveness until the end of the scheduled trimming cycle following initial treatment.

Application, as currently labeled, is by direct stem injections. This is accomplished by placing the active ingredient, packaged in a ready-to-use, methanol formulation, in the cambial area of the target stem using pressurized injection. As of this writing there are only two commercial manufacturers of injection systems. Several utility contractors are independently developing injection equipment for private use.

The COLT 75[2] is three separate injection units utilizing a spring loaded, syringe type of design. The STALLION 75[2] is a system using compressed air as an injection force, to power the six independent units.

The ARBORCHEM Tree Injectors[3] come in two models - 3-Point and 6-Point. The number of "points" refer to the number of injections that can be done in a single cycle. The ARBORCHEM Tree Injectors utilize carbon dioxide (CO_2) as a long lasting, efficient power source.

[1] Clipper 20UL Tree Growth Retardant, registered trademark of ICI Americas, Inc., Wilmington, Delaware.

[2] COLT 75 and STALLION 75, products of TIS Enterprises, Springfield, Pennsylvania.

[3] ARBORCHEM Tree Injectors, products of Arborchem Products Co., Ft. Washington, Pennsylvania.

To apply paclabutrazol, several small injection holes are spaced evenly around a tree's circumference within two feet of the groundline. This spacing, from four to eight inches depending on species, aids in the uniform distribution of the chemical throughout the upper crown. The injection holes are drilled using a 3/16" inch drill bit to minimize wounding. The holes should be drilled straight and clean to allow the injection probe to fit firmly in the tree and prevent leakage. Knots, burls, wounds, and other areas which might restrict chemical uptake should be avoided.

Holes are drilled at 30-45° angle to the tree face and no more than 2½ inches deep. This hole forms a small chamber, located near cambial area to enhance xylem tissue uptake, into which the chemical is injected. As the chemical is injected into the chamber, the surrounding wood becomes saturated. Ray cells then slowly move paclabutrazol outward toward the xylem.

As paclabutrazol moves up the stem into meristematic areas, elongation of the effected plant cells begins slowing. Outward indication of paclabutrazol's effects appear as a shortening and compaction of the internodes between leaves and stems.

To date, paclabutrazol has shown no symptoms of phytotoxicity, even at extremely high test applications. The safety and efficacy of this compound have helped to make it a very attractive management tool. While just a few utilities have commercial treatments in operation, many utility foresters are now in the process of field trials and cost effectiveness.

HUCKLEBERRY - A WILDFIRE HAZARD IN EAST-COAST PINE FORESTS

William A. Patterson III[1/]

David W. Crary, Jr.[1/]

Nancy J. Putnam[1/]

ABSTRACT

Wildfires are common in the pine-oak forests of coastal New England, New York, and New Jersey. Pitch pine, with its flammable foliage and litter, contributes to fire hazard on the dry, sandy sites where it grows. The severest fires burn where huckleberry forms a dense shrub layer below pine, however. Huckleberry is a low shrub that reaches maximum heights of 1 to 2 m. Density of mature individuals (i.e. those 8 to 12 years old) may exceed 60 to 80 stems/m^2. Resinous oils in the green leaves of huckleberry allow live shrubs to burn, although leaves must be preheated by litter burning on the soil surface. Huckleberry thus provides vertical continuity to fuels in pitch pine forests and acts as a "ladder" up which flames can climb to the overstory. We have initiated a series of experiments to study fire behavior in huckleberry stands and to evaluate ways of reducing fire hazard. Prescribed burning and mowing are being employed at Cape Cod National Seashore to determine the best way to reduce the height and abundance of live stems and the accumulation of flammable litter. We are evaluating summer and winter treatments at one to four year intervals. Our paper will discuss the results after the initial year of treatment.

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INTERACTIONS AMONG RED RASPBERRIES AND NORTHERN FOREST TREES

R. A. Lautenschlager[1/]

ABSTRACT

Of the variety of common northeastern forest brush, both woody and herbacous, red raspberry (Rubus idaeus L.) is considered a troublesome competitor with forest crops. Although its competitive potential has been recognized for half a century (5), specifics regarding this potential and raspberry's basic biology are either lacking or accumulating slowly. Still, its ability to rapidly colonize and dominate disturbed sites has been demonstrated (3,6).

Raspberry's competitive potential is assumed to be associated with competition for light, moisture, nutrients, and space, or its ability to produce physical damage or allelopathic chemicals. Although Whitney (6) has examined the basic biology, including growth and reproduction of raspberry, and Graber and Thompson (2) have examined mechanisms causing this buried seed strategest to germinate, many gaps in our understanding of this species still exist. For instance, although it is accepted that raspberry seeds may remain viable in the forest floor for upwards to a century, and that fresh seeds are much less likely to germinate than seeds which have resided in the forest soil for several years (2), the mechanisms (physical or chemical) responsible for these changes and its eventual germination remain unclear, although my work (Table 1) and work by Barber (1) and Nesme (4) stress the importance of scarification.

I am presently documenting the competitive potential of R. idaeus and several other competitive forest brush groups by manipulating post-harvest successional brush with a variety of herbicide treatments and planting treated areas with white spruce (Picea glauca (Moench) Voss) seedlings. In addition I'm attempting, through laboratory and field studies, to understand factors responsible for raspberry germination and establishment. These experiments will establish cause and effect relationships relating: 1) spruce growth to competitive group abundance; 2) raspberry germination to a variety of manipulated physical and chemical factors including light, temperature and temperature fluctuations, nutrient additions, scarification and stratification; 3) raspberry establishment to three shade, moisture and nutrient levels; and 4) spruce and raspberry growth to shade, nitrogen, spacing and inter- and intra-specific competition.

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Table 1. Results of *Rubus idaeus* L. germination trials for seeds treated with and without: nitrogen (12mg/l), scarification (20 min. in sulfuric acid) and light (16 hrs/day) and a supplemental treatment (no stratification).

TREATMENT	LIGHT	DARK
	$\bar{X} \pm$ SE	$\bar{X} \pm$ SE
No N, No Scarification	0	0
Yes N, Yes Scarification	7[1/] ± 3	10 ± 3
No N, Yes Scarification	7 ± 3	11 ± 3
Yes N, No Scarification	0	0
Supplemental	0	0

1/ Percent germination

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EVALUATING THE MECHANISM OF HAYSCENTED FERN INTERFERENCE

Stephen B. Horsley[1]

ABSTRACT

Knowledge of the ecological and physiological mechanisms of weed interference with desired species is important in developing long-term silvicultural strategies of vegetation management. In the Allegheny hardwood forest of northwestern Pennsylvania, hayscented fern (Dennstaedtia punctilobula Michx.) interferes strongly with the establishment of black cherry (Prunus serotina Ehrh.) and other desirable hardwood species, frequently resulting in regeneration failure. We are evaluating competitive and allelopathic mechanisms through which hayscented fern may interfere with black cherry seedling establishment in partially harvest cut stands. These studies evaluate the effects of hayscented fern on site and environmental resources and the response of black cherry seedlings to these changes. Studies of the direct allelopathic effects of hayscented fern foliage leachings, root and rhizome washings, and residual soil products suggest that allelopathy does not account for poor growth of black cherry in the presence of hayscented fern. Regardless of whether foliage leachings were produced by misting or soaking up to two times the biomass found in typical forest stands or whether the seedlings were grown in sand or natural soil cores, seedling growth was not less on treated than on control seedlings. Seedlings receiving hayscented fern root washings grew slightly less than control seedlings, but differences were not enough to suggest a key role for allelopathy. There was no evidence that allelochemicals accumulate in soil beneath fern. Nor does hayscented fern interfere with black cherry water relations. Measurements of soil moisture made gravimetrically and with tension lysimeters showed that soil moisture under ferns was less variable, and often higher, inside fern cover than outside. Pre-dawn seedling moisture stress returned to near-zero overnight throughout the growing season, whether seedlings were growing with or without fern. Mid-day seedling moisture stress was greater in seedlings growing outside than inside fern cover. Hayscented fern does not interfere with development of a mycorrhizal relationship in black cherry seedlings. Although seedlings growing with fern had fewer root tips, both the speed and degree of mycorrhizal infection were similar for seedlings growing with or without fern cover. Hayscented fern did have a dramatic effect on both the quantity and the quality of light available to seedlings growing beneath it. Light just above fern tops was 17 to 18 percent of full sunlight, compared with 1 to 3 percent of full sunlight beneath fern cover. Light above fern cover had a red/far red ratio of 1.10 compared with about 0.06 beneath fern cover. Seedling survival and growth were poor beneath fern compared with seedlings where ferns were restrained behind a barrier, permitting light to reach them. Presence of hayscented fern also resulted in substantial reduction in the amount of nitrate-nitrogen in soil solution sampled with tension lysimeters.

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PREEMERGENCE APPLICATIONS OF DINITROANALINES ON GLADIOLUS

A. Bing[1/] and Maria Macksel[2/]

ABSTRACT

A field study was conducted at the Long Island Horticultural Research Laboratory in 1986 to compare the efficacy and crop tolerance of three dinitroanaline herbicides. Pendimethalin and prodiamine provided near excellent control of grasses and broadleafed weeds. Oryzalin was less effective against smartweed and purslane, but very effective on barnyardgrass. Yields of cut flowers and corms of gladiolus varieties 'Arrows', 'Gallery', 'Green Ice' and 'Reflection' were not adversely affected.

INTRODUCTION

Gladiolus (*Gladiolus hortulanus*) are grown for cut flowers used by retail flower shops, homeowners or for exhibitions. They are propagated from small cormels which produce a variety of sizes of corms. The larger ones are grown for flowering while the smaller ones are grown another year to produce larger flowering sizes. In commercial cut flower production, the corms are frequently discarded after flowering, requiring new corms for the next year's crop.

A high degree of weed control is necessary to get maximum yields of corms with a low incidence of insect and disease damage. The smaller the corms or cormels planted the slower they start and therefore, the greater the weed competition, especially early in the growth of the gladiolus plant.

Several papers have been written on this continuing gladiolus weed control project (1, 2, 3, 4). Prodiamine (2,4-dinitro-$\underline{N}^3$,$\underline{N}^3$-dipropyl-6-(trifuoro-methyl) -1,3-benzenediamine) and pendimethalin ($\underline{N}$-(1-ethylpropyl)3,4-dimethyl-2,6- dinitrobezenamine) have looked very good for preemergence weed control in turfgrass, so a comparison with oryzalin (3,5-dinitro-$\underline{N}^4$,$\underline{N}^4$-dipopylsulfanilamide) on gladiolus appeared useful. Double the usual rates were used to check safety to gladiolus.

METHODS AND MATERIALS

Small gladiolus corms size 5 and 6 were graded out of the corms harvested the previous season (4). Varieties 'Arrows', 'Gallery', 'Green Ice' and 'Reflection' were weighed into lots of 50 using a combination of sizes to give uniformity between lots of one variety. The corms were planted June 11 in hand dug trenches 3 inches deep by 4 inches wide with 100 corms in a length of 5 ft with a 3 ft unplanted space between each lot. Rows were 33 inches apart. Each block contained 5 plots of 4 rows. Each row contained 1 variety. The untreated plots were not planted with gladiolus. The corms and unplanted plots were covered, leaving a small ridge of soil which was raked level before treatment a week later to remove early germinating weeds and give a level surface. The experimental design was a randomized complete block of 5 replicates of 5 treatments each with 4 varieties. The soil was a Riverhead sandy loam with 1-2% OM and a pH of 5.5. At the time of treatment on June 18, the soil surface was moist and loose at 80° F. The sky was clear with an air temperature of 80° F and a wind of 7-8 MPH. Herbicides were applied using a compressed CO_2 back pack sprayer and 8003T Jet nozzle.

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During the growing season visual observations for plant injury were made. Handweeded plots were frequently weeded to avoid competition. In the unplanted untreated plots weeds were allowed to grow unchecked.

The predominant weeds in the area were barnyardgrass(*Echinochloa crus-galli (L.)Beauv*), Pennsylvania smartweed (*Polygonum pensylvanicum L.*), and common purslane (*Portulaca oleracea L.*). Weed growth ratings were made on July 15 using a scale of 1= no weeds to 10 = complete weed cover.

Cut flowers were harvested periodically by breaking off the flower spike by hand leaving all the large leaves to improve corm development.

Corms were dug Octcober 22, 1986. After loosening the soil with a spading fork, the plants with corms attached were pulled out of the ground. Loose soil and cormels were shaken off and then the corms broken off by hand and each plot was placed in a separate wire mesh bottomed bulb storage tray. The trays were stacked in a greenhouse for 2 days before weighing the corms, roots and attached cormels.

RESULTS AND DISCUSSION

The untreated plots developed a heavy stand of smartweed, purslane and barnyardgrass. Grass plants near and a few that grew in the treated plots looked healthy but only had short knobs for roots and were not firmly anchorerd. The herbicides were chosen for grass control but pendimethalin and prodiamine also were very effective against broadleafed weeds. Table 1 shows the means of grass growth ratings of 1.0, 0.4 and 1.2 from the pendimethalin, prodiamine and oryzalin plots compared to 4.4 for the untreated. The smartweed plus purslane ratings for the same treatments were 0.8, 1.6, and 3.6 compared to 7.2 for the untreated. There were no readily visible differences between the growth of gladiolus plants within a variety. All treatments were significantly better than the untreated.

The cut flower yields showing averages of 5 reps in Table 2 indicate no differences between treatments with varieties 'Arrow', 'Gallery', 'Green Ice' and 'Reflection'.

The average corm yield of 5 replicates in grams is shown in Table 3. Variety 'Green Ice' showed the only significant differences with a higher yield from the oryzalin compared to the hand-weeded treatment. There was no significant reduction in corm yield from any herbicide treatment.

SUMMARY

Pendimethalin and prodiamine appear very safe on gladiolus and are very effective against grassy and some broadleafed weeds.

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Table 1. Weed growth in a gladiolus planting as affected by a preemergence application of oryzalin, pendimethalin or prodiamine. Planted June 11, treated June 18 and rated July 15, 1986.

Treatment		Weed Growth [z]		
Chemical	Rate lb/aia	Grasses	Broadleaves	General
untreated		4.4	7.2	7.6
handweeded		0	0	0
pendimethalin	4	1.0	0.8	1.4
prodiamine	4	0.4	1.6	1.6
oryzalin	4	1.2	3.6	3.6
LSD.05		1.5	1.7	2.0

[z]Average of 5 replicates.
Weed cover: 0 = none, 1-3 = light, 4 - 6 = moderate, 7 - 10 = heavy.

Table 2. The effect of oryzalin, pendimethalin or prodiamine on the weight of cut flowers of 4 varieties of gladiolus. Small corms planted June 11 and plots treated June 18, 1986.

Treatment		Yield in grams [z]			
Chemical	Rate lb/aia	'Arrow'	cv 'Gallery'	'Green Ice'	'Reflection'
pendimethalin	4	686	1,902	2,112	1,460
prodiamine	4	782	1,968	2,051	1,658
oryzalin	4	1,012	1,528	2,339	1,516
handweeded		742	1,647	2,039	1,402
LSD.05		NS	NS	NS	NS

[z]Average of 5 replicates planted with 100 corms each.

Table 3. The effect of oryzalin, pendimethalin or prodiamine on the fresh weight of gladiolus varieties planted June 11, treated June 18, dug October 22, and weighed October 24, 1986.

Treatment		Yield in grams [z]			
Chemical	Rate lb/aia	'Arrow'	'Gallery'	'Green Ice'	'Reflection'
pendimethalin	4	1,145	1,683	1,914	1,981
prodiamine	4	1,135	1,764	2,040	2,015
oryzalin	4	1,292	1,708	2,134	1,924
handweeded		1,152	1,597	1,812	2,080
LSD.05		NS	NS	287.6	NS

[z]Average of 5 replicates planted with 100 corms each.

Weed Management and Competition in First Year Field Grown Ornamentals

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ABSTRACT

Weed control is an essential component of any ornamental production system. Much data exists to document the impact that weeds have on agronomic, vegetable and fruit crops. Less information is available on the influence that weeds have on woody ornamental species. Although the tools are now available to nurserymen to produce many ornamental species in an essentially bareground, weed-free environment, there are possible benefits to maintaining a permanent or semipermanent ground cover of weeds and/or cover crops.

A field study was established in 1986 at the Long Island Horticultural Research Lab to examine the effect that several weed and ground cover mangement systems have on the growth and development of woody ornamental species. The treatments examined the competitve effect of annual broadleaf weeds, grassy weeds and tall fescue (Festuca arundinacea 'K31') as influenced by mowing, cultivation and percent ground cover. Directed applications of paraquat, within a one meter strip in the row, were used to establish a 50 percent ground cover regime in the plots. The weedy grass and broadleaf treatments were maintained by periodic directed applications of the selective herbicides bentazon and sethoxydim.

Taxus (Taxus media), Green Ash (Fraxinus pennsylvannica) and White Pine (Pinus strobus) were the three species which were the most successfully established of the six planted. Of these, Green Ash exhibited the greatest response to the treatments. Plant height was significantly reduced where vegetation was allowed to completely cover the ground, regardless of the type (grasses, broadleaf, tall fescue) and maintenance regime (mowed). But growth was not adversely in any treatments which were maintained weedfree within the row. The growth of the two evergreen species was slower and treatment effects were less evident although it appears that they were less adversely affected by weed competition than was Green Ash.

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SOLID FINE FESCUE SOD VS STRIP CULTURE FOR NURSERY STOCK

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ABSTRACT

Waldina hard fescue (Festuca ovina var. duriuscula L. Koch 'Waldina') and white clover (Trifolium repens L.) were seeded in replicated plots in fall, 1984. The white clover did not survive the winter. These plots were then maintained as a natural vegetation treatment. In spring, 1985, vegetation free strips 76cm(30 in) wide were created in half the plots of each cover with glyphosate, creating the following four treatments: hard fescue covering the entire plot, hard fescue with a vegetation free strip to plant into, naturally occurring vegetation covering the entire plot, and naturally occurring vegetation with a vegetation free strip. Perennial weeds had been eliminated from all the plots with glyphosate prior to seeding, so the predominant weeds in the natural vegetation plots were summer annuals. Rooted cuttings of forsythia (Forsythia X intermedia Zab.) and Doublefile viburnum (Viburnum plicatum Thunb. var. tomentosum); seedlings of Colorado spruce (Picea pungens Engelm.) and Scotch pine (Pinus sylvestris L.); transplants of Douglas fir [Pseudotsuga menziesii (Mirb.) Franco] and Fraser fir [Abies fraseri (Pursh) Poir.] ; and 1-gal. containers of Andorra junipers [Juniperus horizontalis (Moench) var. plumosa] were planted in the test plots. The vegetation free strips were maintained with directed sprays of oxyfluorfen. All plots were mowed in June and September each year. Plant mortality was determined and the quality of all plants was rated in June and September, 1986. The highest quality plants were found in the natural vegetation plots with the strips. Conifers in the natural vegetation without a strip and in the fescue with a strip were slightly lower quality, but commercially acceptable. Fraser fir in the natural vegetation plots were slightly superior to those in the fescue strip plots. One reason for the reduced ratings of some plants in the fescue strip plots was some hard fescue got established close to the plants in the strips. Forsythia and viburnum in the fescue strip plots were of acceptable quality, while those growing in the natural vegetation without a strip were too stunted to be considered acceptable. They apparently do not tolerate the shade provided by the weeds as well as the conifers. Except for the junipers, which were marginally acceptable, none of the plants in the hard fescue without a strip were commercially acceptable. All plants in these plots were stunted, many were chlorotic, and the growth of Fraser fir was curled, possibly from an alleleopathic effect. Hard fescue sod was much more competitive and injurious to the plants in this study than the natural vegetation. The cover treatments had little or no effect on plant survival, except many viburnums were lost to rabbits in the natural vegetation plots without strips.

