Influence of Three Safeners on the Herbicidal Effects of Triasulfuron[1]

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ABSTRACT

In this study triasulfuron caused severe inhibition of corn growth. Triasulfuron at 60 uM caused a 69% reduction in shoot length and a 60% reduction in shoot dry weight. With the addition of 1mM of BAS-145138 the percent decreases in shoot length and dry weight were 35 and 33%, respectively. Similarly, corn roots were also partially protected by BAS-145138. Dichlormid and R-29148 also afforded partial protection to corn from the herbicidal activity of triasulfuron. For example, shoot length was reduced 32% by 20 uM triasulfuron but only 10% when 1 mM dichlormid was also added. Although complete protection of corn from triasulfuron was not given by BAS-145138, dichlormid, or R-29148, the results of this study offer hope that such protection may be found in the near future.

INTRODUCTION

Sulfonylurea herbicides represent a relatively new, highly active class of herbicides. The development of safeners to allow broader use of these compounds in corn (Zea mays L.) and/or sorghum [Sorghum bicolor (L.) Moench.] culture would be most useful. However, research on safeners for sulfonylurea herbicides has been limited.

The safener NA (1,8-naphthalic anhydride) has been shown to have good safening activity against chlorsulfuron {2-chloro-N-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzenesulfonamide} in corn (2,4,5,6). Good protection by NA and partial protection by cyometrinil {(Z)-α[(cyanomethoxy)imino] benzeneacetonitrile} to sorghum treated with chlorsulfuron has been observed (3). Devlin and Zbiec (1) have shown that BAS-145138 can partially protect corn from the sulfonylurea herbicides chlorimuron {2-[[[[(4-chloro-6-methoxy-2-pyrimidinyl)amino]carbonyl] amino]sulfonyl]benzoic acid}, chlorsulfuron, and sulfometuron {2-[[[[(4,6-dimethyl-2-pyrimidinyl)amino]carbonyl] amino]sulfonyl] benzoic acid}.

1/ Paper No. 3000. Massachusetts Agricultural Experiment Station, University of Massachusetts at East Wareham. This research project is supported from Experiment Station Project No. 629.

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In the present study the safening effects of the safeners BAS-145138, dichlormid, and R-29148 in corn treated with triasulfuron were observed.

MATERIALS AND METHODS

Corn seeds were soaked for 6 h in 1 mM solutions of BAS-145-138, dichlormid, or R-29148. The seeds were then sown in 9-cm styrofoam pots (15 seeds per pot) filled with moist vermiculite that had been previously treated on the suface with 5 ml of 0, 20, 40, or 60 uM of triasulfuron in water. The herbicide solution was applied as a fine spray using a small atomizer at 10 kPa. The seeds were covered with about one cm of untreated moist vermiculite. Petri dish halves were used as holders for the pots to catch drainage and as an indirect way to provide water and nutrients.

The plants were grown in a growth chamber under constant conditions of light (152 uE $m^{-2}s^{-1}$, 16 h light and 8 h dark) and temperature (22 1°C). After shoot emergence, 30 ml of 0.5 strength Hoagland solution was applied daily to each pot via the petri dish holders. After 12 days the seedlings were removed from the pots and the roots thoroughly washed. The 10 largest seedlings (determined by shoot length) from each pot were selected, and their shoot length, root length, fresh weight, and dry weight determined. All experiments were replicated four times and the data subjected to analysis of variance.

RESULTS AND DISCUSSION

Growth of corn was severly inhibited by triasulfuron. In the BAS-145138 experiments shoot length of corn treated with 20, 40, and 60 uM triasulfuron was reduced 50, 57, and 73%, respectively (Table 1).

In the dichlormid and R-29148 experiments similar inhibition of shoot length by triasulfuron was observed (Table 2 & 3). As expected, fresh weight and dry weight of both roots and shoots were also reduced by triasulfuron (Table 1,2,3).

<u>BAS-145138 experiment.</u> Shoot length of corn treated with 20, 40, and 60 uM triasulfuron was reduced 50, 57, and 73% (Table 1). In the presence of 1 mM BAS-145138 triasulfuron was considerably less effective, the afore-mentioned reductions reading 14, 26, and 35% (Table 1). Similar safening action was also noted when shoot fresh and dry weights were measured. For example, at 40 uM triasulfuron shoot fresh and dry weights were down 57 and 34%, respectively. With the addition of 1 mM BAS-145138, shoot fresh and dry weights were only inhibited 19 and 7%, respectively (Table 1). Root growth was also partially protected by BAS-145138 from the herbicidal action of triasulfuron (Table 1).

Table 1. Safening influence of BAS-145138 (BAS) on herbicidal effects of Triasulfuron (HERB) on the growth of corn.

HERB (uM)	BAS (mM)	SHOOTS Length (mm)	SHOOTS Fr Wgt (mg/pl)	SHOOTS Dry Wgt (mg/pl)	ROOTS Length (mm)	ROOTS Fr Wgt (mg/pl)	ROOTS Dry Wgt (mg/pl)
0	0	181	623	44	176	508	38
20	0	90	337	32	88	171	21
20	1	155	531	41	164	406	33
40	0	78	271	29	67	109	15
40	1	134	504	41	147	275	26
60	0	48	172	17	42	109	17
60	1	117	415	36	128	210	23
LSD	5%	4.0	26	2.9	13.9	34	3.0
	1%	5.4	36	3.9	18.9	46	4.0

Dichlormid experiment. Shoot growth in length of corn treated with 20, 40, and 60 uM triasulfuron was inhibited 32, 45, and 70%, respectively. With the addition of 1 mM dichlormid, these reductions were 10, 20, and 27%, respectively (Table 2). Shoot fresh and dry weight reductions caused by triasulfuron were also offset by dichlormid. For example, 60 uM dichlormid reduced shoot fresh weight 63% and shoot dry weight 48% (Table 2). However, with the addition of 1 mM dichlormid fresh weight was only reduced 11% and dry weight was similar to the control (Table 2). Safening action of dichlormid in triasulfuron-treated corn plants was also apparent when root length, fresh weight, and dry weight were measured (Table 2).