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Table 1. Quality ratings of plants grown in different cover crops with and without vegetation free strips around the plants. Only living plants were rated. Plants were rated on a scale of 1-10, with 10=highest quality. Plants rated below 7 are considered commercially unacceptable.

	Fescue w/strip		Fescue w/o strip		Natural w/strip		Natural w/o strip	
	June	Sept.	June	Sept.	June	Sept.	June	Sept.
Colo. spruce	8.4	8.7	5.7	4.4	9.7	9.9	9.0	8.5
Doug. Fir	8.3	8.8	4.1	4.3	9.3	9.9	8.9	8.8
Fraser fir	8.6	8.7	3.9	3.7	9.4	9.7	9.1	9.4
Sc. pine	8.0	8.2	5.3	3.8	9.5	9.5	8.0	7.0
Juniper	8.8	8.9	7.1	5.4	9.3	9.7	8.4	8.3
Forsythia	8.0	9.0	3.1	3.2	9.2	10.0	6.7	6.8
Viburnum	8.2	9.7	3.5	3.1	8.8	9.4	5.7	6.2

Table 2. The number of dead plants (out of 18) in each treatment. Where present, the second number indicates the number of plants that died between the June and September ratings.

	Fescue w/strip	Fescue w/o strip	Natural w/strip	Natural w/o strip
Col. spruce	0+1	0	0	0
Doug. fir	0	0	0	0
Fraser fir	1	2	2	1
Sc pine	0+2	2	0	2[a]
Juniper	0	0	0	0+1[a]
Forsythia	0+1	2+3	1	4
Viburnum[b]	7	3	6	13+1

[a] - accidently mowed off
[b] - most viburnum losses were due to animal feeding

EFFECTS OF HERBICIDES ON GROUND COVERS AND TURFGRASS

J.F. Ahrens [1/]

ABSTRACT

Herbicides were evaluated in newly planted ground covers of pachysandra (Pachysandra terminalis Siebold and Zucc.), ajuga (Ajuga reptans L.), English ivy (Hedera helix L.), purple wintercreeper (Euonymus fortunei 'Sarcoxie') and myrtle (Vinca minor L.), and also in mixed turfgrass of Kentucky bluegrass (Poa pratensis L.) and red fescue (Festuca rubra L.).

Three hand weedings in untreated control plots of the ground covers required a total of 476 hours of labor per acre (1176 h/ha). A preemergence application of napropamide 5G plus oxadiazon 2G at 4+2 lb/A, a week after planting, reduced handweeding by 98% with only slight injury to the five ground covers. This combination controlled common groundsel (Senecio vulgaris L.) better than oxadiazon alone at 3 lb/A, or metolachlor 5G plus oxadiazon 2G at 3+2 or 6+2 lb/A. Granular oxadiazon at 3 lb/A slightly suppressed early growth of several ground covers but sprays of oxadiazon at 3 lb/A injured ajuga and pachysandra more than granules.

Metolachlor 5G plus oxadiazon 2G at 3+2 lb/A injured ajuga more than oxadiazon 2G at 3 lb/A, but only slightly affected the other ground covers. Metolachlor 5G at 6 lb/A was the only preemergence treatment that moderately thinned (18%) the turfgrass. Granular oxyfluorfen plus oryzalin at 2+1 lb/A gave excellent season-long weed control but unacceptable injury to all of the ground covers. Sprays of pendimethalin DG (water dispersable granules) at 3 or 6 lb/A, gave poor control of common groundsel and suppressed growth of pachysandra, but only slightly injured the other ground covers.

Two postemergence sprays of fluazifop-p-butyl at 0.375 or 0.75 lb/A at 7 and 12 weeks after planting injured none of the ground covers, but the second application of asulam at 3.34 or 6.68 lb/A injured ajuga, English ivy and myrtle.

INTRODUCTION

Weeds are highly competitive and expensive to remove manually in newly planted ornamental ground covers (1). Safe and effective herbicides can greatly reduce maintenance costs during establishment. Preemergence herbicides such as oxadiazon [3-[2,4-dichloro-5-(1-methylethoxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2-(3H)-one], metolachlor [2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide], oryzalin [4-(dipropylamino)-3,5-dinitrobenzenesulfonamide] and napropamide [N,N-diethyl-2-(1-naphthalenyloxy)propanamide], are registered for certain ground cover plants, but since all fail to control certain annual weed species when used alone, knowledge of efficacy and plant tolerance with herbicide combinations is particularly important (3).

The postemergence herbicides fluazifop [(±)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid] and asulam [methyl[(4-aminophenyl) sulfonyl]carbamate] have potential for controlling escaped weeds in ground cover

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plantings, but more information is required on plant tolerance to asulam and to the active (±) isomer fluazifop-p-butyl (1,4).

Since ground cover plantings are often grown on slopes and surrounded by turfgrass, it is important to evaluate the tolerance of turfgrasses to the herbicides used in the ground covers. It is also desirable to know the tolerance of ground covers to newer turfgrass herbicides such as pendimethalin [N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine]. The purpose of these experiments, therefore, was to evaluate several herbicides alone or in combination on selected ground covers and turfgrass under similar soil conditions.

MATERIALS AND METHODS

Ground cover experiment. Five or 10 plants each of five ground covers that had been rooted during the winter of 1986 were planted on May 5 and 6, 1986 into 48 plots each 3.5 by 8 ft in prepared Windsor loamy coarse sand, pH 6.0. The plots were arranged in randomized complete blocks with 10 herbicide treatments and two controls (weed-free and weedy), and four replicates. Borders of 2.5 and 4 ft separated the plots on the sides and ends. The plants were spaced 8 in apart in rows 8 to 12 in apart.

Preemergence herbicides were applied on May 13 and postemergence herbicides were applied on June 24 and reapplied on August 1. Sprays were applied with a knapsack sprayer calibrated to deliver 30 gal/A in a 4.5 ft swath; granules were applied with an auger-feed applicator calibrated for each treatment. The plots to receive postemergence sprays were also treated on May 13 with granular oxadiazon at 1.5 lb/A. About 0.25 inch of irrigation was applied 1 hour after the last herbicide treatment on May 13 and at frequent intervals during the season to supplement rainfall. A rain shower (0.1 inch), occurred 1.5 hours after the June 24 sprays of postemergence herbicides. Heavy rainfall started about 24 hours after the August 1 application.

Weed control and plant injury ratings were made at three times after treatment (June 24, July 28 and Sept 18) on a scale of 0 to 10, with 0 as no control or injury and 10 as 100% control, or dead plants. After rating the weeds the time was recorded for one person to hand weed a 20.6 ft^2 area in each of the plots. Except on Sept 18, broadleaf weeds were removed from the postemergence plots and weeding times were not recorded.

The plots received 635 lb/A of 10-6-4 fertilizer on May 6 and 350 lb/A of 0-15-30 on June 27, 1986. The primary weeds occurring in the plot area were large crabgrass (*Digitaria sanguinalis* L.(Scop.), common groundsel, common purslane (*Portulaca oleracea* L.), common lambsquarters (*Chenopodium album* L.), and carpetweed (*Mollugo verticillata* L.). Seeds of common groundsel were uniformly sown over the plots.

Mixed turfgrass experiment. A mixed stand of established Kentucky bluegrass, red fescue and white clover (*Trifolium repens* L.) adjacent to the ground cover experiment was used to evaluate turfgrass tolerance to the landscape herbicides. The soil also was a Windsor loamy coarse sand. A randomized complete block with four replicates, 17 herbicide treatments, and two controls was used. Plots were 4 ft by 8 ft with 4 ft borders on the ends. A 10-6-4 fertilizer was applied at 425 lb/A just before the herbicides on May 14, 1986. The herbicides were applied as granules or sprays in 30 gal/A over a 3 ft swath centered on the 4 ft plots.

Irrigation (0.25 in) was applied 20 min after the last herbicide treatment and as needed to supplement rainfall during the season, so that the turf never suffered a sustained drought stress. Percentage thinning of the turfgrass was evaluated visually on July 7 and September 17.

RESULTS AND DISCUSSION

Ground cover experiment. Times required to look for weeds in weed-free plots averaged 8.3 h/A per weeding. This figure was subtracted from all weeding times to obtain the times shown in Table 1. Despite only a moderate weed population, times for three weedings of the untreated plots totaled 476 h/A for the season. This compares to 526 h/A reported for a similar experiment in 1977 (1).

The granular combination of oxyfluorfen [2-chloro-1-3-ethoxy-4-nitrophenoxy) -4-(trifluoromethyl)benzene] plus oryzalin 2+1 G at 2+1 or 4+2 lb/A gave near perfect weed control for the season (98.5 and 99.6%), but caused unacceptable injury to all five ground covers (Table 2). These were the only treatments to injure purple wintercreeper, causing slight to moderate growth suppression in late season. Leaves of other plants were burned and distorted. Ajuga in plots treated with the lower dosage (2+1 lb/A) recovered by September. Nevertheless, this product does not have the safety margin necessary for the ground cover plants studied.

Oxadiazon granules (2G) and wettable powder (WP) at 3 lb/A reduced weeding times by 92 and 88%, respectively. Both only partially controlled common groundsel in July and September. Oxadiazon granules at 1.5 lb/A caused slight early injury on all ground covers except wintercreeper (Table 2). Early growth suppression was slightly greater at 3 lb/A, but the plants recovered by July. Oxadiazon WP at 3 lb/A suppressed early growth more than oxadiazon G, especially of pachysandra and ajuga.

Napropamide 5G plus oxadiazon 2G at 4+2 lb/A gave excellent control of all weeds including common groundsel, and reduced weeding times 98% for the season, without excessive injury to any of the ground covers. Late season control was significantly better with this combination than with metolachlor+oxadiazon. Slight early growth suppression was evident in all plants except wintercreeper, but recovery was rapid and complete. Napropamide+oxadiazon at 6+2 lb/A gave only slightly improved weed control over the lower dosage and greater early injury to myrtle.

Metolachlor 5G plus oxadiazon 2G at 3+2 and 6+2 reduced weeding times for the season by 89% and 92%, but did not control common groundsel as well as napropamide+oxadiazon. These treatments also caused excessive early injury to ajuga. Metolachlor+oxadiazon could be a good choice for ground covers on sites where yellow nutsedge (*Cyperus esculentus* L.) is a problem (2).

Pendimethalin water dispersable granule (DG) at 3 or 6 lb/A gave excellent control of crabgrass, carpetweed and purslane, and poor control of common groundsel, reducing weeding times for the season 74 and 81%. It suppressed growth in pachysandra that was noticeable in July at 3 lb/A, and also in September at 6 lb/A. The other ground covers were not injured by pendimethalin.

The postemergence herbicides asulam and fluazifop-p-butyl were applied on emerged weeds in June and August following a preemergence application of oxadiazon at 1.5 lb/A to control broadleaf weeds. No injury was observed in any ground

Table 1. Effects of herbicides on weed control in ground covers.

Herbicide	lb/A ai	Weed control ratings 1/ 7/28 crab-grass	ground-sel	Weeding times - hours/acre 2/ 6/24	7/28	9/18	Total	% Reduction
untreated		0	0	287	123	66	476	0
Preemergence treatments applied 5/13/86								
oxyfluorfen+	2+1	9.7	10	0	1	6	7	98.5
oryzalin 2+1G	4+2	10	10	0	0	2	2	99.6
oxadiazon 2G	3	7.8	6.8	2	13	22	37	92.2
oxadiazon 50WP	3	8.6	4.8	1	24	34	59	87.6
metolachlor 5G+	3+2	9.8	4.9	1	15	38	54	88.7
oxadiazon 2G	6+2	10	7.0	0.4	9	30	39.4	91.7
napropamide 5G+	4+2	9.8	9.9	0.4	1	8	9.4	98.0
oxadiazon 2G	6+2	10	10	0	0	4	4	99.2
pendimethalin	3	9.4	2.0	45	29	51	125	73.7
60 DG	6	10	2.0	27	22	42	91	80.9
Postemergence treatments applied 6/24 and 8/1 following oxadiazon G at 1.5 lb/A on 5/13/86.								
fluazifop-p	0.375	9.8	1.8	-	-	28	-	
butyl	0.75	10	3.0	-	-	50	-	
asulam	3.34	9.5	10	-	-	9	-	
	6.68	9.5	10	-	-	3	-	
L.S.D. p = .05				48	14	19		13.4
p = .01				64	18	26		18.1

1/ 0 = no control; 10 = 100% control (weed-free).

2/ Corrected for times required to look for weeds in weed-free plots.

Table 2. Effects of herbicides on injury to ground covers. 1/

Herbicide	lb/A ai	Pachysandra 6/13	8/1	9/17	Ajuga 6/13	8/1	9/17	English ivy 6/13	8/1	9/17	Myrtle 6/13	8/1	9/17
untreated													
Preemergence treatments applied 5/13													
oxyfluorfen+	2+1	2.5	4.5	3.0	4.3	4.0	0.8	2.8	2.5	2.5	2.5	3.5	2.0
oryzalin 2+1G	4+2	2.5	5.8	8.0	5.5	7.5	6.5	3.0	3.3	3.5	2.8	5.0	3.8
oxadiazon 2G	3	1.8	1.5	0	1.5	0.8	0	1.3	0	0	1.5	0.5	0
oxadiazon 50WP	3	2.0	3.0	0	2.8	1.8	0	1.8	0.8	0	2.0	0.3	0
metolachlor 5G+	3+2	2.0	1.5	0	3.3	1.0	0	1.0	0	0	1.8	1.3	0
oxadiazon 2G	6+2	1.8	1.3	0	3.8	2.3	0	0.8	0	0	1.8	1.8	0
napropamide 5G+	4+2	2.0	0.3	0	2.0	0.3	0	0.8	0.3	0	1.8	0.5	0
oxadiazon 2G	6+2	1.8	0.5	0	1.5	0	0	0.8	0	0	2.3	0	0
pendimethalin	3	0.8	2.5	0	0.8	0.3	0	0.5	0	0	0.3	0	0
60 DG	6	0.5	3.5	0.5	0.5	0.3	0	0	0	0	0.8	0.3	0
Postemergence treatments applied 6/24 and 8/1 following oxadiazon G at 1.5 lb/A on 5/13													
fluazifop-p-	0.375	1.8	0.3	0	1.3	0	0	0.5	0	0	1.3	0.3	0
butyl	0.75	1.5	0	0	1.0	0	0	1.0	0	0	1.0	0.3	0
asulam	3.34	1.8	0	0	1.3	0.3	2.8	1.0	0	2.5	0.8	0	2.0
	6.68	0.8	0	0.3	1.3	0.3	4.3	0.3	0	3.0	1.0	0	2.5

1/ 0 = no injury; 10 = dead plants.

covers with fluazifop-p-butyl. The June application of asulam at 3.34 or 6.68 lb/A caused no injury, but the August application caused discoloration and necrosis on ajuga, English ivy and myrtle. Although effects of the two applications of asulam could have been cumulative, it also is possible that the rain shower shortly after the June application reduced absorption, avoiding the injury. However, asulam at 4.5 lb/A did not injure English ivy or myrtle excessively in 1977 (1).

Turfgrass experiment. Of the preemergence herbicides applied on the ground covers, only metolachlor 5G at 6 lb/A moderately thinned (18%) the turfgrass (Table 3). Metolachlor 5G alone at 3 lb/A or plus oxadiazon 2G at 3+1 lb/A caused about 5% thinning. Granular combination products of oxyfluorfen+oryzalin at 4+2 lb/A and oxyfluorfen+pendimethalin at 4+2 lb/A both reduced white clover in the plots with minor effects on the stand of turfgrass. Oryzalin 4 AS (liquid) sprays at 1.5 or 3 lb/A, and napropamide 5G alone at 4 or 8 lb/A had minor effects on the turfgrass, causing about 5% thinning. Our tentative conclusion is that several of the preemergence herbicides with potential uses in ground cover or shrub plantings present little hazard to surrounding turf areas that are well maintained.

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Table 3. Effect of landscape herbicides on percentage thinning of mixed turfgrass.

Herbicide	lb/A, ai	July 7	Sept 17
untreated	-	0	0
oryzalin 4AS	1.5	0	0
	3.0	0	4
pendimethalin 60 DG	1.5	0	3
	3.0	0	0
	4.5	4	0
metolachlor 5G	3.0	4	0
	6.0	18	15
napropamide 5G	4.0	0	3
	8.0	0	4
oxadiazon 2G	2.0	1	4
	4.0	0	0
napropamide 5G+ oxadiazon 2G	4+2	0	0
metolachlor 5G+ oxadiazon 2G	3+2	4	5
oxyfluorfen+ oryzalin 2+1G	2+1	0	3
	4+2	4	0
oxyfluorfen+ pendimethalin 2+1G	2+1	0	0
	4+2	3	5

POSTEMERGENCE HERBICIDES IN WOODY LANDSCAPE PLANTS

C. Benjamin Coffman and J. Ray Frank [1]/

ABSTRACT

Field investigations were conducted at Beltsville, Maryland, in 1983, on a Keyport silt loam (Aquic Hapludult), and continued through 1985. One to 3-year old nursery stock were transplanted into a clean, cultivated field in the spring of 1983. Two plants each of the following species were planted on 1.2 m centers in each plot: low-fast cotoneaster (Cotoneaster dammerii Schneid.), hinocrimson azalea (Rhododendron x Hinocrimson), Andorra juniper (Juniperus horizontalis 'Plumosa' Rehd.), Hicks yew (Taxus media 'Hicksii' Rehd.), periwinkle (Vinca minor L.), Japanese spurge (Pachysandra terminalis Sieb. and Zucc.), and English ivy (Hedera helix L.). Plots were 3 by 11 m, with treatments replicated three times in a randomized complete block design. Fertilizer and irrigation were provided as needed. Plots were hand hoed weed-free each spring prior to herbicide applications. Controls included a hand-weeded and a non-weeded treatment. Herbicide treatments consisted of individual applications of 1 to 2% granular oxyfluorfen at 4.5 kg/ha, and haloxyfop, fluazifop, and sethoxydim at 0.3 and 0.6 kg/ha. Sequential applications of oxyfluorfen with each of the three postemergence grass herbicides, applied in a final volume of 374 L/ha, were also investigated. Percent weed cover and major species were estimated each fall. Weed yields were obtained from two locations in each plot. Test plants were rated on a scale of 0 to 10, with 0 = no effect and 10 = plant death. Preliminary analysis of the data indicates that all test species satisfactorily tolerated the herbicide treatments. Weed control was best when oxyfluorfen application was followed by timely application of a postemergence grass herbicide.