Table 2. Safening influence of Dichlormid (DICHL) on herbicidal effects of Triasulfuron (HERB) on the growth of corn.

HERB (uM)	DICHL (mM)	SHOOTS Length (mm)	SHOOTS Fr Wgt (mg/pl)	SHOOTS Dry Wgt (mg/pl)	ROOTS Length (mm)	ROOTS Fr Wgt (mg/pl)	ROOTS Dry Wgt (mg/pl)
0	0	187	587	50	170	567	45
20	0	127	458	47	128	238	27
20	1	168	594	53	189	542	46
40	0	102	382	43	122	194	23
40	1	150	574	55	178	376	36
60	0	57	220	26	71	136	20
60	1	137	523	53	148	260	28
LSD	5%	8.3	44	4.9	18	52	4.2
	1%	11.0	60	6.6	24	70	5.7

R-29148 experiment. Shoot length of corn treated with 20, 40, and 60 uM triasulfuron was inhibited 35, 48, and 65%, respectively. When also treated with 1 mM R-29148, inhibitions of shoot length were 15, 21, and 28%, respectively (Table 3). Strong safening action was observed when shoot fresh and dry weights were measured. Corn plants treated with 20, 40, and 60 uM triasulfuron had shoot fresh weight inhibited 29, 44, and 65% and shoot dry weight inhibited 17, 27, and 56%, respectively (Table 3). However, with the addition of 1 mM R-29148 fresh weight reductions were 5, 9, and 19% and dry weight reductions were 0, 0, and 5%, respectively (Table 3). Root growth in triasulfuron-treated corn plants was also protected by R-29148 (Table 3).

Table 3. Safening influence of R-29148 (R-29) on herbicidal effects of Triasulfuron (HERB) on the growth of corn.

		SHOOTS			ROOTS		
HERB (uM)	R-29 (mM)	Length (mm)	Fr Wgt (mg/pl)	Dry Wgt (mg/pl)	Length (mm)	Fr Wgt (mg/pl)	Dry Wgt (mg/pl)
0	0	144	518	41	136	560	42
20	0	93	367	34	124	244	25
20	1	122	490	42	146	406	35
40	0	75	288	30	104	173	21
40	1	114	473	44	146	310	32
60	0	50	179	18	66	134	17
60	1	104	421	39	142	282	28
LSD	5%	7.6	24	3.0	12	34	1.7
	1%	10.4	32	4.1	16	46	2.4

It is apparent from this study that BAS-145138, dichlormid, and R-29148 can at least partially protect corn plants from the herbicidal activity of triasulfuron. Corn seed treatments with anyone of the above safeners would allow the use of triasulfuron for weed control in corn culture.

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The Effect of Chlorimuron-ethyl on Cranberry Fruit Quality[1]

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ABSTRACT

The effect of chlorimuron-ethyl on the quality and development of the cranberry (Vaccinium macrocarpon cv "Early Black") fruit was studied. The influence of the herbicide on berry volume, acidity, soluble solids, anthocyanin content, and flavonol content was determined, both for the year of treatment and for the year after treatment. Preemergence application of chlorimuron-ethyl at 1.12, 2.24, 3.36, and 4.48 kg/ha did not affect the quality and development of the cranberry fruit. Berries analyzed the year after application showed increases in individual berry volume and decreases in acidity due to chlorimuron-ethyl applications. Also increases in yield were observed the second year after application.

INTRODUCTION

The sufonylurea herbicide chlorimuron-ethyl {ethyl 2[[[[(4-chloro-6-methoxy-2-primidenyl)amino]carbonyl]amino]sulfonyl]benzoic acid} is a very efficient postemergence herbicide for the control of a number of important broadleaf weeds in soybean (1,3). Chlorimuron-ethyl can also be applied preemergence and is readily absorbed by plant roots and is translocated throughout the plant (2). Differential metabolism between susceptible and tolerant plant species generally determines selectivity (2). The herbicidal activity of chlorimuron-ethyl is determined by its ability to block the activity of acetolactate synthase, an enzyme which is necessary for the synthesis of the essential amino acids valine, leucine, and isoleucine (2). Consequently, protein synthesis is eventually terminated and the treated plant dies.

In numerous field studies on cranberry bogs we have shown that cranberry is relatively tolerant of chlorimuron-ethyl and that preemergence application of the herbicide controls a large

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number of bog weeds (unpublished data). We feel that chlorimuron-ethyl would make an excellent preemergence herbicide for use on cranberry bogs.

The purpose of this study was to determine the effect of chlorimuron-ethyl on the growth and development of the cranberry fruit. The effects of the herbicide on cranberry fruit volume, acidity, soluble solids, total flavonols, and anthocyanin development were determined.

METHODS AND MATERIALS

A section of cranberry bog free of weeds and having a relatively consistent number of uprights over a large area was chosen for treatment. Chlorimuron-ethyl was applied in mid-April as an aqueous spray to plots $6m^2$ in area, each being replicated four times and the plots randomized within replicates. Applications were made with a hand held knapsacks sprayer as a fine mist at the rate of 750 l/ha. At harvest berries were hand scooped and berry volume determined. A sub-sample was taken from each plot and frozen for chemical analysis at a later date.

After 30 days the frozen berries were removed from the freezer and their acidity, soluble solids, anthocyanin content, and total flavonols determined. Standard methods for determining acidity and soluble solids were employed. Anthocyanins were determined according to the methods of Deubert (4) and flavonols according to the methods of Lee and Francis (5).

To determine if chlorimuron-ethyl had any residual effect cranberries were again harvested from the above mentioned plots the following year and their growth and development analyzed as before. All data were subject to analysis of variance.

RESULTS AND DISCUSSION

Preemergence application of chlorimuron-ethyl at 1.12, 2.24, 3.36, and 4.48 kg/ha did not affect the quality and development of the cranberry fruit. No significant differences could be found in cranberry volume, acidity, soluble solids, and total flavonols (Table 1).

One of the most important parameters measured in this study was the effect of chlorimuron-ethyl on anthocyanin development by the cranberry. As the cranberry ripens, relatively large amounts of anthocyanin pigments are synthesized, imparting to the mature fruit an attractive red color. As might be expected, a direct relationship exists between color development in the cranberry and its commercial value. Thus growers must guard against herbicides that might retard color development. In this study no significant differences in anthocyanin content were found when control berries and berries treated with chlorimuron-

ethyl were compared (Table 1).

Table 1. The effect of chlorimuron-ethyl (Herb) on cranberry fruit quality. Acidity is in ml of 0.1 N NaOH/100g of berries.

Herb (kg/ha)	Vol (ml)	Acidity (ml)	Sol. Solids (%)	Anthocyanin (mg/100g)	Total Flavonols (mg/100g)
0	1.39	255	4.9	31	20
1.12	1.39	256	4.9	32	19
2.24	1.38	255	4.9	32	21
3.36	1.38	256	5.0	29	19
4.48	1.40	257	5.1	28	18
LSD 5%	0.13	7.5	0.21	4.4	2.0
1%	0.18	10.4	0.29	6.0	2.7

A percent drop in yield was observed with increasing rates of chlorimuron-ethyl applied. However, the drop in yield was not significant, only suggestive of a possible herbicidal effect (Table 2). When the same plots were harvested the following growing season a significant increase in yield was observed in plots previously treated with 2.24, 3.36, and 4.48 kg/ha chlorimuron-ethyl (Table 2). Most likely this was due to better weed control where the herbicide had been applied.

Table 2. Effect of chlorimuron-ethyl (Herb) on cranberry yield in the year of application (1st yr) and in the year after application (2nd yr).

Herb (kg/ha)	Yield (%) 1st yr	2nd yr
0	100	100
1.12	96	118
2.24	83	134
3.36	79	135
4.48	81	134
LSD 5%	21	31
1%	30	43

In addition to differences in yield, differences in volume and acidity were also observed the second year. Plots previously treated with 2.24, 3.36, and 4.48 kg/ha chlorimuron-ethyl had berry volume increases of 9, 12, and 9%, respectively (Table 3).

At these same rates cranberry acidity was progressively decreased (Table 3). In contrast, no significant differences were found the second year in the soluble solids, anthocyanin content, and flavonol content of the cranberries (Table 3).

Table 3. The effect of chlorimuron-ethyl (Herb) on cranberry fruit quality the second year after treatment. Acidity is in ml of 0.1N NaOH/100g of berries.

Herb (kg/ha)	Vol (ml)	Acidity (ml)	Sol.Solids (%)	Anthocyanin (mg/100g)	Total Flavonols (mg/100g)
0	1.27	326	6.1	28	23
1.12	1.29	323	5.9	28	24
2.24	1.39	291	6.2	26	23
3.36	1.42	288	6.3	26	22
4.48	1.38	275	6.2	26	22
LSD 5%	0.09	18	0.3	4.0	1.5
1%	0.12	25	0.4	5.6	2.1

The data in this study suggest that chlorimuron-ethyl, because of its broad spectrum of weed control and because the cranberry is relatively tolerant of the herbicide, would be very useful for the control of weeds on cranberry bogs.

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Postemergence Johnsongrass Control in Field Corn

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Abstract

On-farm field trials were conducted in 1989-90 to evaluate the performance of DPX-V9360 and CGA-136872 on johnsongrass [*Sorghum halepense* (L.) Pers.] control in field corn (*Zea mays* L. 'Hytest 736 and 650A').

In 1989, single applications of DPX-V9360 were applied to johnsongrass plants that were up to 65 cm in height. Control, at all rates, was excellent (97%) by 3 weeks after treatment, but decreased to 78% by 10 weeks after treatment (Table 1). This reduction in control was attributed to seedling emergence and rhizome regrowth. There was no visual indication of corn phytotoxicity from any treatment.

In 1990, both DPX-V9360 and CGA-136872 were applied to johnsongrass plants that were up to 90 cm in height. Single and split applications were evaluated. Control at all rates and schedules was variable by 2 weeks after treatment, but by 10 weeks after treatment, exceeded 90%. Split applications did not significantly increase the degree of control (Table 2). As in 1989, there was no visible indication of corn phytotoxicity from any treatment.

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Table 1. The Effect of DPX-V9360 On Johnsongrass Control in Field Corn, Salem County, New Jersey, 1989.

Herbicide[2]	Rate oz AI/A	% Johnsongrass Control[1] 3 WAT[3]	10 WAT
DPX-V9360	0.50	97	78
DPX-V9360	0.75	97	78
DPX-V9360	1.00	97	78
Untreated	-----	0	0
LSD (0.05)		3	11

[1] Scale 0-100%; 0 = no control; 100% = complete control
[2] All treatments included X-77 @ 0.5% v/v
[3] WAT = Weeks after treatment

Table 2. The Effect of DPX-V9360 and CGA-136872 On Johnsongrass Control in Field Corn, Salem County, New Jersey, 1990.