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TOLERANCE OF 19 LANDSCAPE PLANTS TO SETHOXYDIM AND BAS-517

Larry Kuhns, Mary Ann Kaps, and Scott Guiser[1]

ABSTRACT

Sethoxydim and BAS-517, with and without crop oil concentrate, were applied over the top of 19 different actively growing containerized woody ornamental plants on June 27, 1986. The plants treated were: Azalea poukanensis, Azalea Herbert, Azalea Delaware Valley White, Rhododendron President Lincoln, Rhododendron Roseum Elegans, Rhododendron X chionoides, Rhododendron PJM, Emerald Gaiety euonymus [Euonymus fortunei (Turcz.) Hand.-Mazz. var. Emerald Gaiety], Dwarf winged euonymus [Euonymus alata (Thunb.) Siebold var. Compacta], Bar Harbor juniper (Juniperus horizontalis Moench var. Bar Harbor), Blue Hetz juniper (Juniperus chinensis L. var. Hetzii), Blue Princess Holly (Ilex X Meserveae S. Y. Hu var. Blue Princess), red-stemmed dogwood (Cornus alba L.), Dwarf inkberry [Ilex glabra (L.) A. Gray var. Compacta], Dwarf Korean lilac [Syringa patula (Palib.) Nakai], Japanese pieris [Pieris japonica (Thunb.) D. Don ex G. Don], bush cinquefoil (Potentilla fruticosa L.), Burkwood viburnum (Viburnum X Burkwoodi Hort. Burkw. & Skipw.), and Vanhoutte spirea [Spiraea X Vanhouttei (C. Briot) Zab.]. Sethoxydim was applied at 0.27 and 1.1 kg ai/ha plus 1% oil concentrate. BAS-517 was applied at 0.27 and 0.55 kg ai/ha plus 1% oil concentrate and 0.55 kg ai/ha without oil. A 1% solution of oil concentrate alone was also applied. All treatments were applied in the equivalent of 345 l/ha. Plants were evaluated for tolerance to the herbicides1 and 6 weeks after treatment. Two of the four Pieris treated with BAS-517 at 0.55 kg ai/ha plus oil concentrate had some dead tips one week after application. Six weeks after application the dead tips were still evident, but they were being overgrown by new growth from below. It is not known why only two of the four plants were injured, or why not all of the tips on the affected plants were killed. Herbert azalea may have initially been slightly stunted by the sethoxydim treatments. If so, severity was not rate related, and no stunting was evident six weeks after treatment. All other plants appeared to be tolerant of the treatments applied.

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METOLACHLOR CONTROL OF YELLOW NUTSEDGE IN HOLLY AND AZALEA

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ABSTRACT

Controlling yellow nutsedge (Cyperus esculentus L.) is a major problem in many horticultural crops. Pine bark mulch which is used in raised bed ornamental production often contains viable nutsedge tubers. These tubers germinate despite applications of preemergence herbicides which prevent germination of many other weed species. This research was conducted because no registered herbicides are now available which will control yellow nutsedge without extensive damage to ornamental crops.

Beds of newly planted 'Hetzii' holly (Ilex crenata 'Hetzii'), and three varieties of azaleas [Rhododendron obtusum (Lindl.) Planch 'Delaware Valley White', 'Hershey Red', and 'Hinocrimson'] were spray treated on September 5, 1985 with metolachlor at 4.5, 6.7, 9.0, or 13.5 kg/ha. One series of metolachlor applications to each variety was made prior to mulch application while a second series was made immediately after mulching. No irrigation was used for 24 hours after treatment. Each treatment was replicated three times and each plot contained 10 or more plants.

Phytotoxicity on a 0-10 scale was determined on September 16, 1985 and May 15, July 10, and August 13, 1986. The number of nutsedge seedlings and the height x width of holly and azaleas in cm^2 was determined on the same dates in 1986.

Yellow nutsedge was controlled for 10 months when metolachlor was applied on top of the mulch at rates as low as 4.5 kg/ha. When metolachlor was applied under the mulch, no significant reduction in nutsedge germination was observed. Less than 20% phytotoxicity in the form of necrosis was observed during the first week after spray application on 'Hetzii' holly. No phytotoxicity was observed on the three azalea varieties. No phytotoxicity was observed on 'Hetzii' holly or any of the three azalea varieties during any evaluation in 1986. No reduction in height x width of holly and azaleas was observed at any time during the experiment. These results indicate that metolachlor, currently registered for weed control in turf, could be used satisfactorily in ornamentals.

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HERBICIDES FOR *JUNIPERUS* AND *TAXUS* CONTAINER STOCK

Nancy P. Cain [1/]

ABSTRACT

Weed control has been a major cost in nursery container production in Ontario since most is done by hand due to the lack of registration of herbicides for this crop. Trials have been done for three years at the research station and additionally at grower sites during 1986 to evaluate herbicides with potential for registration in this crop.

Dichlobenil 4.0 or 4.4 kg ai/ha, diphenamid 6.75 kg ai/ha, and simazine 2.25 kg ai/ha were evaluated on *Juniperus horizontalis* cv 'Plumosa compacta' in containers at Guelph. In 1986, these treatments were evaluated additionally at grower sites (site locations have been listed in Table 1). *J. chinensis* cv 'Mountbatten' (site 2), *J. h.* cvs 'Plumosa compacta' and 'Blue Chip' and *Taxus media* cv 'Densiformis' (site 3) were first year plants. *J. h.* cv 'Plumosa compacta', *J. chinensis* cv 'Old Gold' (site 2), *J. horizontalis* cv 'Wiltonii', *J. scopularum* cv 'Wichita' and *J. sabina* cv 'Tamariscifolia' (site 4) were established plants. As well, oxyfluorfen 2.0 kg ai/ha and chloroxuron 3.0 kg ai/ha were evaluated in 1986.

Dichlobenil 4.4 kg ai/ha resulted in advanced fall coloring one year at Guelph. In grower trials there was slight (less than 6%) temporary discoloration on 'Plumosa compacta' with simazine and oxyfluorfen and on 'Blue Chip' with oxyfluorfen. No injury was observed on the other cultivars.

The most common weeds at all sites were either or both groundsel (*Senecio vulgaris* L.) and a cress species. Simazine and dichlobenil provided consistently good control of these (Table 1) and other weeds. Diphenamid control of these weeds was variable. Chloroxuron provided good control of groundsel; chloroxuron and oxyfluorfen provided good control of the cress.

TABLE 1. Groundsel and cress control in container nursery stock one month after application (Number of weeds per pot).

HERBICIDE	RATE (KG AI/HA)	GROUNDSEL			CRESS	
		SITE 1	SITE 2	SITE 3	SITE 3	SITE 4
Control	-	10.8	2.2	1.5	1.9	40
Chloroxuron	3.0	1.6	0.6	0.9	0.3	5
Dichlobenil	4.0	0.0	0.0	0.3	0.3	4
Diphenamid	6.75	3.3	0.6	1.1	0.1	25
Oxyfluorfen	2.0	-	1.6	1.1	0.3	0
Simazine	2.25	0.0	0.6	0.1	0.0	2

Site 1 - Guelph, Site 2 - Oakville, Site 3 - Niagara-on-the-Lake, Site 4 - Dundas

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SELECTIVITY OF HERBICIDES IN WHITE PINE AND COLORADO SPRUCE

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ABSTRACT

Herbicides were evaluated during 1985 and 1986 in newly planted and established white pine (Pinus strobus L.) and Colorado spruce (Picea pungens) growing in silt loam soils in South Windsor, Connecticut. Most sprays were applied in 280 L/ha (30 gal/A) directly over the trees with a 2-nozzle boom so that the lower 2/3 or more of trees was contacted by the sprays. Pendimethalin and metolachlor at 4.48 and 6.72 kg/ha alone or plus simazine at 2.24 kg/ha were compared with oryzalin at 2.9 or 4.48 kg/ha plus simazine at 2.24 kg/ha for preemergence control. Pendimethalin plus simazine applied before bud break caused no injury to either conifer, but gave poorer late season control of annual grasses and common ragweed (Ambrosia artemsiifolia L.) than oryzalin plus simazine. April applications of metolachlor plus simazine before bud break gave control comparable to that of oryzalin plus simazine without conifer injury but May applications during active growth caused moderate needle distortion only on white pine.

Imazapyr was applied before bud break in April, during active growth in May and on dormant plants in late September at dosages of 0.28, 0.56 and 1.12 kg/ha. Imazapyr at 1.12 kg/ha in April gave control in August equivalent to oryzalin+simazine (71%), but control of ragweed was short at 0.28 or 0.56 kg/ha. The April and May treatments of imazapyr all discolored and suppressed growth of the conifers. Addition of X-77 surfactant increased the injury. Granular imazapyr was slightly less injurious than imazapyr 2E. September applications of imazapyr at 0.28 kg/ha without surfactant, followed by pendimethalin at 4.48 kg/ha in April gave excellent control of winter annual weeds and common dandelion (Taraxacum officinale Weber in Wiggers), but only fair residual control and no injury to white pine. Higher rates of imazapyr improved residual control but injured the pines (Table 1). Imazapyr may not have the selectivity required in plantations of young white pine or Colorado spruce.

Semi-directed sprays of metsulfuron methyl at 10.5 or 21 g/ha or sulfometuron methyl at 105 or 210 g/ha, applied on the lower 30 cm of 1.5 m well established white pines in April or June, shortened needles and distorted terminal leader growth. April applications at the higher dosages also suppressed leader growth. However, applications of sulfometuron methyl at 105 or 210 g/ha over the lower 2/3 of smaller white pines (1 m) in September, followed by April applications of pendimethalin or oryzalin, gave season-long weed control and no serious injury or growth suppression. Weed control with sulfometuron in the fall was better than the current standard of glyphosate in the fall. Needles of pines treated with sulfometuron methyl in September showed moderate basal chlorosis the following July, but most regained their normal color by September. Colorado spruce was injured more seriously than white pine by September applications of sulfometuron methyl. Further studies with fall applications of sulfometuron methyl in white pine are warranted.

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Table 1. Effects of herbicides on weed control, injury and growth of white pine in two experiments.

Herbicide ai, kg/ha Sept 25 1985	Herbicide ai, kg/ha April 10 1986	Weed control 1/ (0-10) May 28	Weed control 1/ (0-10) July 31	Injury 1/ (0-10) May	Injury 1/ (0-10) July	Injury 1/ (0-10) Sept	Terminal leader growth cm
Experiment 1 2/							
untreated		0	0	0	0	0	41.5
imazapyr 0.28	pendimethalin 4.48	6.4	4.3	1.0	1.0	1.5	42.3
0.56	4.48	7.8	5.5	3.0	4.0	3.8	25.7
1.12	4.48	8.4	5.3	4.5	6.0	6.5	4.0
sulfometuron 0.105	pendimethalin 4.48	9.6	7.6	0	0.8	0.3	50.3
0.210	pendimethalin 4.48	9.8	8.9	0.8	2.8	2.4	39.3
	pendimethalin 4.48+ simazine 2.24 3/	36.4	7.1	0	0	0	52.8
L.S.D. p = .05							11.6
p = .01							15.4
Experiment 2 4/							
untreated		0	0	0	0	0	58.5
imazapyr 0.28	pendimethalin 4.48	7.8	3.8	0	0.3	0.3	57.8
0.56	pendimethalin 4.48	8.4	5.8	1.5	1.8	1.8	51.3
1.12	pendimethalin 4.48	8.9	8.0	3.3	4.5	4.3	31.8
sulfometuron 0.105	oryzalin 3.36	9.9	9.3	0	1.5	0.9	61.7
0.210	oryzalin 3.36	9.9	9.6	0	3.0	1.5	52.0
glyphosate 1.49	oryzalin+ simazine 3.36+2.24	8.4	8.1	0	0	0	54.1
L.S.D. p = .05							10.6
p = .01							14.2

1/ 0 = no control or plant injury; 10 = 100% control or dead plants.
2/ X-77 surfactant added at 0.25% v/v.
3/ Received same treatment in April 1985.
4/ All plots received oryzalin+simazine at 3.36+2.6 kg/ha in April 1985. No surfactant was added to the September treatments.

WEED CONTROL WITH LACTOFEN IN COMMERCIAL AND ORNAMENTAL CONIFERS

Hagwood, H.B./R. L. Nichols[1/]

ABSTRACT

Lactofen (1-Carboethoxy) ethyl-5-[2-Chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoate) herbicide was evaluated in conifer nurseries to determine crop tolerance and weed control efficacy. An Experimental Use Permit was granted in 1986 to allow operational comparison of lactofen with oxyfluorfen (2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(triluoromethyl)benzene and bifenox (methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate) for use in pine seedlings. Each herbicide was applied preemergence, then followed with 12 postemergence applications. The postemergence applications were made weekly, commencing after complete stand emergence. Pre and post rates for lactofen, oxyfluorfen, and bifenox were 0.45 and 0.11, 0.56 and 0.14, and 3.36 and 0.56 kg ai/ha, respectively.

Results were assessed by surveying the cooperating nurseries. Control of carpetweed (Mollugo verticillata L.), common purslane (Portulaca oleracea L.), dogfennel (Eupatorium capillifolium (Lam.) Small), eclipta (Eclipta prostrata L.), Florida beggarweed (Desmodium tortuosum (SW.) DC), Florida pusley (Richardia scabra L.), pigweeds (Amaranthus spp.), morningglories (Ipomoea spp.), sicklepod (Cassia obtusifolia L.), prostrate spurge (Euphorbia humistrata Engelm. ex. Gray), large crabgrass (Digitaria Sanguinalis (L.) Scop.) and yellow nutsedge (Cyperus esculentus L.) was rated. Respondents indicated that at 86 and 71% of the nurseries lactofen provided greater or equivalent overall weed control compared with bifenox and oxyfluorfen, respectively. Lactofen provided superior broadleaf weed control, while oxyfluorfen provided slightly greater control of grass weeds. Nurserymen indicated that crop tolerance with lactofen was superior or equivalent to that with oxyfluorfen or bifenox at 93 and 86% of the responding nurseries. Lactofen provided greater control of eclipta and prostrate spurge than did the other herbicides.

Field grown ornamentals, including Juniperus spp., Pinus spp., and bald cypress (Taxodium disticum L.), exhibit high tolerance to postemergence treatments of lactofen. Research suggests that lactofen may be chemigated. The ornamental conifer Juniperus horizontalis 'Wiltoni' showed no visual phytotoxic effects from lactofen applied through irrigation at a total, cumulative rate of 3.36 kg ai/ha (Skroch, unpublished 1986). Research in agronomic crops indicated that lactofen efficacy, alone or in combination with certain postemergence graminicides, is frequently greater when applied through irrigation at 0.22-0.64 cm/ha compared with ground applications (Dowler, unpublished 1985, 86).

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Potential for Injury to Roses with Nonfoliar Applications of Glyphosate

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ABSTRACT

Poor weed control in roses grown in greenhouse beds is a chronic impediment to efficient production. Because the typical rotation cycle is five years, steam sterilization and fumigation are relatively short lived control options. Constant reinfestation by weed seeds makes hand weeding an expensive but necessary practice as there are currently no herbicides registered for use in greenhouse grown roses. Although it is not registered for this use, many growers have used glyphosate as a directed or wiper application to control low growing weeds under the rose canopy. Injury is often observed on the roses even though care has been taken to avoid foliar applications.

Two greenhouse studies were conducted in 1986 at the Long Island Horticultural Research Laboratory, Riverhead New York, to determine which portions of the rose bark are most sensitive to glyphosate injury and if there is a potential for root absorption of glyphosate.

Bare root hybrid tea roses, Rosa spp. pl.patent# 76-21774, were planted in Cornell soilless media (peat:vermiculite1:1) on April 15 in three gallon containters. The plants were allowed to establish for two months before severe pruning and treatment.

In one study, the plants were completely defoliated and three distinct stem sections were treated with a three percent solution of glyphosate applied with a small brush. The treated stem sections were: the understock or mature woody trunk, the basal six inches of the mature green scion tissue and the immature green scion stems. In a separate experiment, the soilless media was treated with one liter drenches of glyphosate solutions having concentrations varying from 1% to 50%. In both studies, the plants were allowed to grow after treatment and marketable and unmarketable flower production was recorded for the next three months. In early August, the plants were again severely pruned and allowed to regrow. Flower production following this second regrowth was also recorded.

The results indicate that, although some injury occurred on most plants that had any portion of their stems treated with glyphosate, the treatments that caused a significant and long lasting reduction in marketable flower production were those on immature green stem tissue only. Plants which were only marginally injured recovered fully after the second severe pruning.

Significant and severe injury resulted from root absorption of a single exposure to high (30% and 50%) concentrations of glyphosate, but little injury occurred from exposure to low concentrations (1% and 3%).

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PPG-1259 FOR CONTROL OF HERBACEOUS AND WOODY WEED SPECIES

Edward J. Spyhalski[1/]

ABSTRACT

PPG-1259 (CAS 78327-32-9) is being evaluated for selective control of herbaceous and woody plants by PPG Industries, Inc.

Studies indicate crop tolerance by corn (*Zea mays*) and Sorghum [*Sorghum bicolor* (L.) Moench]. The rate of PPG-1259 which will provide selective weed control, whether applied pre or postemergence, ranges from 0.09 to 0.175 kg/ha on tolerant agronomic crops. Weeds controlled at the suggested rates are many annual broadleaf weeds and small-seeded grasses. Some of the broadleaf weeds controlled are lambsquarters (*Chenopodium album* L.), jimsonweed (*Datura stramonium* L.), nightshades (*Solanum* species), velvetleaf (*Abutilon theophrasti*, Medic.), pigweeds (*Amaranthus* species), common ragweed (*Ambrosia artemisiifolia* L.), common cocklebur (*Xanthium strumarium* L.), smartweed (*Polygonum pensylvanicum* L.) and ladysthumb (*P. persicaria* L.). The grass weeds that are effectively controlled by PPG-1259 in the upper rate range are barnyard grass [*Echinochloa crusgalli* (L.) Beauv.] and several foxtail species (*Setaria faberi* Herrm.), [*S. viridis* (L.) Beauv.], [*S. glauca* (L.) Beauv.], [*S. verticillata* (L.) Beauv.].