Herbicide[2]	Rate oz AI/A	% Johnsongrass Control[1] 2 WAT[3]	10 WAT
DPX-V9360	0.25 0.25[4]	65	100
DPX-V9360	0.50	79	98
DPX-V9360	0.50 0.50[4]	83	100
DPX-V9360	1.00	85	100
CGA-136872	0.29 0.29[4]	63	90
CGA-136872	0.43 0.14[4]	78	97
CGA-136872	0.57	85	92
CGA-136872	1.14	75	92
Untreated	----	0	0
LSD (0.05)		15	10

[1] Scale 0-100%, 0 = no control; 100 = complete control
[2] All treatments included X-77 @ 0.25% v/v
[3] Weeks after initial treatment
[4] Second application was applied 2 weeks after the initial treatment at the time the two-week ratings were made

WEED CONTROL IN WHEAT WITH TRIASULFURON

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ABSTRACT

Winter annual weeds continue to be a problem for producers attempting to maximize both yield and quality of winter wheat (Triticum aestivium L.). Weeds such as common chickweed [Stellaria media (L.) Vill.] and henbit (Lamium amplexicaule L.) can compete with the crop and cause yield reductions while wild garlic (Allium vineale L.) reduces quality, thus resulting in lower prices to the producer. Research was conducted during the years 1988 through 1990 to evaluate low rates (5-20 g/ha) of triasulfuron applied in the spring for control of these weeds and also to evaluate the potential for carryover to rotational crops such as soybeans [Glycine max (L.)Merr.] and alfalfa (Medicago sativa L.). Replicated field trials were located in Delaware, Maryland, Michigan, Pennsylvania, and Virginia. Most trials were in wheat while several were conducted on heavy infestations of wild garlic growing in a non-crop situation. Wild garlic control from triasulfuron at 5 g/ha was 90-100% at most locations where a wheat crop was present. In non-crop situations, 10-20 g/ha were required to obtain acceptable control. Control of common chickweed was very good to excellent at most locations at rates of 5-10 g/ha. Henbit control varied from poor to very good depending on location. Response of rotational soybeans to triasulfuron was variable with no injury at numerous locations although soybeans were injured Virginia and Delaware. Alfalfa planted in mid- to late-summer was not affected by previous applications of triasulfuron.

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GLYPHOSATE AND TRICLOPYR APPLIED AS A DIRECTED SPRAY OR OVER-THE-TOP OF CONIFERS IN THE FALL

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ABSTRACT

Glyphosate and triclopyr are labelled for use as directed sprays in Christmas tree plantings. Though growers are cautioned against contacting the foliage of the trees with the spray, it is almost impossible to make a thorough band application without contacting some foliage. Many growers have found through experience that contacting the lower one-third of Christmas trees after their leaves and buds are fully hardened does not harm them. Other growers have sprayed right over the top of their trees with glyphosate. Some reported injuring their trees and some report they did not. This study was designed to evaluate some of the factors which could affect whether or not an herbicide application that contacts the foliage of the conifers will cause injury: herbicide and formulation, rate of application, species treated, and the amount of foliage contacted.

The experiment was conducted at the farms of three cooperating growers and the Penn State Horticulture Research Farm at Rock Springs. The trees at growers' farms were established at least two years and were 30-75 cm tall. The trees at the research farm were planted in the spring prior to application and varied from 25-40 cm tall. At the growers' farms glyphosate and the amine and ester formulations of triclopyr were applied as directed sprays to the lower third of the trees or over the top at 0.3, 0.8, and 1.6 kg ai/ha. With the exception of the amine formulation, the same treatments were applied at the research farm. Several commonly grown Christmas tree species, with varying sensitivity to glyphosate were included in the study. Douglas fir (Pseudotsuga menziesii [(Mirb.)Franco]) was treated at two grower sites, while Colorado spruce (Picea pungens[Engelm.]), eastern white pine (Pinus strobus L.), and Scots pine (Pinus sylvestris L.) were treated at one grower site each. At the research farm Douglas fir, Fraser fir (Abies fraseri [(Pursh)Poir]), white pine, and Scots pine transplants were planted in the spring and treated in the fall. At each site the treatments were replicated three times and there were five trees of each species in each replication. A CO_2 pressurized test plot sprayer set at 30 psi was used to make all applications. An OCO2 nozzle was used to apply a directed spray to both sides of the tree rows. An 8004E nozzle was used for over the top applications. Directed sprays and over the top sprays were in a volume equivalent to 168 and 187 l/ha, respectively. Applications were made between September 1 and October 5, 1987. July and August had been very dry and the new growth of all trees was well hardened prior to application.

One of the hottest, driest summers on record in Pennsylvania followed the dry summer and fall of 1987. This placed a lot of trees under stress and produced some erratic results in the study. The Douglas fir at one grower's site were eliminated from the study because stunted growth was scattered throughout the trees in the treated area, regardless of treatment. Spruce gall adelgids also caused yellowed and twisted needles in scattered pockets. At the research farm many of the newly planted Scots pine died, so only surviving trees were rated. Slight chlorosis was common in the white pines regardless of treatment. None of the species had good uniform growth throughout the test area.

Colorado spruce and Douglas fir at another grower's site were generally uniform and healthy and showed no signs of injury from any of the treatments. The Douglas fir at the research farm showed no signs of injury except for those treated over the top with 0.8 or 1.6 kg ai/ha glyphosate (Table 1). One replication in each treatment had bud loss and poor apical dominance. Plants in the other two replications of each treatment did not exhibit these symptoms. Scots pine at

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a grower's site were injured by directed spray and over the top applications of glyphosate at 0.8 or 1.6 kg ai/ha. Injury symptoms included bud abortion and clustering of new growth rather than the development of a strong central leader. Glyphosate treated Scots pine at the research farm appeared to be slightly stunted only by the 1.6 kg ai/ha rate. Triclopyr treatments did not have any significant effect on the Scots pine at the reseach farm. At the grower's site some trees with stunted, clustered growth were scattered through the triclopyr treatments, but they could not be correlated with any specific treatment. The white pine at the grower's site had some chlorotic, stunted plants with clustered growth scattered throughout the test area, but they could not be correlated to chemical treatment or rate of application. At the research farm the white pine receiving applications of triclopyr at 1.6 kg ai/ha over the top or as a directed spray, and glyphosate at 1.6 kg ai/ha over the top, were more yellow and slightly stunted compared to the controls. None of the Fraser fir at the research farm were injured by any of the treatments.

The extremely dry conditions in late summer, 1987, and all summer, 1988, caused some stunting and chlorosis throughout the study areas that was difficult to distinguish from herbicide related injury. However, it was evident that the treatments used in this study did not cause severe injury or plant loss.

Figure 1. Injury rating of four Christmas tree species planted at the Penn State Horticulture Research Farm at Rock Springs in April 1987 and treated in October, 1987. Injury to the trees was rated in August, 1988 on a scale of 1-10 with 1=no injury and 10=dead. The herbicides were applied either over the top (O) or directed (D) to hit the lower third of each side of the trees.

			Injury Rating			
Herbicide	Rate (kg ai/ha)	Method of Application	Douglas fir	Fraser fir	Scots pine	White Pine
Control			1.3	2.3	1.5	2.0
Glyphosate	0.3	D	1.0	1.7	1.3	1.3
		O	1.7	1.3	1.0	1.0
	0.8	D	1.0	1.3	1.3	1.3
		O	2.7	2.0	1.7	1.7
	1.6	D	1.7	2.7	3.0	2.0
		O	3.0	3.0	2.0	3.3
Triclopyr	0.3	D	1.7	1.3	1.0	1.3
		O	1.0	1.7	1.0	1.0
	0.8	D	2.0	1.3	1.0	1.7
		O	1.3	3.0	1.0	1.3
	1.6	D	2.0	2.0	1.7	2.7
		O	1.7	2.3	1.7	3.3
LSD (.05)			2.0	1.5	1.1	1.8

CONTROLLING BLACK LOCUST, BOXELDER, AND TREE-OF-HEAVEN WITH BASAL BARK APPLIED HERBICIDES

Gregory T. Lyman, Larry J. Kuhns, and Arthur E. Gover[1/]

ABSTRACT

Basal bark herbicide applications are used to control many types of brush. Variables that can affect the degree of control provided by a basal bark application include the brush species, herbicide selected, rate of application, and the carrier. This study was designed to investigate each of these and had the following objectives: 1. to compare the effectiveness of 5% and 20% Garlon 4[2/] (triclopyr) and 5% and 20% of a combination of Access[3/] (triclopyr + picloram); 2. to compare the effectiveness of diesel fuel and mineral oil as carriers; and 3. to compare the effectiveness of three herbicides-triclopyr, triclopyr + picloram, and imazapyr.

The herbicide treatments used are listed in Table 1. The tree species treated were black locust (Robinia pseudo-acacia L.), boxelder maple (Acer negundo L.), and tree-of-heaven (Ailanthus altissima Mill.). They are all known to be capable of developing sucker growth if their tops are killed. The black locust and boxelder maple were 2-10 cm in diameter while the tree of heaven were 7-25 cm in diameter. The treatments were applied on March 17 (tree of heaven) and April 5 (black locust and boxelder), 1988. Tree of heaven and boxelder were rated for control on August 8 and black locust were rated on September 9, 1988. All species were rated again on October 9, 1989. The herbicides were applied using a Spraying Systems #5500 Cone Jet Nozzle with a Y-2 tip adjusted to spray a fine mist. The treatments were uniformly applied to the bottom 30-45 cm of the trunks. Application was stopped before there was runoff into the soil.

Boxelder was killed in 1988 by all treatments except imazapyr. Imazapyr killed about 30% of the boxelder in 1988 and slightly to severely injured all but one of the others. By the end of 1989, two-thirds of the plants were dead and the others were moderately to severely injured.

Triclopyr at 20% in mineral oil provided total control of tree of heaven by the end of 1988. Triclopyr at 5% in mineral oil and triclopyr + picloram at 20% in diesel fuel resulted in almost total kill in 1988. Surviving plants were severely injured, and showed little sign of improvement in 1989. Triclopyr at 20% in diesel fuel and triclopyr + picloram at 5% in diesel fuel killed most of the trees and severely injured the rest in 1988. Very slight improvement of control took place in 1989. Triclopyr at 5% in diesel fuel killed just under half of the treated trees. Imazapyr provided limited control the year of application, but by the end of 1989 over 75% of the trees were dead.

Triclopyr + picloram at 20% in diesel fuel provided total control of black locust in 1988. All other treatments containing triclopyr provided very good control of black locust, but allowed several escapes. The imazapyr did not provide good control of the black locust.

Mineral oil as a carrier for triclopyr provided as good or better control of all brush species than diesel fuel. Since it is also much more desirable to handle when mixing and applying, and it has better environmental characteristics, mineral oil should be considered a superior carrier to diesel fuel. Triclopyr at 5% in mineral oil provided excellent control of boxelder and tree of heaven, and very good control of black locust. Increasing the rate of application to 20% triclopyr only slightly improved the level of control. The 20% rate of triclopyr + picloram did provide better broad spectrum control than the 5% rate. There does not appear to be any benefit from adding picloram to triclopyr for control of these species. Imazapyr did not provide satisfactory control at this rate of application and with diesel fuel as a carrier. None of the species produced basal suckers after their tops were rated dead.