PPG-1259 applications result in rapid foliage kill and subsequent plant death on several woody plant species. Prominent woody weed species controlled have been multiflora rose (*Rosa multiflora* Thunb. ex. murr.) and eastern red cedar (*Juniperus virginiana* L.). Rates effective for woody species control are 1-2 kg/ha. PPG-1259 moves into the plant through roots and through foliage. Within the plant, major movement of the product is toward the terminals.

PPG-1259 technical is a white, crystalline powder melting at 176-178.5 C. and has a density of 1.2318 g/ml at 25 C. The product has no odor. PPG-1259 has a low order of solubility in common organic solvents.

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PREEMERGENCE CRABGRASS CONTROL IN TURF--1986

T. L. Watschke and G. Hamilton[1]

Abstract

Two experiments were conducted during 1986 to evaluate compounds for preemergence crabgrass (Digitaria ischaemun) (Schreb.) Michx. control in cool season in cool season turfgrass. Many of the chemical treatments in the two tests were identical and the treatment dates were only one day apart. The principal difference between the two tests was that one received irrigation following application and at any point during the season when wilt stress became apparent and the other test did not receive irrigation at any time. All treatments in the irrigated test provided acceptable control (at least 85%) without causing significant thinning or other injury. Pendimethalin, benefin + trifluralin, oxadiazon, DCPA, and bensulide all provided 95% control or better.

Results from the nonirrigated study were somewhat different. Acceptable control was found for benefin, benefin + trifluralin on fertilizer carrier, oxadiazon at the high rate (3.36 kg ai/ha), DCPA, pendimethalin, and bensulide. The benefin & trifluralin combination when not formulated on fertilizer did not provide acceptable control. The experimental compound SD095841 did not provide acceptable control at any rate in the nonirrigated test, while in the irrigated study, acceptable control was attained for all rates. Two experimental benefin formulations were included in the nonirrigated study and neither provided acceptable control at either rate used (2.24 and 3.36 kg ai/ha).

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Table 1. Preemergence control of smooth crabgrass and injury to a mixed cool season turfgrass stand from application of several herbicides on April 25, 1986. Injury was rated on June 25 and control was rated on August 7, 1986. Irrigation applied after application and whenever needed throughout the study.

Treatment	Rate (kg ai/ha)	Crabgrass (Control %)	Injury (% Thinning)
Pendimethalin + F	1.68	95	0
Benefin + Trifluralin	1.49 + 0.75	94	0
Benefin + Trifluralin	1.49 + 0.75	97	0
Benefin + Trifluralin + F	1.49 + 0.75	98	0
Benefin 2.5 G	2.24	94	0
SD 095481 0.5 G	0.56	85	0
SD 095481 0.5 G	0.84	95	0
SD 095481 0.5 G	1.12	90	0
Oxadiazon 2 G	2.24	96	0
Oxadiazon 2 G	3.36	98	0
DCPA 75 W	11.76	95	10
Pendimethalin 60 DG	1.68	98	0
Bensulide 2.2 S	11.12	96	0
Bensulide 4E	11.12	92	0
Prodiamine 65 DG	0.43	90	0
CGA 41065 1.2 E	1.34	93	0
Check	0.00	0	0

Table 2. Preemergence control of smooth crabgrass and injury to a mixed cool season turfgrass stand from application of several herbicides on April 24, 1986. Injury was rated on June 25 and control was rated on August 7, 1986. No irrigation was applied to the plot area.

Treatments	Rate (kg ai/ha)	Crabgrass (Control %)	Injury (% Thinning)
Benefin 2.5 G	2.24	85	0
Benefin + Trifluralin	1.49 + 0.75	80	0
Benefin + Trifluralin + F	1.49 + 0.75	99	0
SD095481 0.5G	0.56	27	0
SD095841 0.5G	0.84	43	0
SD095841 0.5G	1.12	60	0
Oxadiazon 2G	2.24	72	0
Oxadiazon 2G	3.36	91	5
DCPA 75W	11.76	93	0
Pendimethalin 60DG	1.68	94	0
Bensulide 2.2S	11.12	94	0
Bensulide 4E	11.12	93	0
Prodiamine 65DG	0.43	98	0
EL-1052 28W	2.24	47	0
EL-1052 28W	3.36	60	0
Benefin 60DP	2.24	42	0
Benefin 60DP	3.36	50	0
Check	0.00	0	0

TIMING OF PREEMERGENCE HERBICIDES FOR CRABGRASS CONTROL

C.D. Sawyer and J.A. Jagschitz[1/]

ABSTRACT

Trials were established in 1984, 1985 and 1986 to evaluate herbicides for preemergence control of smooth crabgrass [Digitaria ischaemum (Schreb.)Muhl.] in Kentucky bluegrass (Poa pratensis L.), red fescue (Festuca rubra L.), and a mixed stand of red fescue and Kentucky bluegrass at the University of Rhode Island Turf Research Farm, Kingston, R.I. In each trial selected treatments were applied in March as well as April. Herbicides, formulations, rates, dates of treatment, number of applications, and grass species involved are shown in Table 1. Plots were 16 to 20 sq ft in size with three replications. In the 1984 and 1985 trials sprays were applied at 150 gpa and treatments were made March 14-16 or April 12-22. In the 1986 trials sprays were applied at 75 gpa and treatments were put out March 5 or April 25. Granular materials were applied by hand. Test areas received appreciable rainfall or were irrigated within three days of treatment. Plots were irrigated as needed to prevent drought stress.

Smooth crabgrass germination started in early May and continued through July with peak germination occurring in June. Crabgrass cover in untreated plots and dates of cover estimation are shown in Table 1.

Crabgrass control varied somewhat between trials, however the following treatments provided excellent control (90-100%) without turf injury with a single application in March in all trials where tested: pendimethalin 60DG at 3 lbs, pendimethalin 4EC at 2 lbs, prodiamine at 0.5 lbs, and prodiamine 65WDG at 0.375 lbs. DCPA at 10.5 lbs gave excellent control in all but the 1985 red fescue trial. Oxadiazon gave excellent control at 3 lbs in 1984 and 1986, and good control (80-89%) in 1985. Control was less effective, although variable, from March applications of benefin, benefin + trifluralin, bensulide and siduron. Results from benefin alone or with trifluralin were somewhat similar. Benefin + trifluralin at the 3 lb rate and DCPA at the 10.5 lb rate resulted in objectionable injury to red fescue turf in the 1986 trial. Prodiamine 50WP at 2 lbs (2X rate +) resulted in objectionable injury to the fescue/bluegrass stand.

Prostrate spurge (Euphorbia supina Raf.) occurring in the Kentucky bluegrass areas was effectively controlled by single March applications of the following materials in the 1986 trial: DCPA at 10.5 lb, pendimethalin 60DG at 1.5 lb and prodiamine 65WDG at 0.75 lb.

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Table 1. Preemergence control of crabgrass in several lawn areas with herbicides applied in March or April of 1984, 1985 or 1986.

			Percent Crabgrass Control									
			1984		1985				1986			
			Fescue + Bluegrass		Red fescue		Kentucky bluegrass		Red fescue		Kentucky bluegrass	
Herbicide	Formulation	Rate lb ai/A	Mar	Apr	Mar	Apr	Mar	Apr	Mar	Apr	Mar	Apr
benefin	2.5 % G	2.0	55	36	-	-	-	94	-	85	-	95
	2.5 % G	3.0	-	-	72	93	69	94	-	91	-	98
	2.5 % G	2.0-2.0#	78	74	-	80	99+	99	-	-	-	-
benefin + trifluralin	1.33 % + 0.67 % G	2.0	-	-	-	88	-	97	-	88	-	89
		3.0	-	-	-	-	-	-	89*	98	91	98
		2.0-2.0#	-	-	-	-	-	-	93	-	99+	-
bensulide	4 EC	7.5	-	78	-	86	-	80	-	-	-	-
		10.0	70	87	-	-	-	93	79	87	96	62
		12.0	-	-	34	74	96	94	-	-	-	-
		8.0-4.0#	-	-	35	78	-	91	-	-	-	-
		10.0-5.0#	96	-	-	-	-	-	89	-	99	-
DCPA	75WP	10.5	95	96	44	74	98+	98	90*	96	99+	99+
		7.5-3.75#	-	98	-	-	98	-	-	-	-	-
		10.5-5.25#	98	-	-	-	-	-	88	-	99+	-
oxadiazon	2G	2.0	-	86	-	-	-	-	-	-	-	-
		3.0	96	93	87	98	88	95	90	94	91	84
		2.0-1.0#	-	96	-	-	-	-	-	-	-	-
pendimethalin	60DG	1.5	-	-	-	-	-	95	82	91	99+	93
		1.75	-	-	62	63	88	98	-	-	-	-
		3.0	-	-	-	-	-	-	95	-	98+	-
		3.5	-	-	-	96	-	99+	-	-	-	-
		1.5-1.5#	-	-	-	-	-	-	96	-	99+	-
	4 EC	1.5	-	-	-	-	-	91	-	-	-	-
		1.75	-	-	-	57	-	-	-	-	-	-
		2.0	97	99	-	-	-	-	-	-	-	-
		3.0	99	99	-	-	-	-	-	-	-	-
		3.5	-	-	-	81	-	-	-	-	-	-
		2.0-1.0#	97	99	-	-	-	-	-	-	-	-
	1.71 % G	1.5	-	-	68	89	98	97+	-	92	-	98+
prodiamine	50WP(1984) 65WDG(1985+ 1986)	0.25	-	-	-	96	-	87	-	93	-	63
		0.375	-	-	92	96	97	-	93	96	90	87
		0.5	98	95	98	98	92	97	93	98	97	97+
		0.75	-	-	-	-	-	-	94	99	100+	99+
		1.0	99*	100*	-	99	-	100+	-	99	-	99+
		2.0	100	100	-	100	-	100+	-	100	-	100
		0.25-0.25#	100	100	-	-	-	-	99	-	98+	-
siduron	50WP	12.0	32	36	-	80	-	59	-	89	-	67
		12.0-6.0#	47	54	-	-	-	-	-	-	-	-
% crabgrass cover in checks			52		50		43		66		73	
Evaluation date			8/6		8/6		8/7		9/2		9/2	

* Objectionable turf injury. Injury rated on scale of 1-10: 10=brown, 2=objectionable.

\+ Excellent prostrate spurge control (greater than 90% control). Evaluated only in 1985 and 1986 Kentucky bluegrass areas. Spurge cover in check plots was 6%.

\# Repeat applications were made 9 weeks after initial treatment in 1984, 7-8 weeks in 1985, and 10 weeks in 1986.

EFFECT OF HERBICIDES APPLIED DURING ANNUAL GRASS EMERGENCE IN TURF

J. A. Jagschitz and C. D. Sawyer [1/]

ABSTRACT

Eight studies were initiated at the time smooth crabgrass [Digitaria ischaemum (Schreb.) Muhl.] had emerged and some would germinate later, to evaluate pre and postemergence herbicides, for the control of crabgrass. The lawns contained red fescue (Festuca rubra L.), Kentucky bluegrass (Poa pratensis L.) and/or perennial ryegrass (Lolium perenne L.). Herbicides were applied to replicated plots between May 24 and June 13 (crabgrass in 0 to 5 leaf stage). Crabgrass germination started in early May and continued through July with most emergence in June. The herbicides, rates and dates are shown in Table 1. Granular (G) herbicides were applied by hand while others were applied as sprays using 50 to 175 gallons of water per acre (GPA). No rain occurred for at least 20 hours and most lawns received rainfall or irrigation by the third day. Two replicated tests in 1986, on a sod-stripped area, evaluated herbicides for the control of fall panicum (Panicum dichotomiflorum Michx.) at the 1-2 and 1-4 leaf stages. Percent control was based on comparisons between cover in treated plots to that of untreated plots. Turf injury was evaluated throughout the studies.

The results from herbicides applied during crabgrass emergence are shown in Table 1. Postemergence herbicides (DSMA, MSMA and fenoxaprop) and preemergence herbicides (bensulide, DCPA and siduron) did not consistantly provide good (80-89%) or excellent (90-100%) crabgrass control. Herbicides applied during weed emergence should have both pre and post activity to be successful. Pendimethalin and prodiamine (pre materials) gave good to excellent control, however, results were from only one trial and further testing is required. Tridiphane, applied in three studies, provided good to excellent crabgrass control and appears to have both pre and post activity. Objectionable red fescue injury was noted in some trials from DSMA, MSMA and tridiphane.

Combining post and preemergence herbicides improved crabgrass control. Adding DSMA or MSMA to benefin, bensulide, DCPA, oxadiazon, pendimethalin and siduron resulted in good to excellent control. A second application of DSMA or MSMA (9-16 days later) was usually required. Mixing fenoxaprop with bensulide, DCPA, pendimethalin or prodiamine provided good to excellent control. The .18 lb rate of fenoxaprop was more effective than the .12 lb rate.

Data from herbicides applied to fall panicum are presented in Table 1. All materials provided some control with 1 to 2 leaf panicum being more susceptible than 1-4 leaf. Excellent control was provided by oxadiazon, pendimethalin and tridiphane at both leaf stages. Benefin and siduron gave excellent control of 1 to 2 leaf fall panicum. Bensulide, DCPA and prodiamine provided only partial control. Rooting of fall panicum was inhibited by bensulide, pendimethalin and siduron.

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Table 1. Effectiveness of herbicides applied in several lawns during early annual grass germination.

PRE & POST TREATMENT (Crabgrass 0-5 leaf)		PERCENT CRABGRASS CONTROL (Aug-Sept) (Treatment Date)								% PANICUM CONTROL Aug 6 (Treat Jul 7)	
HERBICIDE	LB/ACRE	May 77	May 77	Jun 79	Jun 80	Jun 83	Jun 84	Jun 85	Jun 86	1-2 leaf	1-4 leaf
DSMA	4	51[a]	67	15	73	-	-	-	-	-	-
DSMA	4*	-	-	77	69	-	-	-	-	-	-
MSMA	1.5	-	-	-	-	14	56	-	-	-	-
MSMA	1.5*	-	-	-	-	-	66	-	-	-	-
MSMA	1.8*	-	-	-	-	-	-	56	-	-	-
fenoxaprop EC	.12	-	-	-	-	-	27	34	-	-	-
fenoxaprop EC	.18	-	-	-	-	23	42	-	77	-	-
benefin DF	2	-	-	-	-	-	-	-	-	94	45
benefin G + DSMA	3 + 4	-	-	31	80	-	-	-	-	-	-
benefin G + DSMA	3 + 4*	-	-	96	86	-	-	-	-	-	-
bensulide EC	7.5-10	73	75	-	-	-	32	-	-	51	56
bensulide + DSMA	7.5-10 + 4	85[a]	93	56	94	-	-	-	-	-	-
bensulide + DSMA	7.5 + 4*	-	-	98	98	-	-	-	-	-	-
bensulide + MSMA	7.5 + 1.5	-	-	-	-	65	71	-	-	-	-
bensulide + MSMA	10 + 1.8*	-	-	-	-	-	-	97	-	-	-
bensulide + fenoxaprop	7.5-10 + .12	-	-	-	-	81	58	87	-	-	-
bensulide + fenoxaprop	7.5-10 + .18	-	-	-	-	87	-	-	100	-	-
DCPA WP	10 - 10.5	74[a]	39	-	-	-	19	-	-	76	46
DCPA + DSMA	10 + 4	99[a]	92	29	95	-	-	-	-	-	-
DCPA + DSMA	10 + 4*	-	-	99	99	-	-	-	-	-	-
DCPA + MSMA	10.5 + 1.5	-	-	-	-	77	85	-	-	-	-
DCPA + MSMA	10.5 + 1.5*	-	-	-	-	-	-	95[a]	-	-	-
DCPA + fenoxaprop	10.5 + .12	-	-	-	-	-	80	83	-	-	-
DCPA + fenoxaprop	10.5 + .18	-	-	-	-	-	-	-	99	-	-
oxadiazon G	3	-	-	-	-	-	-	-	-	99	94
oxadiazon + DSMA	3 + 4	-	-	33	90	-	-	-	-	-	-
oxadiazon + DSMA	3 + 4*	-	-	98	96	-	-	-	-	-	-
pendimethalin WDG	1.5	-	-	-	-	-	-	-	94	99	88
pendimethalin + MSMA	1.5 + 1.8*	-	-	-	-	-	-	99	-	-	-
pendimethalin + fenoxaprop	1.5 + .12	-	-	-	-	-	-	91	-	-	-
pendimethalin + fenoxaprop	1.5 + .18	-	-	-	-	-	-	-	99	-	-
prodiamine WDG	.375	-	-	-	-	-	-	-	87	45	11
prodiamine + fenoxaprop	.375 + .18	-	-	-	-	-	-	-	99	-	-
siduron WP	10 - 12	95	79	23	36	58	51	38	-	91	63
siduron + DSMA	10 + 4	97[a]	98	79	99	-	-	-	-	-	-
siduron + DSMA	10 + 4*	-	-	97	100	-	-	-	-	-	-
siduron + MSMA	12 + 1.8*	-	-	-	-	-	-	95	-	-	-
tridiphane EC	1	-	-	-	-	-	75	53	-	-	-
tridiphane EC	1.5	-	-	-	-	-	87	83[a]	-	100	93
tridiphane EC	2	-	-	-	-	-	-	93[a]	97[a]	-	-
Cover in Checks at Control Time		37%	62%	92%	57%	91%	69%	91%	52%	48%	58%

* Second application of DSMA or MSMA applied 9 - 16 days later.

a Objectionable red fescue injury.

PRE AND POSTEMERGENCE CRABGRASS/WEED CONTROL IN TURF [1/]

A. Enache and R. D. Ilnicki [2/]

ABSTRACT

Field trials were conducted at the Soils and Crops Research Center at Adelphia, N. J. in 1986 to evaluate the efficacy of experimental and commercially available herbicides when applied to cool-season grasses for pre and postemergence control of large crabgrass [Digitaria sanguinalis (L.) Scop.] and smooth crabgrass [Digitaria ischaemum (Schreb.) Muhl.]. The same herbicides were evaluated for general weed control.

Three different perennial grasses, ryegrass (Lolium perenne L.), tall fescue (Festuca arundinacea Schreb.) and Kentucky bluegrass (Poa pratensis L.) were employed in this study. The soil was a sandy loam with a pH of 6.1 and an organic matter content of 1.8%. The experiment was conducted as a randomized complete block design with three replications. Treatments were applied at 375 l/ha using a CO_2-propelled backpack sprayer at 221 kPa, with a water carrier. The preemergence treatments were applied on April 14, 1986, and postemergence treatments on June 16 (PO_1) and June 24 (PO_2). Herbicides evaluated in this study were: pendimethalin, BAS 514 H, prodiamine, bensulide, oxadiazon, CGA 131036, fenoxaprop, SD 214512 and imazethapyr. Rates used for the herbicides studies are listed in Table 1. No injury to the grasses was observed with any treatment of the herbicides evaluated. BAS 514-H gave the best crabgrass control when applied either pre or postemergence to all three turf species (>93%) except for tall fescue where pendimethalin applied preemergence performed the best. Prodiamine provided the best crabgrass control at the lower rate in all three situations. The same pattern followed CGA 131036 (PE) and SD 214512 when applied early post. Imazethapyr performed better at 0.048 kg/ha on ryegrass and tall fescue, and at 0.024 kg on Kentucky bluegrass. Bensulide, oxadiazon and fenoxaprop provided >85% crabgrass control on ryegrass and tall fescue, but less on Kentucky bluegrass. As a general conclusion, all the herbicide treatments provided better crabgrass control on ryegrass and tall fescue than on Kentucky bluegrass.

With respect to the control of other weeds present on turf fields, pendimethalin, BAS 514-H, oxadiazon, imazethapyr and CGA 131036 provided >70% at all rates. Prodiamine resulted in better control at lower rates, while SD 214512 provided better control at higher rates.

[1/] New Jersey Agricultural Experiment Station Publication No. J-15173-2-86.

[2/] Weed Sci. Tech. and Res. Prof. of Weed Sci., respectively, Dept. of Soils and Crops, N. J. Agr. Exp. Sta., Cook College-Rutgers University, New Brunswick, N.J. 08903.

Table 1. The effect of pre and postemergence[1] applications of herbicides on crabgrass/general weed spectrum in turf, Adelphia, N.J., 1986.

Treatment	Rate and Schedule [2]	Ryegrass DIGSA [3]	Ryegrass OW [4]	Tall Fescue DIGSA	Tall Fescue OW	Kentucky bluegrass DIGSA	Kentucky bluegrass OW
	(kg/ha)	%		%		%	
pendimethalin	1.68 PE	86.7	80.2	100.0*	75.2	71.7	81.2
	3.36 PE	95.0	85.2	83.3	86.2	61.7	79.0
BAS 514 H	2.24 PE	96.7**	95.0	87.5	90.2	80.7**	72.3
	2.24 PO^1	100.0*	91.0	93.3**	95.1	86.7*	95.0
prodiamine	0.56 PE	83.3	90.0	90.0	80.7	61.7	60.1
	1.12 PE	75.0	85.0	80.0	70.2	58.3	55.2
	2.24 PE	73.3	85.0	80.0	70.2	58.3	55.2
bensulide	11.3 PE	90.0	75.1	86.7	70.0	68.3	75.1
oxadiazon	2.24 PE	93.3	95.2	86.7	90.2	63.3	91.2
CGA 131036	0.01 PE	81.7	88.2	93.3	88.3	75.0	80.1
	0.02 PE	75.0	80.1	92.5	91.2	75.0	79.8
	0.03 PE	75.0	80.1	90.0	75.2	71.3	80.5
fenoxaprop	0.20 PO_1	86.7	70.2	87.5	65.3	80.0	69.3
SD 214512	0.84 PO_1	86.7	75.1	70.0	65.3	73.3	69.3
	1.12 PO_1	83.3	72.3	73.0	65.3	73.3	69.3
	0.84 PO_2	76.7	71.3	85.0	75.3	75.0	68.1
	1.12 PO_2	81.7	75.4	83.0	75.3	75.0	74.2
imazethapyr	0.024 PO_2	73.3	85.2	90.0	86.7	73.3	70.1
	0.049 PO_2	81.7	80.1	86.7	88.2	70.0	70.0
	0.074 PO_2	73.3	80.1	86.7	82.8	70.0	70.0
Untreated check	-	0	0	0	0	0	0
LSD 0.05							

(1) Pre and post applications refer to crabgrass stage of growth.
(2) Schedule: PE = preemergnce, applied April14, 1986
PO_1 = postemergence, applied June 16, 1986
PO_2 = postemergence, applied June 24, 1986
(3) DIGSA = Digitaria sanguinalis (L.) Scop and Digitaria ischaemum (Schreb.) Muhl
(4) OW = Other weeds present on turf fields: Stellaria media (L.) Vill., Anthemis vulgaris L., Thlaspiarvense L., Capsella burso-pasteris (L.) Medic.
*Best weed control treatment.
**Second best weed control treatment

CRABGRASS CONTROL WITH PRE- AND POSTEMERGENCE HERBICIDES

Prasanta C. Bhowmik[1]

ABSTRACT

Three field experiments were conducted at the University of Massachusetts Turfgrass research Center, South Deerfield. The objectives of these experiments were i) to evaluate the efficacy of various herbicides applied preemergence or postemergence for crabgrass [Digitaria sanguinalis (L.) Scop.] control, ii) to determine the optimum stage of crabgrass growth for postemergence applications, and iii) to evaluate the effects of carrier volume on postemergence activity of two herbicides. Experiments were conducted on an established perennial ryegrass (Lolium perenne L.) turf maintained at a height of 3.8 cm under low fertility. Treatments were applied to 1 by 3 m plots with a CO_2 backpack sprayer at a pressure of 152 kPa in 675 L/ha. The preemergence treatments were applied on April 25, 1986. The postemergence treatments were applied on June 19 and June 27, 1986 when the crabgrasses were at the 2- to 3-leaf and 3- to 5- leaf stage, respectively.

The preemergence application of trifluralin and benefin (premix) combination 2G at 2.2 kg/ha provided excellent crabgrass control (>90%) over the entire season with little or no injury to turfgrass. Both formulations (60 WDG and 2.5G) of benefin at 2.2 to 3.3 kg/ha gave excellent crabgrass control. Pendimethalin 60WDG at 1.7 to 3.4 kg/ha and prodiamine 60WDG at 0.56 to 2.2 kg/ha controlled crabgrass effectively over the entire season. DCPA 75WP at 11.8 kg/ha and oxadiazon 50WP at 2.2 to 3.3 kg/ha controlled crabgrass effectively. However, oxadiazon treatments resulted in temporary turf injury (25 to 38%). In contrast, bensulide 4E at 11.8 kg/ha provided only 87% crabgrass control (July 10, 1986).

In general, late postemergence application (6- to 7-leaf stage and tillering, July 11, 1986) of XRM-4763 resulted in better crabgrass control than early postemergence application (3- to 4-leaf stage, June 19, 1986) of the same rate. Crabgrass control increased as the rate of XRM-4763 increased from 1.1 to 2.2 kg/ha. In addition, carrier volume (water) had an positive impact on crabgrass control with increased volume of carrier from 562 to 1688 L/ha.

Fenoxaprop at 0.20 and 0.39 kg/ha applied postemergence provided excellent crabgrass control. There were no significant differences between EC and EW formulations of fenoxaprop especially when applied with 338 or 675 L/ha of water carrier. EC formulation of fenoxaprop at both rates (0.20 and 0.39 kg/ha) failed to provide acceptable crabgrass control at 1350 L/ha volume of carrier. However, EW formulation of fenoxaprop exhibited excellent crabgrass control only at the highest rate (0.39 kg/ha) with 1350 L/ha volume of carrier.

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POST CRABGRASS CONTROL USING HERBICIDAL COMBINATIONS

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ABSTRACT

A field experiment was conducted on a predominantly fine fescue turf to evaluate various experimental herbicides on the postemergence control of smooth crabgrass [Digitaria ischaemum (Schreb.) Michx.]. The objectives of the study were to evaluate: 1) fenoxaprop-ethyl and SC-0051 alone, 2) fenoxaprop-ethyl in combination with commercial herbicides to assess antagonistic relationships.

Fenoxaprop-ethyl, applied alone at 0.13 and 0.20 kg ai/ha did not provide acceptable control (85% or greater) of smooth crabgrass (Table 1). Acceptable control (98%) was found when fenoxaprop-ethyl was applied in combination with pendimethalin at 0.20 and 1.68 kg ai/ha respectively, and when combined with 2,4-D, MCPP, and dicamba at 0.39, 1.12, 0.60, and 0.10 kg ai/ha respectively. Combining fenoxaprop-ethyl with pendimethalin provided a better control than fenoxaprop-ethyl applied alone. Combining fenoxaprop-ethyl with all other broadleaf herbicides at rates of 0.13, 0.20, and 0.28 did not provide acceptable crabgrass control. One or more of the components of the threeway broadleaf herbicide mixture caused an apparent antagonism when combined with fenoxaprop-ethyl. This antagonism reduced the efficacy of fenoxaprop-ethyl. Increasing the rate of fenoxaprop-ethyl to 0.39 kg ai/ha improved control to an acceptable level. The experimental material SC-0051 did not provide crabgrass control at any rate.

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Table 1. The effect of single and combined herbicides on postemergence control of smooth crabgrass in a predominantly fine fescue turf. Treatments were applied 7/10 and rated 8/11.

TREATMENT	FORMULATION	RATE (kg ai/ha)	CRABGRASS CONTROL
			--------%--------
Fenoxaprop-ethyl	1EC	0.13	75[a]b
Fenoxaprop-ethyl	1EC	0.20	83 ab
Fenoxaprop-ethyl + Bromoxynil + 2,4-D + 2,4-DP		0.20 + 0.28 + 0.28 + 0.28	77 b
Fenoxaprop-ethyl + 2,4-D + Triclopyr		0.20 + 0.75 + 0.375	75 b
Fenoxaprop-ethyl + 2,4-D + MCPP + Dicamba		0.20 + 1.12 + 0.60 + 0.10	53 c
Fenoxaprop-ethyl + 2,4-D + MCPP + Dicamba		0.28 + 1.12 + 0.60 + 0.10	68 bc
Fenoxaprop-ethyl + 2,4-D + MCPP + Dicamba		0.39 + 1.12 + 0.60 + 0.10	87 ab
Fenoxaprop-ethyl + 2,4-D + MCPP + Dicamba		0.13 + 1.12 + 0.60 + 0.10	22 ed
Fenoxaprop-ethyl + Pendimethalin		0.20 + 1.68	98 a
SC-0051	91.8%	0.14	12 ef
SC-0051	91.8%	0.28	27 ed
SC-0051	91.8%	0.56	33 d
MSMA	6S	2.24	68 bc
CHECK		0.00	0 f

a/ means followed by the same letter are not significant at p=.05 by Duncan's multiple range test.

POSTEMERGENCE CRABGRASS CONTROL IN TURF - 1985 AND 1986

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ABSTRACT

Post emergence control of smooth crabgrass [Digitaria ischaemum (Schreb.)Muhl.] was evaluated in seven trials at the University of Rhode Island Turf Research Farm, Kingston, R.I. during 1985 and 1986. The test areas were lawns of red fescue (Festuca rubra L.), Kentucky bluegrass (Poa pratensis L.) and perennial ryegrass (Lolium perenne L.). Herbicides, rates, treatment dates and growth stage of crabgrass at time of treatment are shown in Table 1. Sprays were applied at 175 gpa water in 1985 trials with the exception of fenoxaprop 1EC and SC-0051 which were applied at 50 gpa. In 1986 trials, sprays were applied at 75 gpa. Granular materials were applied to moist turf by hand. Plot size was between 16 and 36 sq.ft. with 3 or 4 replications. No rainfall occurred within 20 hours after treatment. Test areas were irrigated when necessary to avoid moisture stress. Crabgrass germination started in early May and continued into early July in 1985. During 1986, germination also began in early May, however few new plants emerged after mid-June.

In the June 4 trial, with crabgrass in the 1-4 leaf stage, only tridiphane gave good control (80-89%). Substantial crabgrass germination occurred following treatment, indicating good preemergence activity of tridiphane. At the 2 lb rate control was excellent (90-100%) however turf injury was considered to be objectionable. Similar results were observed for tridiphane in the June 10, 1986 trial. Fenoxaprop and MSMA were ineffective in this trial because of subsequent germination.

In July trials most crabgrass was in the tillering stage and there was little further germination. Fenoxaprop 1EC was consistent in providing good to excellent control with a single application at the 0.12 and 0.18 lb rates. The 0.5 EW formulation of fenoxaprop also gave excellent control at the 0.12 lb rate. Control was not diminished by either of two safeners included in some fenoxaprop treatments and there appeared to be a slight reduction in turf discoloration. Fluroxypyr at 0.5 lb provided good control in the June 10 trial but performed poorly in July trials. When combined with tridiphane however, control was good to excellent and better than comparable rates of tridiphane alone. In July trials control with tridiphane was inconsistent. Granular formulations of tridiphane without fertilizer provided results similar to sprays. Crabgrass control with granular formulations containing fertilizer was poor compared to similar treatments without fertilizer. MSMA provided excellent control with two applications although injury to red fescue was considered objectionable at the 2.0 lb rate. The experimental compound AC-263499 gave little control and injury was objectionable. Crabgrass control with SC-0051 was also poor except in the July 14 trial where the 0.25 lb rate gave excellent control.

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Table 1. Postemergence control of crabgrass in several lawn areas treated in 1985 and 1986.

			Percent Crabgrass Control						
			Treatment Date #						
			Jun 4 1985	June 10 1986	Jul 4 1986	Jul 14 1985	Jul 22 1986	Jul 25 1985	Jul 25 1985
		Rate	PR+KB[1]	PR+KB	PR+KB	PR+KB	KB	KB	RF
Herbicide	Formulation	lb ai/A	1-4 leaf[2]	1-3 leaf	2-6 leaf	early tiller	late tiller	late tiller	late tiller
AC-263499	2 EC	0.11	-	0*	-	-	29*	-	-
	2 EC	0.17	-	13*	-	-	-	-	-
fenoxaprop	1 EC	0.12	34	-	-	83	97	-	95
+ safe #2	1 EC	0.12	-	-	-	81	-	-	90
+ safe #4	1 EC	0.12	-	-	-	82	-	-	87
	1 EC	0.18	-	77	97	91	98	95	95
+ safe #2	1 EC	0.18	-	-	-	93	-	98	91
+ safe #4	1 EC	0.18	-	-	-	82	-	95	94
	1 EC	0.25	-	-	-	98	99	99	95
+ safe #2	1 EC	0.25	-	-	-	92	-	97	96
+ safe #4	1 EC	0.25	-	-	-	93	-	78	91
	1 EC	0.18-0.18	-	98	-	-	-	-	-
	0.5 EW	0.12	-	-	-	-	96	-	-
fluroxypyr	1.7 EC	0.5	-	81	51	-	26	-	-
MSMA	6 L	2.0	-	-	-	-	85	-	-
	6 L	1.0-1.0	-	-	-	-	99	-	-
	6 L	1.5-1.5	-	-	-	-	99	-	-
	6 L	1.8-1.8	56	-	-	-	-	-	-
	6 L	2.0-2.0		-	-	99	99	100	99*
SC-0051	0.55E	0.125	-	-	-	-	-	50	38
	0.55 E	0.25	8	-	-	93	-	62	33
	0.55 E	0.125-0.125	56	-	-	-	-	-	-
tridiphane	2 EC	1.0	53	-	-	30	-	-	46
	2 EC	1.5	83	-	76	56	70	94	84
	2 EC	2.0	93*	97*	80	79	88	-	68
	2 EC	1.0-1.0	67	99	-	59	95	-	91
	2 EC	2.0-2.0	-	-	-	-	-	-	98*
	0.863 G	1.5	-	-	-	57*	-	-	57
	0.863 G	2.0	-	-	-	-	-	-	69
	0.863	1.5-1.5	-	-	-	88*	-	-	92*
	0.863	2.0-2.0	-	-	-	-	-	-	97*
	0.863 G+fert	1.5	-	-	-	7	-	-	-
	0.863 G+Fert	1.5+1.5	-	-	-	31	-	-	-
tridiphane +	2 EC+1.7 EC	1.0+0.25	-	-	86	-	-	-	-
fluroxypyr	2 EC+1.7 EC	1.5+0.5	-	-	94	-	93	-	-
% Crabgrass cover in checks			91	52	66	80	72	17	61
Evaluation date			9/5	9/8	9/8	9/5	9/11	9/5	9/6
# Date of second treatment			6/14	7/8	-	7/22-8/1	8/1	8/1	8/1-7

* Objectionable turf injury. Injury rated on scale of 1 - 10: 10 = brown, 2 = objectionable.

1 Species in test area: PR = perennial ryegrass, KB = Kentucky bluegrass, RF = red fescue.

2 Crabgrass stage in test area at time of first treatment.

FACTORS INFLUENCING FENOXAPROP EFFICACY

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ABSTRACT

The influences of plant growth stage, spray volume, additional surfactant, formulation and tank mixing with preemergent herbicides on fenoxaprop-ethyl activity were evaluated in a series of experiments. Tests were conducted in areas of drought stress and on irrigated turf.

Turfgrass infested with smooth crabgrass (Digitaria ischaemum #DIGIS) was treated with fenoxaprop at three growth stages: 2 to 4 true leaves (EP), 1 to 3 tillers (MP) and 3 to 5 tillers (LP). In 1985 experiments excellent control of crabgrass was achieved with EP applications and good control (>90%) was achieved with MP and LP treatments. However, in 1986 experiments poor control was observed with EP and MP applications with fair control with LP treatments. The differences between years is attributed to severe drought stress in 1986.

Spray volume and additional surfactant were evaluated under stressed and non-stressed conditions. Fenoxaprop was applied to tillered crabgrass at 15, 30, 60, and 120 gpa using flat fan nozzles. Flooding nozzles were compared at 120 gpa. All volume and nozzle treatments were applied with and without an additional 1/4% v/v nonionic surfactant. Control at 15 gpa was less than at other spray volumes. Control was also decreased when applications were made with a flooding nozzle as compared to flat fan nozzles. The addition of surfactant improved the weed control for flooding nozzle applications but not to a point comparable to flat fan nozzle applications. Under non-stressed conditions control was less at 15 gpa than at 30, 60 or 120 gpa. Flooding nozzle applications were equally effective as flat fan treatments when applied to non-stressed turf.

The EC and EW formulations were compared in the spray volume experiment. No differences were observed between the two formulations.

The major factor influencing fenoxaprop activity in 1986 was drought stress. Severe reductions in control were observed in experiments conducted in areas of drought as compared to previous experiments or to tests on irrigated turf. Tank mixing with preemergent herbicides improved early postemergent control of drought stressed crabgrass; with the pendimethalin tank mix providing better control than tank mixes with DCPA or bensulide.

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EVALUATION OF SAFENING AGENTS FOR FENOXAPROP-ETHYL

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ABSTRACT

Injury of Kentucky bluegrass (*Poa pratensis*) and bentgrass (*Agrostis palustris*) by fenoxaprop, in the form of discoloration and reduced growth, has been observed under certain environmental and management conditions. A number of additives have been evaluated for their ability to safen or mask this phytotoxic effect. These include plant growth regulators, nutrients, phenoxy and other broadleaf herbicides. The combination of a nonburning nitrogen source (21.8 lb N/A) and chelated iron (0.54 lb Fe/A) applied in tank mix with or sequentially to fenoxaprop, has proven most effective and least antagonistic. Other additives have effected various turf responses, including herbicide antagonism, undesireable growth responses, increased injury, and no response. The safening ability of the nitrogen + iron combination is limited to a maximum of 20% injury. It has been observed in mature and seedling bluegrass, and mature bentgrass.