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[2/] Garlon 4 is an emulsifiable concentrate containing the acid equivalent of 480 g/l triclopyr, DowElanco, Indianapolis, IN.

[3/] Access is an emulsifiable concentrate containing the acid equivalents of 120 g/l picloram and 240 g/l triclopyr, DowElanco, Indianapolis, IN.

TABLE 1: Number of stems of black locust, boxelder maple, and tree-of-heaven in each injury rating category (0-5), with 0 being no treatment effect, and 5 indicating no visible living tissue. Stems of tree of heaven were treated March 17, 1988, boxelder and black locust were treated April 4. Plants were rated in August or September, 1988 (T1), and October, 1989 (T2).

Injury Rating	Garlon 4[1/] 5% Diesel Fuel		Garlon 4 5% Mineral[4/] Oil		Garlon 4 20% Diesel Fuel		Garlon 4 20% Mineral Oil		Access[2/] 5% Diesel Fuel		Access 20% Diesel Fuel		Chopper[3/] 6.25% Diesel Fuel	
	Number of Stems													
boxelder	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
0													1	
1													3	
2													5	
3													6	5
4													13	8
5	39	39	34	34	31	31	33	33	36	36	30	30	11	26
Total	39	39	34	34	31	31	33	33	36	36	30	30	39	39
tree-of-heaven	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
0													6	
1	1												8	
2	6												5	1
3	3	5			3				1				7	1
4	4	8	1	3	5	4			14	4	4	3	12	8
5	10	11	34	32	34	38	40	40	17	18	28	29	4	32
Total	24	24	35	35	42	42	40	40	22	22	32	32	42	42
black locust	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
0	1	1												3
1		1				1		1					7	2
2		1		1				1					1	2
3	3	1	1	1	1		2		1	1				
4			1						6	1				1
5	16	15	8	8	19	19	9	9		5	9	9	1	1
Total	19	19	10	10	20	20	11	11	7	7	9	9	9	9

1/ Garlon 4 is an emulsifiable concentrate containing the acid equivalent of 480 g/l triclopyr, DowElanco, Indianapolis, IN

2/ Access is an emulsifiable concentrate containing the acid equivalents of 120 g/l picloram and 240 g/l triclopyr, DowElanco, Indianapolis, IN.

3/ Chopper is a water soluble concentrate containing the acid equivalent of 240 g/l imazapyr, American Cyanamid Company, Wayne, NJ.

4/ Rite Way, N.G. Gilbert Corporation, Muncie, IN.

COMPARING THE CONTROL BY BARK ABSORBED HERBICIDES APPLIED AT TWO HEIGHTS

Gregory T. Lyman, Larry J. Kuhns, and Arthur E. Gover[1/]

ABSTRACT

The basal bark technique of herbicide application has proven to be an effective way to control brush. By applying the herbicide at a height of 1.2 m rather than at the base of the plant the treatment could be made quicker and easier. The applicator would not need to be concerned with clearing vegetation from around the base of the stem, brush could be treated even when the base was covered with snow, and the bark tissues at 1.2 m are thinner than at the base. The objective of this study was to compare the brush control provided by triclopyr applied at a height of 1.2 m with a conventional basal bark application.

Garlon 4[2/] (triclopyr) at 5 and 20% in diesel fuel was applied to stems of boxelder maple (Acer negundo L.), tree-of-heaven (Ailanthus altissima Mill.), black locust (Robinia pseudo-acacia L.), and black birch (Betula lenta L.) in late March, 1988. The boxelder maple and black locust stems were 2-10 cm in diameter, the black birch were 5-10 cm, and the tree-of-heaven were 7-25 cm. Treatments were applied through a Spraying Systems 5500 Cone Jet Nozzle with a Y-2 tip adjusted to produce a fine mist to either the base of the stem or at a height of approximately 1.2 m. An attempt was made to keep the treatment width at 30-40 cm, but some of the 1.2 m treatments spread wider, particularly on birch which has a shiny, smooth bark surface. Each stem was rated on September 9, 1988 and October 9, 1989 on a scale of 0-5, with 0 indicating no treatment effect and 5 indicating no living tissue evident. Stems treated at the base received only one rating. Stems treated at 1.2 m received two ratings; one above the treated area and one below.

A related mini-experiment was designed and set out to determine if enough herbicide was absorbed and translocated downward to kill or severely injure the root system. Ten multiple stem red maple (Acer rubrum L.) trees that branched from a single stem 30-100 cm above the ground were selected for treatment. One branch was treated with triclopyr at 20% in Basal Oil. A caulk ring was formed around the stem prior to treatment to prevent the herbicide from running onto the main stem. The herbicide was applied to the bark with a needle and syringe to eliminate the chance of spray drift onto the untreated stem.

A summary of the results is presented in Table 1. Triclopyr at 20% applied to the base of the trees provided almost total control of all species. When applied at 1.2 m almost all of the stems above the treated area were killed. Below the treated area all of the black locust and tree of heaven stumps vigorously sprouted, and 40% of the boxelder sprouted. No stump sprouting was evident on the birch. Triclopyr applied at 5% provided similar results, but the overall degree of control was lower.

When applied to one stem of a multiple-stem tree, triclopyr at 20% in Basal Oil killed the treated stem on all but one of the treated stems without causing any injury to the untreated stem.

It appears that bark applied triclopyr is absorbed and causes a localized death of cambium and conductive tissues. There is no indication that the herbicide is translocated downward in amounts sufficient to kill roots or stump sprouts. Though upward movement can not be ruled out, it is unlikely that it occurs in significant amounts because typical foliar symptoms of triclopyr activity are rarely seen. For species with the potential to produce stump sprouts, basal bark treatments are far superior to higher applications.