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PHYTOTOXIC EFFECTS OF SOME HERBICIDES APPLIED TO BENTGRASS

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ABSTRACT

Fenoxaprop caused an unacceptable level of discoloration to creeping bentgrass (Agrostis palustris Huds. 'Penncross') turf at rates of 0.06 lb ai/A or above. When fenoxaprop (0.04, 0.06 and 0.08 lb ai/A) was tank mixed with a safener (0.55 lb/A Fe plus 0.5 lb N/1000 ft^2) acceptable turf quality was maintained. The high rate of fenoxaprop (0.12 lb ai/A) plus safener elicited an objectionable yellow-brown mottling of turf. Oxadiazon (3.0 lb ai/A), pendimethalin (1.5 lb ai/A), diclofop (2.0 lb ai/A) and prodiamine (0.5 + 0.5, 0.75 + 0.75 and 1.0 + 1.0 lb ai/A) caused unacceptable discoloration or loss of density in creeping bentgrass. Fenoxaprop tank mixed with safener plus either pendimethalin or prodiamine caused severe injury and loss of bentgrass turf. Diclofop applied at 1.0 lb ai/A discolored turf for about 10 days, but the 0.5 lb ai/A caused no visual injury to bentgrass.

INTRODUCTION

Fenoxaprop [(±)-2[4-[(6-chloro-2-benozoxazolyl)oxy]phenoxy]propanoic acid] has been shown to effectively control crabgrass (Digitaria spp) postemergently (2). Fenoxaprop, however, is injurious to creeping bentgrass (Agrostis palustris Huds.). When tank-mixed with safeners (chemistry undisclosed), Bhowmik and Eichenlaub (1) observed that the injurious effects of fenoxaprop could be minimized or negated. Diclofop (methyl 2-[4-(2,4 diclorophenoxy)phenoxy] propanoate) has been shown to effectively provide postemergence goosegrass [Eleusine indica (L) Gaertn.] control (3), but its safety to creeping bentgrass needs documentation. Prodiamine [N^3,N^3-Di-n-propyl-2,4-dinitro-6- (trifluoromethyl)-m-phenylenediamine] and pendimethalin [N-(1-ethylpropyl)-3,4 dimethyl-2,6 dinitrobenzenamine] are effective preemergence crabgrass herbicides (4), however, their safety to creeping bentgrass also needs assessment. Hence, the primary objectives of these studies were to determine the sensitivity of creeping bentgrass to fenoxaprop, diclofop, pendimethalin and prodiamine.

METHODS AND MATERIALS

This investigation involved three separate studies. In Study I, fenoxaprop was applied alone or tank-mixed with a safener. The safener consisted of a mixture of 0.55 lb ai/A of chelated iron (a complex of potassium iron phosphate-citrate) and 0.50 lb N/1000 ft^2 from a 7.2% methylene urea + 4.5% water insoluble N + 6.3% urea fertilizer. In Study II, diclofop, oxadiazon [2-tert-butyl-4-(2,4-dichloro-5-isopropoxyphenyl)-Δ^2-1,3,4-oxadiazolin-5-one], pendimethalin and prodiamine were applied separately. In Study III, diclofop was applied alone and fenoxaprop plus safener were applied alone or tank-mixed with pendimethalin or prodiamine.

Studies I and II were conducted on a Penncross creeping bentgrass turf maintained at low N and at a 0.25 inch height in Silver Spring, MD. Soil in

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Silver Spring was sandy loam with a pH of 7.6 and 1.9% organic matter. Study III was conducted on a Penncross nursery at Woodmont C.C. in Rockville, MD. The latter turf was well nourished, maintained at 0.19 inch height and grown on a silt loam with a pH of 6.4 and 3.6% organic matter. Smooth crabgrass [Digitaria ischaemum (Schreb.) Muhl] was 5 leaf to 2 tiller stage and goosegrass was in the 4 to 7 leaf stage when herbicides were applied at Rockville. All sprayable herbicides were applied in 50 gpa at 38 psi with a backpack sprayer and granulars were applied with a shaker bottle. Dates and rates of applications appear in data tables.

Plot size in each study was 5.0 by 5.0 ft and arranged in a randomized complete block with either three (Studies I and II) or four (Study III) replications. Injury was visually assessed as a percent of plot area exhibiting green and healthy turf. Overall quality was visually estimated on a 0 to 10 scale where 0 = dead or brown turf and 10 = optimum green color and density. Weed cover was visually estimated on a basis of percent plot area colonized. Annual grass populations exceeding 0.25% cover were subjectively judged as unacceptable under putting green conditions. All data were analyzed using analysis of variance and significantly different means were separated using the Bayes LSD at the 5% level.

RESULTS AND DISCUSSION

Study I No apparent injury was observed by any fenoxaprop treatment until 26 June, eight days after treatment (+ 8 DAT) (Table 1). Fenoxaprop without safener caused unacceptable injury at rates exceeding 0.06 lb ai/A; however, the 0.04 lb ai/A rate did not injure turf. When fenoxaprop was mixed with the safener, injury to turf was effectively reduced at all rates except 0.12 lb ai/A. Although the 0.12 lb ai/A + safener treatment did not statistically enhance injury, the discoloration (described below) elicited was unacceptable. The same trends were evident through 11 July, when sequential 0.04 and 0.06 lb ai/A + safener treatments were applied. The sequentially treated plots exhibited no increase in injury on 17 July (+ 6 DAT). High injury levels observed in all plots on 24 July was due to yellowing from a broadleaf phenoxy herbicide applied on 21 July and algae infestation from excessive irrigation.

Although no injury was observed on 22 June, safener treated plots exhibited improved color, which enhanced overall quality (Table 2). Discoloration from fenoxaprop alone was first observed + 6 DAT and intensified during the 8 to 12 day period following application. Discoloration remained unacceptable in all non-safened fenoxaprop treatments, except the 0.04 lb ai/A rate, until 17 July. The 0.12 lb ai/A + safener treatment elicited a yellow-brown mottling of turf, which would be considered objectionable by most golf course superintendents. The mottling, however, was only noticeable when close to turf, thereby not affecting overall quality ratings significantly. Sequential, safener treatments (i.e. 0.06 + 0.06 and 0.12 + 0.06 lb ai/A) tended to darken the green color, but also intensified the brown mottling. Observations indicated that a single application of fenoxaprop + safener at 0.04, 0.06 and 0.08 lb ai/A rates provided acceptable quality. However, single or sequential safener applications at the 0.12 lb ai/A rate generally caused objectionable levels of discoloration.

Study II On 20 May (+ 11 DAT) prodiamine (1.0 lb/A) and pendimethalin treated turf exhibited some browning; however, unacceptable injury was apparent in diclofop and oxadiazon treated plots (Table 3). While injured turf had

recuperated, unacceptable injury was again observed 29 May in oxadiazon and diclofop (2.0 lb ai/A) treated bentgrass. Except for the high rate of diclofop, no significant injury ratings were collected on 13 or 26 June; however, by 3 July diclofop (2.0 lb/A) treated turf had recovered. On 3 July, one week following sequential herbicide applications, prodiamine treated plots developed a brownish color, with healthier foliage exhibiting a droughty, blue-green color. Oxadiazon treated turf displayed a yellowish-brown color. By 24 July, extensive and severe injury was evident in all prodiamine treated plots. Some recovery of turf was noted in prodiamine treated plots by 22 Aug; however, plots exhibited a 17 to 26% loss in turf cover. Sequentially treated diclofop plots (1.0 + 0.5 lb/A) exhibited no injury. Data indicate that all Study II treatments, except lower rates of diclofop, were too injurious for use on bentgrass turf.

Study III Early 1986 test results suggested that diclofop, pendimethalin and prodiamine discolored turf slightly, but may have potential for use on bentgrass (Table 1, 2 and 3). On 1 July, this study was initiated to determine if low rates of diclofop alone or fenoxaprop + safener tank mixes with prodiamine or pendimethalin would be safe on bentgrass. Data collected 14 July (+ 13 DAT) showed that all fenoxaprop tank mixtures were extremely damaging to the turf (Table 4). Injury intensified in all tank mixed treatments over time. Fenoxaprop + safener alone caused unacceptable injury at both 0.06 and 0.12 lb ai/A rates. Diclofop applied at the 1.0 lb ai/A rate discolored turf for about 2 weeks. Plots treated with diclofop at 0.5 lb/A on 1 July and re-treated with 0.08 lb/A fenoxaprop + safener on 14 July were not injured.

All treatments reduced annual grass weed populations (Table 4). Diclofop effectively controlled goosegrass, but not crabgrass. When plots were treated with both diclofop (0.5 lb ai/A on 1 July) and fenoxaprop + safener (0.08 lb ai/A or 14 July) crabgrass and goosegrass were effectively controlled. Despite a severe loss of turf cover in plots treated with fenoxaprop + safener and either pendimethalin or prodiamine, weeds were postemergently controlled and there was no reinfestation from germinating seed.

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Table 1. Fenoxaprop injury to Penncross creeping bentgrass as determined by visual estimates of the percentage of plot area exhibiting green and healthy cover in Silver Spring, MD, 1986.

Treatment[a]	Rate applied 18 June	Plot area green 22 June	26 June	30 June	3 July	7 July	11 July	Rate applied 11 July	Plot area green 17 July	24 July
	(lb ai/A)	(%)						(lb ai/A)	(%)	
Fenoxaprop	0.04	100a[b]	94a	93ab	96a	92ab	94ab	0.04	95a	63b
Fenoxaprop + Safener	0.04	98a	97a	95a	97a	95ab	96a	0.04	95a	86a
Fenoxaprop	0.06	98a	88ab	84b	87ab	82cd	85d	*	93a	70ab
Fenoxaprop	0.06	99a	91ab	84b	93ab	89bc	90bc	0.06	95a	70ab
Fenoxaprop + Safener	0.06	99a	97a	96a	97a	97a	98a	0.06	94a	81ab
Fenoxaprop	0.08	98a	83b	52c	84ab	76d	87cd	*	95a	75ab
Fenoxaprop + Safener	0.08	98a	94a	92ab	96a	97a	96a	*	96a	83ab
Fenoxaprop	0.12	99a	88ab	57c	78ab	76d	86cd	*	95a	81ab
Fenoxaprop + Safener	0.12	98a	88ab	87ab	89ab	90ab	93ab	0.06	87b	81ab
Untreated	—	99a	96a	91ab	97a	90ab	89bcd	—	96a	84ab

[a]Safener consisted of a mixture of 0.55 lb ai/A of iron plus 0.5 lb N/1000 ft^2 of methylene urea (18N-0-0).

[b]Means in a column followed by the same letter are not significantly different at the 5% level according to the Bayes LSD.

*Treatment not applied.

Table 2. Overall quality of Penncross creeping bentgrass treated with fenoxaprop or fenoxaprop plus safener in Silver Spring, MD, 1986.

Treatment[a]	Rate applied 18 June	Overall quality 26 June	30 June	3 July	7 July	11 July	Rate applied 11 July	Overall Quality 17 July	24 July
	(lb ai/A)	(0-10 scale)					(lb ai/A)	(0-10-scale)	
Fenoxaprop	0.04	7.2bc[b]	6.7ab	7.2ab	6.8bc	6.9bc	0.04	7.1ab	5.0a
Fenoxaprop + Safener	0.04	8.2a	7.9a	7.9a	7.9a	8.3a	0.04	7.7a	6.3a
Fenoxaprop	0.06	6.1e	6.6ab	6.2bc	5.8de	5.9de	*	7.0ab	5.6a
Fenoxaprop	0.06	6.9cd	6.0bc	6.9b	6.6bcd	6.2cd	0.06	7.0ab	5.3a
Fenoxaprop + Safener	0.06	8.3a	7.9a	8.0a	8.2a	8.1a	0.06	7.7a	5.8a
Fenoxaprop	0.08	6.2de	5.1cd	5.9c	5.7e	5.8de	*	7.3a	5.2a
Fenoxaprop + Safener	0.08	7.8ab	7.5a	7.9ab	8.0a	7.9a	*	7.9a	6.4a
Fenoxaprop	0.12	6.2de	4.4d	5.5c	5.9de	5.4e	*	7.1ab	6.2a
Fenoxaprop + Safener	0.12	7.3bc	6.9ab	7.2ab	7.4ab	7.6ab	0.06	6.7ab	5.9a
Untreated	—	7.2bc	6.8ab	7.1ab	6.4cde	6.5cd	—	7.4a	6.3a

[a]Safener consisted of a mixture of 0.55 lb ai/A of iron plus 0.5 lb N/1000 ft^2 of methylene urea (18N-0-0).

[b]Means in a column followed by the same letter in the same column are not significantly different at the 5% level according to the Bayes LSD.

*Treatment not applied.

Table 3. Preemergence herbicide injury to Penncross creeping bentgrass as determined by visual estimates of the percentage of plot area exhibiting green and healthy cover in Silver Spring, MD, 1986.

Treatment	Rate[a]	Plot area green									
		20 May	29 May	13 June	26 June	3 July	17 July	24 July	4 Aug[b]	13 Aug[b]	22 Aug[b]
	(lb ai/A)	(%)									
Prodiamine 65WDG	0.5 + 0.5	94a[c]	98a	96a	89a	86a	89a	45b	72ab	65abc	83ab
Prodiamine 65WDG	0.75+0.75	95a	98a	97a	86a	86a	88a	42b	62ab	62bc	80ab
Prodiamine 65WDG	1.0 + 1.0	90a	98a	97a	86a	87a	86a	30b	40c	42c	74b
Pendimethalin 60 DG	1.5 + 1.5	90a	93bc	94a	83a	96a	87a	35b	70ab	84ab	95a
Diclofop 3EC	1.0 + 0.5	75b	97a	96a	88a	92a	92a	82a	85a	92ab	94ab
Diclofop 3EC	2.0	42c	70d	60b	77a	90a	98a	82a	90a	94ab	98a
Oxadiazon 2G	3.0	72b	91c	95a	80a	82a	86a	78a	89a	88ab	96a
Untreated	---	93a	96ab	95a	79a	88a	94a	83a	88a	95a	98a

[a]Treatments were initially applied 9 May and sequentials were applied 26 June, 1986.

[b]Due to severe drought stress in one replicate, only data from two replicates were used in the analyses.

[c]Means in a column followed by the same letter are not significantly different at the 5% level according to the Bayes LSD.

Table 4. Penncross creeping bentgrass injury and overall quality as affected by fenoxaprop and fenoxaprop tank-mixes in Rockville, MD, 1986. Crabgrass and goosegrass cover were visually determined on 25 August 1986.

Treatment[a,b]	Rate applied 1 July	Rate applied 14 July	Plot area green			Overall quality			Cover	
			14 July	28 July	25 Aug	14 July	28 July	25 Aug	crabgrass	goosegrass
	---(lb ai/A)---		(%)			(0-10- scale)			(%)	
Fenoxaprop 1EC	0.06	0.06	89ab[c]	87a	86a	6.8a	5.4b	5.0b	0.0b	0.3b
Fenoxaprop 1EC + Prodiamine 65WDG	0.06 + 1.0	*	66c	48c	31b	5.6b	2.4cd	1.5c	0.0b	0.0b
Fenoxaprop 1EC Pendimethalin 60DG	0.06 + 2.0	*	47e	24d	20b	4.5c	1.6d	1.1c	0.0b	0.0b
Fenoxaprop 1EC	0.12	*	60cd	68d	87a	5.0bc	3.4c	4.9b	0.0b	0.2b
Fenoxaprop 1EC + Prodiamine 65WDG	0.12 + 1.0	*	56d	30d	30b	4.1cd	1.4d	1.6c	0.0b	0.0b
Fenoxaprop 1EC + Pendimethalin 60DG	0.12 + 2.0	*	36f	29d	24b	3.4d	1.5d	1.6c	0.0b	0.0b
Diclofop 3EC/ Fenoxaprop 1EC	0.5	0.08	94a	98a	99a	7.4a	7.5a	8.0a	0.0b	0.0b
Diclofop 3EC	1.0	*	86b	96a	98a	6.6a	7.1a	7.6a	0.8b	0.0b
Untreated	--	--	96a	96a	98a	7.5a	6.9a	8.0a	3.1a	0.7a

[a]Treatments were initially applied 1 July and sequential treatments were made 14 July, 1986.

[b]All fenoxaprop treatments were mixed with the nitrogen and iron safener.

[c]Means in a column followed by the same letter are not significantly different at the 5% level according to the Bayes LSD.

*Treatment not applied.

SELECTIVE CHEMICAL CONTROL OF BUNCH-TYPE PERENNIAL GRASSES

J. N. Rogers, III and T. L. Watschke[1]

ABSTRACT

A study to evaluate several compounds (sulfometuron methyl, metsulfuron methyl, chlorsulfuron, diclofop, sethoxydim, glyphosate and RE-40885) for selective control of tall fescue (Festuca arundinacea Schreb.) and orchardgrass (Dactylis glomerata L.) was initiated June 18, 1986. Treatments were applied on June 18, 1986, (except for RE-40885 which was applied July 22, 1986) with repeat application September 26, 1986, to 0.9 by 3.1 meter plots. The design was a randomized complete block design with three replications. Each compound was applied with a hand-held compressed air boom sprayer except for glyphosate which was applied with a wick (Walk-a-Wick, Coolidge, AZ). In addition, one treatment of sulfometuron methyl, metsulfuron, methyl, and cholorsulfuron was applied by wick. Injury to tall fescue, orchardgrass and fine textured species, [fine fescue (Festuca rubra L.) and Kentucky Bluegrass (Poa pratensis L.] were rated periodically throughout the study. Percent reduction of orchardgrass and tall fescue clumps was rated on October 31, 1986.

Diclofop, sethoxydim and sulfometuron methyl caused the most severe injury to tall fescue. Sulfometuron methyl treated tall fescue sustained the longest injury. Of the chemicals applied, only diclofop did not injure fine textured species. Chlorsulfuron treated turf had intermediate injury on both tall fescue and fine textured grasses. Metsulfuron methyl and RE-40885, had little effect on any of the grasses. Glyphosate also had little effect on the grasses, however, this was due to the application method.

Only sulfometuron methyl caused significant reduction in orchardgrass. Diclofop at the high rate caused some injury to orchardgrass, but was significantly less than sulfometuron methyl after the second application.

The wick applied treatments, except glyphosate, caused greater injury to all species following the second application compared to the first. All wick applied materials utilized double the highest sprayer rate.

Over the 135 day period, diclofop and sulfometuron methyl were most effective in percent reduction of tall fescue. Only sulfometuron methyl adequately reduced orchardgrass.

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Table 1. Effect of herbicides on orchardgrass, tall fescue and fine textured species injury[1] to orchardgrass, tall fescue, and fine textured species from application of nonselective herbicides in 1986.

		Orchardgrass						Tall Fescue						Fine Textured Species					
Herbicide	Rate, kg/ha	7-9		8-8		10-31		7-9		8-8		10-31		7-9		8-8		10-31	
1. Sulfometuron methyl	0.070	5.0[2]	a	1.0	b	6.3	a	6.3	a	8.7	a	6.3	bc	6.8	a	7.3	a	7.3	a
2. Sulfometuron methyl	0.053	3.3	ab	1.3	b	7.0	a	6.3	a	8.3	ab	7.0	b	6.8	a	7.7	a	7.7	a
3. Sulfometuron methyl	0.035	3.3	ab	1.0	b	5.0	b	5.3	ab	6.0	bc	6.7	b	5.0	bc	4.7	b	7.3	a
4. Metsulfuron methyl	0.070	1.0	c	1.0	b	1.0	d	1.5	f	1.0	e	3.0	fg	1.5	fg	1.0	e	2.0	cd
5. Metsulfuron methyl	0.053	1.0	c	1.0	b	1.0	d	1.8	ef	1.7	e	2.0	gh	1.7	efg	1.0	e	1.7	cd
6. Chlorsulfuron	0.21	1.0	c	1.0	b	1.0	d	3.7	bcde	1.3	e	4.7	de	1.8	efg	3.0	c	1.7	cd
7. Chlorsulfuron	0.28	1.0	c	1.0	b	1.0	d	4.7	abcd	2.0	e	4.3	de	3.0	de	3.7	bc	1.7	cd
8. Diclofop	4.48	4.7	a	1.7	b	3.3	c	4.7	abcd	1.0	e	8.7	a	4.0	cd	1.0	e	2.0	cd
9. Diclofop	2.24	3.7	ab	1.0	b	1.0	d	5.0	abc	1.0	e	6.7	b	2.3	efg	1.0	e	1.0	d
10. Sethoxydim	0.31	2.0	bc	1.7	b	1.3	d	5.0	abc	2.3	de	5.3	cd	6.0	ab	1.0	e	6.7	a
11. Glyphosate (W)[3]	4.48	1.0	c	1.3	b	1.3	d	3.0	cdef	1.0	e	1.3	h	2.3	efg	1.0	e	1.0	d
12. Glyphosate (W)	2.24	1.0	c	1.3	b	1.0	d	1.8	ef	1.0	e	1.0	h	2.7	def	1.0	e	1.0	d
13. Sulfometuron methyl (W)	0.14	1.0	c	1.0	b	2.0	d	2.8	def	2.0	e	6.0	bc	2.7	def	1.0	e	7.0	a
14. Metsulfuron methyl (W)	0.14	2.0	bc	1.0	b	2.0	d	1.5	f	1.0	e	4.7	de	2.2	efg	1.0	e	5.3	b
15. Chlorsulfuron (W)	0.56	1.0	c	1.0	b	1.0	d	1.8	ef	1.0	e	3.7	ef	1.5	fg	1.3	de	2.3	c
16. RE-40885	1.68	1.0	c	4.3	a	1.0	d	1.0	f	4.7	cd	2.7	fg	1.0	g	2.7	cd	1.3	cd
17. Check	----	1.0	c	1.0	b	1.0	d	1.0	f	1.0	e	1.0	h	1.0	g	1.0	e	1.0	d

1/ Injury 1-9; 1 = no injury, 9 = dead

2/ Means in the same column followed by the same letter are not significantly different at the 0.05 level of Bayes LSD Multiple Comparison Test

3/ W = wick application

Table 2. Reduction of orchardgrass and tall fescue from applications of nonselective herbicides in 1986.

Herbicide	Rate, kg/ha	Orchardgrass (%)		Tall fescue (%)	
1. Sulfometuron methyl	0.070[1]	71	a	59	ab
2. Sulfometuron methyl	0.053	77	a	47	bcd
3. Sulfometuron methyl	0.035	39	bc	30	b-g
4. Metsulfuron methyl	0.070	29	cd	12	e-h
5. Metsulfuron methyl	0.053	7	de	23	c-h
6. Chlorsulfuron	0.21	5	de	47	bcd
7. Chlorsulfuron	0.28	16	cde	38	b-e
8. Diclofop	4.48	23	cde	83	a
9. Diclofop	2.24	19	cde	51	bc
10. Sethoxydim	0.31	23	cde	35	b-f
11. Glyphosate (W)[2]	4.48	20	cde	7	gfh
12. Glyphosate (W)	2.24	16	cde	22	c-h
13. Sulfometuron methyl (W)	0.14	64	ab	21	d-h
14. Metsulfuron methyl (W)	0.14	17	cde	2	gh
15. Chlorsulfuron (W)	0.56	11	cd	17	e-h
16. RE-40885	1.68	0	e	0	h
17. Check	----	0	e	0	h

1/ Means in the same column followed by the same letter are not significantly different at the 0.05 Level of Bayes LSD Multiple Comparison Test.

2/ W = wick application

SELECTIVE CONTROL OF TALL FESCUE IN KENTUCKY BLUEGRASS

PETER H. DERNOEDEN[1/]

ABSTRACT

Various rates of chlorsulfuron, diclofop and metsulfuron were evaluated for their safety and efficacy in controlling 'K-31' tall fescue (Festuca arundinacea Schreb.) in Kentucky bluegrass (Poa pratensis L.) turf in two, separate studies. In Study I (Table 1) soil was a Chillum silt loam with a pH of 5.9 and 3.7% organic matter. The bluegrass was 'South Dakota' and plot size was 1.5 by 1.5 m. In Study II (Table 2) soil was a Sassafrass sandy loam with a pH of 6.3 and 1.0% organic matter. The bluegrass was 'Kenblue' and plot size was 1.5 by 3.0 m. Herbicides were applied at the rates and dates given in Tables 1 and 2 in 467 L ha^{-1} at 262 kPa. The statistical design in both tests was a randomized complete block with four replications. Tall fescue control was determined by counting the number of plants in each plot. Density was visually determined on a 0 to 100% scale where 0 = brown or dead turf and 100 = entire plot area green.

In Study I, tall fescue control was first assessed the spring following fall 1984 application(s) of herbicides (Table 1). On 16 April 1985, data showed that all treatments had significantly reduced tall fescue populations. The best level of control was provided by chlorsulfuron applied at 0.067 + 0.067 kg ai ha^{-1}. In spring 1985 all plots were retreated and diclofop rates were increased. Data collected on 15 May 1986 revealed that the high rate of diclofop (2.24 + 2.24 kg ai ha^{-1}) and two chlorsulfuron treatments (0.067 + 0.067 and 0.140 + 0.140 kg ai ha^{-1}) had provided over 90% tall fescue control. No turf injury was observed following fall 1984 application(s) of any herbicide treatment. About one month following sequentially applied chlorsulfuron treatments in 1985, however, a stunting and yellowing of turf was observed. By July 1985, all chlorsulfuron treated plots, except the single, 0.034 kg ai ha^{-1} rate, had caused a significant (18 - 48%) reduction in bluegrass density (data not shown in table form). Between August and October 1985 chlorsulfuron plots treated at 0.067 + 0.067 and 0.140 + 0.140 kg ai ha^{-1} exhibited density reductions ranging from 13 to 24% (data not shown in table form). Turf in aforementioned chlorsulfuron treatments showed good recovery in December 1985, but full recovery was not observed until May 1986.

In Study II, herbicides were only applied once or sequentially in fall 1985 (Table 2). Data collected in August 1986 showed that all chlorsulfuron and metsulfuron treatments had provided over 90% tall fescue control. Diclofop treatments provided poor (52%) to good (85%) tall fescue control. All diclofop treated plots, except the single 4.48 kg ai ha^{-1} treatment, severely reduced stand density. Plots treated sequentially at 2.24 + 2.24 kg ai ha^{-1} had recovered by July 1986 (i.e. 8 months following the second application). During the eight and nine month period following applications of chlorsulfuron or metsulfuron, respectively, no reductions in stand density were observed. In July 1986, however, the test area was not irrigated and turf entered drought dormancy. Following judicious irrigation, plots were rated for density on 2 August 1986. On that date, all chlorsulfuron (except 0.067 + 0.067 kg ai ha^{-1} treatment) and diclofop (4.48 + 4.48 kg ai ha^{-1}) treated plots had significantly reduced density ratings when compared to the untreated control. Data indicated that a single application of metsulfuron provided the best combination of tall fescue control and safety to Kenblue Kentucky bluegrass.

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Table 1. A comparison of various rates of chlorsulfuron and diclofop for selective K-31 tall fescue control in South Dakota Kentucky bluegrass.

Treatment	Rate applied 1984		Tall Fescue 16 Apr 1985	Rate applied 1985		Tall Fescue		Tall Fescue Control[b]
	14 Sept	12 Oct		10 Apr	16 May	10 Sept 1985	15 May 1986	
	--(kg ai ha^{-1})--		(plants/plot)	(kg ai ha^{-1})		------(plants/plot)------		(%)
Chlorsulfuron 75DG	0.034	*	10.8b[a]	0.034	*	8.2b	10.5b	30
Chlorsulfuron 75DG	0.034	0.034	7.8bcd	0.034	0.034	2.2cd	3.0c	80
Chlorsulfuron 75DG	0.067	*	10.0bc	0.067	*	5.0bc	4.8c	68
Chlorsulfuron 75DG	0.067	0.067	4.5d	0.067	0.067	0.0d	0.2d	99
Chlorsulfuron 75DG	0.140	*	7.2bcd	0.140	0.140	0.2d	1.2cd	92
Diclofop 3EC	1.12	*	9.0bc	2.24	*	6.2bc	4.5c	70
Diclofop 3EC	1.12	1.12	6.5cd	2.24	2.24	0.2d	0.5d	97
Untreated	—	—	18.0a	—	—	14.5a	15.0a	--

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

[b]Control based on data collected 15 May 1986.

Table 2. Selective K-31 tall fescue control in Kenblue Kentucky bluegrass with chlorsulfuron, diclofop and metsulfuron methyl and herbicides effects on stand density.

Treatment	Rate[a]	Density 1985	Density 1986					Tall fescue[c]	
		17 Dec	14 Mar	16 Apr	3 July	2 Aug	15 Oct	Plants	Control
	(kg ai ha^{-1})	---------- (0-100% scale) ----------						(plants/plot)	(%)
Chlorsulfuron 75DG	0.067 + 0.067	99a[b]	99a	99a	86a	76abc	97ab	3.0de	97
Chlorsulfuron 75DG	0.140	99a	99a	98a	85a	74bcd	95ab	8.2cde	93
Chlorsulfuron 75DG	0.140 + 0.140	99a	99a	98a	81ab	71cd	94ab	1.5e	99
Chlorsulfuron 75DG	0.28	100a	100a	100a	80ab	75bcd	97ab	2.2de	98
Metsulfuron 60DG	0.067	100a	100a	100a	86a	80abc	95ab	10.5cde	91
Metsulfuron 60DG	0.140	99a	99a	100a	89a	81abc	97ab	7.8cde	93
Diclofop 3EC	2.24 + 2.24	88bc	86b	86a	86a	86ab	97ab	55.0d	52
Diclofop 3EC	3.36 + 3.36	41d	51d	51b	64c	76abc	96ab	21.2c	82
Diclofop 3EC	4.48	97ab	98a	96a	88a	86ab	98ab	45.2b	61
Diclofop 3EC	4.48 + 2.24	78c	72c	58b	73bc	80abc	97ab	20.8c	82
Diclofop 3EC	4.48 + 4.48	26e	29c	22c	50d	61d	94b	17.0cd	85
Untreated Control	---	100a	100a	100a	90a	90a	97ab	115.0a	--

[a]Herbicides were initially applied 25 Sept and sequential treatments were applied 25 Oct 1985.

[b]Means in a column followed by the same letter are not significantly different at the 5% level according to the Bayes LSD.

[c]Tall fescue plant counts were made 22 August 1986.

PGR Effects on Turfgrasses During Moisture Stress[1]

R. W. Duell, S. Sherman & F. Katz[2]

ABSTRACT

Three experimental PGR's, AC 247,466, AC 233,386 and AC 288,542 (chemical identity not released) at three rates each, were compared with recommended rates of three commercially available PGR's (two of which were mowed vs. unmowed), at both 25 and 100kg N/ha, over 14 turfgrasses which included three cultivars of Kentucky bluegrass (Poa pratensis), 4 perennial ryegrasses (Lolium multiflorum), four tall fescues (Festuca arundinacea), two fine fescues (F. rubra commutata and F. longifolia) and one mixture.

Rainfall in April, particularly prior to the application of PGR's on April 25, 1986, was above average, but that for May and June totaled only 24mm and 26mm respectively, about 25% of normal. This condition contrasted markedly with favorable rain distribution in 1985 when some of the same PGR and N-treatments were imposed on these same turf plots. With favorable rainfall PGR effects were best demonstrated in the high N regime and phytotoxicity was minimal. Under moisture stress PGR-induced differences were less dramatic and phytotoxic effects were more pronounced, especially in the higher N regimes. Nitrogen had moved into the root zone enough to produce notable color and height differences at the time of PGR application. Appreciable nitrogen from the 100 kg/ha application remained available in July when temperatures were high and rainfall resumed. Crabgrass volunteered in the chemically suppressed cool season turfgrasses with particular vigor in the high N plots, to the detriment of the sown species. 'Reliant' hard fescue was the most severely injured species where chemical retardation combined with high nitrogen and high temperatures.

The three rates of AC 247,466 appeared to be too low for effective retardation, particularly the early cultivar of Kentucky bluegrass, 'Newport', during the first four weeks after application. Thereafter, this PGR caused excessive discoloration and markedly reduced the stand of several grasses at the high and, to a lesser extent, the intermediate rate.

The AC 233,386 and AC 288,542 retarded foliar growth and seedheads to an extent similar to mefluidide and granular eptam. Discoloration ratings taken from these PGR treatments, under moisture stress, were also comparable to mefluidide and eptam. Mowing mefluidide treated and eptam treated plots increased severity of retardation and discoloration.

Interactions of cultivars and species of grasses with PGR treatments will be illustrated.

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[1] N. J. Agri. Expt. Sta. Publication No. K 15257-2-86

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PERFORMANCE OF MON - 8000 AND COMBINATIONS FOR CHEMICAL MOWING IN ROADSIDES

D.C. RIEGO [1]

ABSTRACT

Chemical mowing is the use of plant growth regulation as an alternative to mechanical mowing. There are basically four criterias for chemical mowing. They are one or combinations of turf grass seedhead suppression, growth regulation, quality and broadleaf weed control.

Currently, the most effective and accepted means of roadside turfgrass regulation is by use of the traditional method - by mechanical mowing. However, it has limitations. In addition, to hard-to-mow areas, mechanical mowing can be very expensive. Hence, the use of plant growth regulation was developed as another tool to mowing.

Field experiments were conducted in 1985 and 1986 to evaluate the performance of MON-8000 and various tank mix combinations for chemical mowing in roadsides. MON-8000 is the sodium sesqui salt of N-(phosphonomethyl glycine). MON-8000 plus chlorsulfuron or sulfometuron methyl provided long term growth and seedhead suppression of tall fescue in roadsides. In addition to tall fescue, MON-8000 + Sulfometuron methyl also provided long term growth and seedhead suppression of smooth brome. Both tank mix combinations provided excellent suppression of broadleaf weeds. Applications were made in the spring on actively growing plants at full green-up but before seedheads begin to emerge.

MON-8000 plus chlorsulfuron or sulfometuron methyl will be recommended for chemical mowing on roadside rights-of-way or other industrial sites where coarse turf are managed.

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CHEMICAL VEGETATION MANAGEMENT ON A PENNSYLVANIA ROADSIDE

Mark G. Prinster and Thomas L. Watschke[1]

ABSTRACT

Several growth retarding and herbicidal compounds were applied to a roadside to determine their effects on seedhead development, vertical foliar growth and tiller production of tall fescue (Festuca arundinacea Schreb.). Mefluidide 0.42 kg/ha, flurprimidol 1.68 kg/ha, mefluidide 0.28 kg/ha + flurprimidol 0.56 kg/ha, amidochlor 2.8 kg/ha, amidochlor 1.1 kg/ha + flurprimidol 0.56 kg/ha, EPTC 3.4 and 6.7 kg/ha, XE-1019 0.06 and 0.11 kg/ha, mefluidide 0.28 kg/ha + XE-1019 0.06 kg/ha, mefluidide 0.28 kg/ha + metsulfuron methyl 17.5 g product ha, glyphosate 0.12 kg/ha + sulfometuron methyl 17.5 g product/ha and glyphosate 0.12 kg/ha + chlorsulfuron 17.5 g product/ha were applied April 30, 1986, to 9.0 by 2.4 meter plots utilizing a randomized complete block design. EPTC was applied with a drop-type spreader and spray treatments were applied with a boom sprayer. Grass heights were measured periodically throughout the experiment. Seedhead suppression and foliar injury were visually rated. Tiller production was determined by counts in a randomly subsampled 20 by 20 cm quadrant. Total vegetation suppression (foliage, seedheads) was evaluated by fresh weight harvest of a 1.5 by 4.5 meter swath (10 cm height).

The mefluidide + metsulfuron methyl combination provided excellent seedhead suppression although it was not significantly greater than mefluidide alone, EPTC at 6.7 kg/ha, glyphosate + sulfometuron methyl and glyphosate + chlorosulfuron. All other treatments provided poor seedhead suppression.

The mefluidide + metsulfuron methyl combination and EPTC at 6.7 kg/ha caused unacceptable injury to tall fescue. Injury caused by XE-1019, flurprimidol, amidochlor + flurprimidol and glyphosate + chlorsulfuron was slight and insignificant. All other treatments caused some discoloration but the injury was assessed to be acceptable for roadside vegetation. Vegetation production was most suppressed by glyphosate + sulfometuron methyl although mefluidide + metsulfuron methyl, EPTC at 6.7 kg/ha, amidochlor and mefluidide alone caused similar results.

Glyphosate + sulfometuron methyl, mefluidide + metsulfuron methyl, glyphosate + chlorsulfuron, EPTC at 6.7 kg/ha, amidochlor and mefluidide alone significantly slowed the vertical foliar growth of tall fescue (height was measured six times throughout the experiment). Mefluidide + metsulfuron methyl reduced tiller dry weights the most followed by EPTC 6.7 kg/ha, mefluidide + flurprimidol, EPTC 3.4 kg/ha, amidochlor and flurprimidol alone. Total number of tillers was highest for turf treated with glyphosate + sulfometuron methyl. No other treatment was different from the check though turf treated with mefluidide + metsulfuron methyl tended to have the fewest tillers. Weight of individual tillers harvested from turf treated with XE-1019, amidochlor + flurprimidol, flurprimidol alone, glyphosate + chlorsulfuron and EPTC at 3.4 kg/ha was not different from tillers harvested from untreated turf. Glyphosate + sulfometuron methyl, EPTC at 6.7 kg/ha, amidochlor alone, and all treatments that included mefluidide significantly reduced individual tiller weight.