[1/] Project Assistant, Professor of Ornamental Horticulture, and Sr. Research Technologist, The Pennsylvania State University.

[2/] Garlon 4 is an emulsifiable concentrate with an acid equivalent of 480 g/l triclopyr, DowElanco, Indianapolis, IN.

TABLE 1: The number of stems of boxelder maple, tree of heaven, black locust, and black birch in each injury rating category (0-5). A rating of 0 indicates no treatment effect, and a rating of 5 indicates no visible living tissue. Treatments were applied in late March 1988 to either the base of the plant or 1.2 m above the ground. All treatments were diluted in diesel fuel. Control was rated on October 9, 1989.

Injury Rating	Garlon 4[1/] 5% Treated at Base	Garlon 4 5% Treated at 1.2m		Garlon 4 20% Treated at Base	Garlon 4 20% Treated at 1.2 m	
	Number of Stems					
boxelder	Above Trt.	Above	Below	Above	Above	Below
0			22			14
1						
2						
3						
4						
5	39	31	9	31	34	20
Total	39	31	31	31	34	34
tree-of-heaven	Above Trt.	Above	Below	Above	Above	Below
0			17			20
1						
2		2				
3	5					
4	8			4		
5	11	32	17	38	40	20
Total	24	34	34	42	40	40
black birch	Above Trt.	Above	Below	Above	Above	Below
0						
1						
2		1				
3	5	5				
4	9	12			4	
5	20	16	34[2/]	22	25	29
Total	34	34	34	22	29	29
black locust	Above Trt.	Above	Below	Above	Above	Below
0	1		13			15
1	1		1	1		1
2	1		1			
3	1					
4						
5	15	19	4	19	16	
Total	19	19	19	20	16	16

[1/] Garlon 4 is an emulsifiable concentrate containing the acid equivalent of 480 g/l triclopyr, DowElanco, Indianapolis, IN.

[2/] No sprouting was evident on black birch, while all other species resprouted below the 1.2 m treatment area.

JOHNSONGRASS RECOVERY FROM SULFONYLUREA HERBICIDES

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

ABSTRACT

The sulfonylurea herbicides CGA-136872 and nicosulfuron have potential for control of johnsongrass [Sorghum halepense (L.) Pers.] in corn (Zea mays L.). To date, the degree of johnsongrass control has varied and may depend on such factors as johnsongrass growth stage, environmental conditions, soil pH, and number of herbicide applications. Most studies have concentrated on johnsongrass control during the year of application. Because regrowth was observed at Painter, Va. in 1989 from 1988 applications, plots in two separate studies that received applications in 1989 were maintained for johnsongrass regrowth evaluations in May of 1990. In these studies, treatments consisted of single applications of CGA-136872 at 20 and 40 g/ha and applications of 20 g/ha twice. In one study, nicosulfuron was included at 35 g/ha applied once and twice. With both herbicides, the second application followed the first by 2 weeks and all applications included 0.25 % (v/v) nonionic surfactant. Initial applications were made to johnsongrass 8 to 45 cm in height. One year later, on May 17, 1990, johnsongrass control was generally not rate-dependent. In the first study, control averaged 60 to 64% from single CGA-136872 applications and the split applications controlled johnsongrass regrowth 85%. In the second study, single CG8-136872 applications controlled johnsongrass regrowth 60 to 69% and the split applications controlled regrowth 70%. In this study, nicosulfuron at 35 g/ha controlled regrowth 83% and 98% at 35 g/ha applied twice. Conclusions drawn from this study are that considerable johnsongrass regrowth can occur the year following applications of these two herbicides and that nicosulfuron will likely reduce regrowth more than CGA-136872.

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[1]Agri. Res. Sci. and Prof., Eastern Shore Agri. Exp. Stn., Va. Polytech. Inst. and State Univ., Painter, VA 23420.

Potential Herbicide Rate Reduction Utilizing Mulch Characteristics and Management Strategies

Robin R. Bellinder, Russell W. Wallace and Luis E. Lanfranconi[1]

ABSTRACT

Seven mulches were evaluated in 1990 for ease of management and weed suppression in tomatoes (Lycopersicon esculentum). The mulches were selected for differing control potentials and included: two winter-killed mulches, oats (Avena sativa) and annual ryegrass (Lolium multiflorum); three spring chemically-killed mulches, red clover (Trifolium pratense), grain rye (Secale cereale), and red fescue (Festuca rubra); one mechanically-killed mulch, hairy vetch (Vicia villosa); and conventional tillage (bare ground). Glyphosate (1.1 kg ai/ha) and glyphosate (1.1 kg) + 2,4-D (0.84 kg) were applied to rye and red clover, respectively. Red fescue was treated with glyphosate (2.2 kg) and later with paraquat at 0.6 kg. Although annual ryegrass was winter-killed, a glyphosate + 2,4-D treatment was required to control perennial weeds. Following tranplanting, postemergence herbicides were applied as-needed. Within each mulch, the herbicide programs included: a weedy check (Trt. 1) and metribuzin + sethoxydim applied at 0.56 + 0.22 (Trt. 2), 0.28 + 0.22 (Trt. 3), and 0.19 + 0.17 kg ai/ha (Trt. 4). At the time of transplanting, mulch control was complete in rye, oats, and annual ryegrass. Red fescue, red clover and hairy vetch continued to grow despite regulation attempts. Approximately 3 weeks after transplanting, percent mulch cover ratings averaged across herbicide treatments were highest in rye (dead) and red fescue (living) at 80%. Oats and annual ryegrass were lowest with less than 2% cover. Preferential deer (Odocoileus virginianus) feeding during the winter decreased oat biomass. Initial herbicide treatments were applied 10 days after transplanting (DAT) to oats, 20 DAT to annual ryegrass, hairy vetch, and red clover, and 34 DAT to rye and red fescue. Initial metribuzin applications contributed to red fescue, red clover and hairy vetch suppression. Plots requiring two applications included treatments 2, 3, and 4 in annual ryegrass, and treatments 3 and 4 in red clover (48 - 50 DAT), however, only the lowest rate of metribuzin was used. In mid-July, percent weed cover was 50% or greater in all weedy check plots except rye and red fescue which were 39 and 17%, respectively. Within individual mulches there were no significant differences in percent weed cover regardless of herbicide rate. In comparing mulch systems across herbicide treatments, two levels of weed control were observed: greater than 95% in bare ground, rye and red fescue, and 65 - 85% in red clover, hairy vetch, annual ryegrass and oats. Weed spectra varied due to differences in mulch establishment and regulation. For example, dandelion (Taraxacum officinale), wild carrot (Daucus carota) and quackgrass (Elytrigia repens) were the predominant weeds in red clover, oats and annual ryegrass, respectively. When comparing untreated mulches, yields were significantly decreased in red clover, oats, annual ryegrass and bare ground plots when compared with rye. When averaged across herbicides, yields were lowest in red clover and red fescue when compared with rye treatments.