Glyphosate + chlorsulfuron and mefluidide showed the most potential for roadside use by effectively suppressing seedhead development and vertical foliar growth while causing minimal injury and stand loss.

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Effects of Imazapyr and Imazethapyr on Turfgrasses[1]

R. W. Duel, F. Katz and S. Sherman[2]

ABSTRACT

Imazapyr, an experimental PGR of American Cyanamid Co., alone and in combination with imazethapyr (Arsenal), a recently released herbicide from the same company, were applied to mono stands of 'Rebel' tall fescue (Festuca arundinacea), and also to 'Palmer', 'Prelude', and 'Pennant', cultivars of perennial ryegrass (Lolium perenne) on April 29, 1986. Comparisons were made with two commercially available PGR's as well as mowed and unmowed checks.

Rates of imazapyr and combinations with imazethapyr controlled seedhead and foliar growth of all four turfgrasses as well as recommended rates of mefluidide did, and better than amidochlor.

Discoloration caused by the experimental PGR's was rate related, and median doses were similar to that caused by mefluidide. Discoloration was minimal on Rebel tall fescue, but more objectionable at high rates on each of the three ryegrass cultivars.

Rebound effects, ie, increased green color and growth (clipping weights), were more notable and lasted longer with PGR-treated Rebel tall fescue than for the same treatments on many of the ryegrasses.

Two later applications of these PGR's, at weekly intervals, on adjacent plots of Pennant ryegrass produced more injury than the earliest application. Severe thinning of the Pennant ryegrass turf resulted from late applications of the highest rates of the experimental materials.

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[1] N. J. Agri. Expt. Sta. Publication No. K 15157-1-86

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WILD VIOLET CONTROL IN COOL SEASON TURF

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ABSTRACT

Three experiments were conducted during 1985 and 1986 to evaluate herbicide treatments for the control of common blue violet (Viola papilionacea Pursch) in cool season turf. In the experiment conducted in the spring of 1986 herbicide efficacy was also evaluated on Indian mockstrawberry [Duchesnea indica (Andr.) Focke] and ground ivy (Glechoma hederacea L.). Excellent control of common blue violet was obtained with repeat applications of 0.84 kg/ha 2,4-D + 0.84 kg/ha 2,4-DP in both amine and ester formulations, and 1.12 kg/ha 2,4-D ester + 0.56 kg/ha triclopyr. Excellent control was also obtained from single applications of 1.68 kg/ha 2,4-D + 1.68 kg/ha 2,4-DP in amine or ester formulations. The addition of 0.14 kg/ha of dicamba to the 2,4-D + 2,4-DP combination did not appreciably increase the level of control. In fall applied treatments where complete violet control was obtained, violets were again found by the following summer. This repopulation was attributed to seed production from cleistogamous flowers of the previous year.

Excellent ground ivy and Indian mockstrawberry control was obtained with 1.12 kg/ha 2,4-D + 1.12 kg/ha 2,4-DP in amine or ester formulations, 0.84 kg/ha 2,4-D amine + 0.84 kg/ha 2,4-DP amine + 0.14 kg/ha dicamba, 1.12 kg/ha 2,4-D ester + 0.56 kg/ha mecoprop + 0.11 kg/ha dicamba and 1.12 kg/ha 2,4-D ester + 0.56 kg/ha triclopyr. Control of these two species occurred within three weeks of herbicide application. Complete control of common blue violet was obtained at seven to eight weeks after treatment.

In summary, the best strategy to employ to control common blue violet was repeat herbicide applications at an interval of 10 to 14 days. Single application will require much larger herbicide dosages to obtain complete control and may cause turf injury.

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POSTEMERGENCE CONTROL OF SPURGE, VIOLET AND OXALIS IN TURF

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ABSTRACT

Prostrate spurge (Euphorbia supina Raf.), oxalis (Oxalis spp.) and violet (Viola spp.) are difficult to control weeds in turfgrass. Eight trials were conducted over several years to evaluate herbicides, alone and in combination, for control of these weeds. The herbicides, rates and dates of application are shown in Table 1. Treatments were applied to replicated plots as sprays in water at the rate of 50 to 75 gallons per acre. No rainfall occurred within 36 hours following treatment. One of the three spurge trials was on a velvet bentgrass putting green and all other trials were on lawns with the grasses indicated in the Table. Percent control determinations were computed by comparing initial and final estimates of weed cover with adjustments made to account for changes in untreated plots. The time interval between treatment and control is shown in the Table. Turf injury estimates were made periodically throughout the tests.

Results for control of spurge, violet and oxalis are presented in Table 1. Percent control of 85% or higher was considered excellent control. The only treatment to cause objectionable turf injury was 2,4-D + triclopyr applied to the velvet bentgrass putting green.

Spurge control. In the putting green test bromoxynil alone and in combination with dicamba, dichlorprop, mecoprop or triclopyr provided excellent control. 2,4-D + triclopyr was also effective but injured bentgrass. In the two lawn tests 2,4-D combinations with dichlorprop or triclopyr gave excellent control, while in one of the two tests bromoxynil (2 lb rate) was effective. Less than excellent control was obtained from bromoxynil combinations, 2,4-D, and 2,4-D combinations with dicamba, fluroxypyr, mecoprop, or dicamba + mecoprop.

Violet control. 2,4-D + picloram provided excellent control in both May and September trials. Two applications of 2,4-D + triclopyr gave excellent control in September. Violet appears to be more susceptible to herbicides applied in September than in May. Fluroxypyr, 2,4-D + dichlorprop and 2,4-D + mecoprop + dicamba provided less than excellent control.

Oxalis control. Combinations of 2,4-D with dichlorprop or triclopyr provided excellent control in June and August trials. 2,4-D + fluroxypyr, used only in August, gave effective control. The combination of 2,4-D + mecoprop + dicamba was effective in August, but not in June. Bromoxynil alone, bromoxynil plus dicamba or mecoprop, 2,4-D and 2,4-D plus dicamba or mecoprop, used only in the June study, provided less than excellent control.

In these weed control studies the amine formulations of 2,4-D plus either dichlorprop or triclopyr performed quite similar to the esther formulations.

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Table 1. Effectiveness of herbicides for the control of prostrate spurge, violet and oxalis in several turfgrass areas. 1981 - 1986

TREATMENT			PERCENT CONTROL[a] (weed amd treatmemt date)							
			SPURGE			VIOLET			OXALIS	
HERBICIDE	E=ester A= amine	LB ai/A	Jul 25[b] 1984	Jul 25 1984	Aug 22 1986	May 15 1985	Sep 18 1985	May 29 1986	Jun 18 1981	Aug 22 1986
bromoxynil	E	1	82	43	-	-	-	-	49	-
bromoxynil	E	1.5	89	68	-	-	-	-	-	-
bromoxynil	E	2	99	77	99	-	-	-	69	-
bromoxynil+dicamba	E+A	1 +.25	92	65	-	-	-	-	48	-
bromoxynil+dichlorprop	E	1 + .5	95	65	-	-	-	-	-	-
bromoxynil+mecoprop	E+A	1 + 1	96	72	-	-	-	-	79	-
bromoxynil+triclopyr	E	1 + .33	96	83	-	-	-	-	-	-
2,4-D	E	1	62	79	-	-	-	-	42	-
2,4-D+dicamba	A	1 + .25	-	59	-	-	-	-	25	-
2,4-D+mecoprop	A	1 + 1	-	58	-	-	-	-	50	-
2,4-D+fluroxypyr	A+E	1 + .5	-	-	62	-	-	-	-	100
fluroxypyr	E	.5	-	-	-	42	-	-	-	-
2,4-D+dichlorprop	E	1 + 1	-	97	95	10	26	-	85	98
(2nd application 11 days)			-	-	-	-	-	15	-	-
(2nd application 4 weeks)			-	-	-	-	69	-	-	-
2,4-D+dichlorprop	A	1 + 1	-	-	89	-	-	-	-	99
(2nd application 11 days)			-	-	-	-	-	15	-	-
2,4-D+dichlorprop+bromoxynil	E	1 + 1 + 1	-	-	-	0	-	-	-	-
2,4-D+dichlorprop+dicamba	E+E+A	.75+.75+.1	-	-	-	-	-	-	-	-
(2nd application 11 days)			-	-	-	-	-	15	-	-
2,4-D+dichlorprop+dicamba	E+E+acid	.75+.75+.19	-	94	-	2	40	-	-	-
2,4-D+mecoprop+dicamba	A	1+.5+.1	-	71	79	8	42	-	-	96
(2nd application 11 days)			-	-	-	-	-	9	-	-
(2nd application 4 weeks)			-	-	-	-	53	-	-	-
2,4-D+mecoprop+dicamba	A	1+.5+.125	-	-	-	-	-	-	21	-
2,4-D+picloram	A+K salt	1 + .125	-	-	-	-	99	76	-	-
2,4-D+picloram	E+K salt	1 + .25	-	-	-	97	-	-	-	-
2,4-D+picloram	A+K salt	1 + .25	-	-	-	-	100	-	-	-
2,4-D+triclopyr	E	.67 + .33	92*	89	-	-	-	-	-	-
2,4-D+triclopyr	E	1 + .5	-	95	87	46	83	29	98	100
(2nd application 11 days)			-	-	-	-	-	73	-	-
(2nd application 4 weeks)			-	-	-	-	99	-	-	-
2,4-D+triclopyr	A	1.1 + .42	-	87	82	17	-	-	-	100
Weed cover in checks - at treatment			14%	6%	6%	20%	28%	20%	28%	14%
at time of control			14%	12%	3%	24%	32%	24%	27%	5%

* Objectionable injury to velvet bentgrass of 2.4 on a scale of 0 to 10, 10 = brown. No other objectionable injury in the tests.

a Control data taken after treatment for spurge was 25-26 days, for violet 2-7.5 months and for oxalis 43-55 days.

b Velvet bentgrass putting green. Other test areas were lawns containing red fescue with some bentgrass while oxalis was in poor thin turf.

CONTROL OF KNOTWEED, WHITE CLOVER, AND OTHER BROADLEAF WEEDS IN TURF

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ABSTRACT

During 1985 and 1986 four field experiments were conducted in order to compare the efficacy of amine and ester formulations of 2,4-D and 2,4-DP on broadleaf weeds in cool season turf. Weed species present in the experiments included prostrate knotweed (Polygonum aviculare L.), white clover (Trifolium repens L.), broadleaf plantain (Plantago major L.), dandelion (Taraxacum officinale Weber in Wiggins) and mousear chickweed (Cerastium vulgatum L.). The amine and ester formulations of the combination of 1.12 kg/ha 2,4-D + 1.12 kg/ha 2,4-DP gave excellent control of white clover, broadleaf plantain, dandelion, and mousear chickweed but only fair (75-80%) control of prostrate knotweed. The 0.84 + 0.84 kg/ha rate of these combinations had a slight reduction in white clover control but were excellent on broadleaf plantain, dandelion, and mousear chickweed. Increasing the rate of the amine combination to 1.68 kg/ha 2,4-D + 1.68 kg/ha 2,4-DP did not appreciably improve prostrate knotweed control. The treatments of 1.12 kg/ha 2,4-D amine + 0.11 kg/ha dicamba, 1.12 kg/ha 2,4-D ester + 0.56 kg/ha triclopyr and 1.12 kg/ha 2,4-D ester + 0.56 mecoprop + 0.11 kg/ha dicamba provided good control of prostrate knotweed and excellent control of the other weed species.

The addition of 0.25, 0.5 or 1 kg/ha of bromoxynil to the amine combination of 1.12 kg/ha 2,4-D + 1.12 kg/ha 2,4-DP did not improve efficacy. The higher rates of bromoxynil caused a rapid necrosis of leaf tissue which appeared to reduce translocation of the phenoxy herbicides to the weed's root system. As a result, many weeds resprouted within four weeks of herbicide application. No turf phytotoxicity was observed with any of the treatments evaluated in the studies.

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Table 1. Efficacy of several herbicide combinations for the control of prostrate knotweed, white clover, broadleaf plantain, dandelion, and mousear chickweed in cool season turf.

treatment	rate (kg/ha)	phenoxy formulation	# of trials	% control POLAV	TRFRE	PLAMA	TAROF	CERVU
2,4-D + 2,4-DP	0.84 + 0.84	amine	2	67	95	100	100	100
2,4-D + 2,4-DP	1.12 + 1.12	amine	3	74	99	100	100	100
2,4-D + 2,4-DP	1.68 + 1.68	amine	3	79	99	100	100	100
2.4-D + 2,4-DP	0.84 + 0.84	ester	2	90	97	-	-	-
2,4-D + 2,4-DP	1.12 + 1.12	ester	3	80	99	100	100	100
2,4-D + 2,4-DP + Bromoxynil	1.12 + 1.12 + 0.56	amine	2	69	89	100	-	-
2,4-D + 2,4-DP + Bromoxynil	1.12 + 1.12 + 1.12	amine	1	68	75	100	-	-
2,4-D + dicamba	1.12 + 0.11	amine	2	82	94	100	100	100
2,4-D + triclopyr	1.12 + 0.56	ester	3	87	97	100	100	100
2,4-D + mecoprop + dicamba	1.12 + 0.56 + 0.11	ester	2	87	100	-	100	100
untreated control	- -	-	4	0	0	0	0	0

ANTAGONISM OF FENOXAPROP BY BROADLEAF HERBICIDES

Scott Harrison

ABSTRACT

The herbicidal action of fenoxaprop is significantly reduced when applied within several days of or in combination with various postemergence broadleaf herbicides, resulting in unacceptable levels of grassy weed control. Achieving near perfect grassy weed control while tank mixing with postemergence broadleaf herbicides is a key interest of applicators treating predominantly asthetic turf.

Several commercially available postemergence broadleaf herbicide formulations were evaluated in 1986 for their ability to be tank mixed with fenoxaprop without effecting significant antagonism. All of the broadleaf herbicides examined reduced fenoxaprop activity on tillered yellow foxtail (*Setaria lutescens*) to unacceptable levels. However, the same treatments provided 85 to 95% control of untillered yellow foxtail, even under severe drought conditions.

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EFFECTS OF TURFGRASS HERBICIDES ON ORNAMENTALS

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ABSTRACT

Preemergent and postemergent turfgrass herbicides were applied over and directed under various woody ornamentals to evaluate the potential for injury. Preemergence herbicides included pendimethalin, oxadiazon, prodiamine, EL-107, and benefin +/- trifluralin. Postemergence herbicides included fenoxaprop, dicamba and triclopyr.

No injury to taxus, California privet, San Jose' holly, white pine, Douglas fir, honeylocust resulted from prodiamine, EL-107, or pendimethalin treatments. Lilac was injured slightly by EL-107 and oxadiazon WP. Oxadiazon WP applications produced injury on hosta, azalea, lilac, honeylocust, and Japanese holly. Granular applications of oxadiazon produced injury to hosta only. Prodiamine produced only slight injury to azalea. Benefin and the benefin + trifluralin granule produced no injury when applied to Norway maple, Japanese holly and American holly.

Fenoxaprop produced no injury to a wide variety of ornamentals including taxus, privet, San Jose' holly, white pine, lilac, honeylocust and four varieties of junipers. Severe injury to Bar Harbour juniper was observed.

Dicamba and triclopyr were directed under taxus, forsythia and dogwood (Cornus stolonifera). Temporary growth malformations occured from root uptake at the 1x rate for both compounds. Severe injury from root uptake resulted when the herbicides were applied at $\geq$4X rates. Forsythia was more sensitive to root uptake injury than was taxus or dogwood.

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CONTROL OF CRABGRASS FROM FALL APPLIED PREEMERGENCE HERBICIDES

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ABSTRACT

An experiment was initiated in November of 1984 to compare the effectiveness of fall versus spring application of various rates of prodiamine and DCPA for the control of smooth crabgrass [Digitaria ischaemum (Schreb.) (Michx.)] in cool season turfgrass. Prodiamine 65 WDG and DCPA 75 W were applied at 0.28, 0.43, 0.56, 0.84, 2.24 and 8.4, 11.76, 16.8 respectively during fall 1984, spring 1985, fall 1985, and spring 1986. The turf was predominately fine fescue, maintained at moderate fertility, mowed with a rotary mower weekly at approximately 6 cm, and overseeded with smooth crabgrass between years.

Smooth crabgrass control for the various rates and application dates was rated on August 29, 1986. Only the high rate of prodiamine adequately controlled crabgrass (85% or above) during 1986 when applications were made the fall of 1984 or the spring of 1985. However, all rates except the lowest controlled crabgrass during 1986 when applied the fall of 1985. All rates controlled crabgrass in 1986 when applications were made in the spring of 1986. DCPA adequately controlled crabgrass in 1986 only when applied in the spring of 1986 (all rates). DCPA did provide control from fall applications, but was generally 15 to 20 percent less than prodiamine. Control from spring applications was not different between the two products.

Injury to fine fescue was rated on August 28, 1985. At that time, the two highest prodiamine rates had thinned the turf by 20 and 27 percent, respectively, as a result of treatment the previous fall. DCPA injury from treatment the previous fall was less severe. Spring treatment during 1985 resulted in comparable injury from the two highest rates of both herbicides. Injury was not apparent at the conclusion of the study (August 29, 1986). The population of fine fescue may have decreased and been replaced by other species in treatments that had caused significant injury.

Prodiamine provided excellent control of crabgrass at low application rates when applied in either spring or fall. DCPA also provided control, but not as completely as prodiamine.

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Table 1. The effect of fall and spring applications of prodiamine and OCPA on the preemergence control of smooth crabgrass in cool season turf. Applications were made November 14, 1984, April 23, 1985, October 24, 1985, and April 29, 1986. Control was rated on August 29, 1986. Injury rated August 28, 1985.

Treatments	Rates (kg ai/ha)	Application Timing					
		Fall '84		Fall '84-Fall '85	Spring '85		Spring '85-Spring '86
		CNT.	INJ.[1]	CNT.	CNT.	INJ.	CNT.
		%					
Prodiamine 65 DG	0.28	17	0	84	10	0	98
Prodiamine 65 DG	0.43	37	0	96	0	0	94
Prodiamine 65 DG	0.56	43	0	96	18	0	94
Prodiamine 65 DG	0.84	33	20	98	40	15	96
Prodiamine 65 DG	2.24	88	27	99	90	20	98
DCPA 75 W	8.40	15	0	75	27	0	96
DCPA 75 W	11.76	18	0	78	22	12	96
DCPA 75 W	16.80	30	5	75	15	18	97
Check	0.00	0	0	0	0	0	0

[1]Injury percentage is thinning of fine fescue.