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CGA-163935: A New Turfgrass Growth Regulator.

J. W. Peek, R. L. Brooks, P. J. Porpiglia and D. B. Vitolo[1]

ABSTRACT

CGA-163935 (ethyl 4-cyclopropyl(hydroxy)methylene-3,5-dioxo-cyclohexanecarboxylate) is a plant growth regulator which decreases the rate of foliar elongation of warm- and cool-season turfgrasses. CGA-163935 reduces cell elongation by inhibiting gibberellic acid biosynthesis. CGA-163935 has proven to be an effective product in reducing the frequency of mowing and the amount of clippings produced by the turf. It can also be used to minimize the need for edging turfgrasses. CGA-163935 is very effective on fast-growing southern turfgrasses such as St. Augustinegrass (Stenotaphrum secundatum [Walt.] Kuntz), bahiagrass (Paspalum notatum Fluegge), and bermudagrass (Cynodon dactylon [L.] Pers.). It is effective on cool season grasses such as tall fescue (Festuca arundinacea Schreb.), perennial ryegrass (Lolium perenne L.), and Kentucky bluegrass (Poa pratensis L.).

CGA-163935 can reduce mowings and clippings by 40-50% for four weeks in highly maintained turfgrass at rates of 300-400 g ai/ha. Higher rates of 600-800 g ai/ha can reduce mowings and clippings for up to eight weeks. CGA-163935, when applied in a 30 cm band at the edge of lawns, can reduce the extension of turfgrass stolons thereby minimizing the need for mechanically edging the perimeters of a lawn.

Various formulations will be available. A 1 lb active ingredient/gallon MEC will be for use on highly maintained turfgrass found on golf courses, sod farms, and lawns. A 2 lb active ingredient/gallon EC will be for use on low maintenance turfgrass found along roadsides, parks, and commercial/municipal property. A more dilute formulation will be used by homeowners to decrease the need of edging along curbs, fences, and flower beds.

CGA-163935 can be used without an adjuvant and can be tank-mixed with other commonly used turf pesticides. Applications are rainfast within one hour after application because CGA-163935 is foliarly absorbed.

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[1]CIBA-GEIGY Corp., Agricultural Division, P. O. Box 18300, Greensboro, NC 27419-8300

EFFECT OF SOIL pH ON BIOAVAILABILITY OF IMAZAQUIN AND IMAZETHAPYR RESIDUES TO MAIZE.

G. L. Tuxhorn, D. L. Shaner, and K. Farny[1]

ABSTRACT

^{14}C imazaquin and imazethapyr were used to investigate the effect of pH on imidazolinone adsorption to soil, and bioavailability to maize. For both compounds, as the pH decreased, adsorption to soil increased, and bioavailability to maize decreased. Bioavailability to maize did not decrease with pH as rapidly as expected from increased adsorption to soil. This is attributed to a greater proportion of the imidazolinone molecules being in the undissociated form at low pH, which is preferentially absorbed over the dissociated form.

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UNDERSTANDING WHOLE PLANT ACTIVITY OF THE IMIDAZOLINONES: RELATIONSHIPS OF PHYSICO-CHEMICAL PARAMETERS TO ROOT ABSORPTION AND TRANSLOCATION

D.L. Little, D.L. Shaner, D.W. Ladner, B. Tecle[1], and R. D. Ilnicki[2]

ABSTRACT

Herbicidal activity of the imidazolinones is known to be correlated with physical and chemical parameters. Modeling the component processes of herbicide action, that is absorption, translocation, metabolism, and intrinsic activity at the site of action, may help us to understand differences between compounds at the whole plant level. Root absorption of 5'-substituted pyridine imidazolinones in both corn and sunflower was highly correlated with their lipophilicities. DNP-treated plants absorbed little imidazolinone, indicating that most of the absorption is due to ion trapping and not to partitioning to lipids. Modeling translocation in corn was complicated by metabolism. However, in sunflower the model for translocation from roots to shoots contained parameters for lipophilicity and electronic nature. Therefore, 5'-substituted pyridine imidazolinones which have lipophilic, electronegative substituents at the 5'-position should be well transported in plants.

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[2]Prof., Dept. Crop Science, Rutgers University, New Brunswick, NJ 08903.

ACCENT: DUPONT'S NEW POST EMERGENCE GRASS HERBICIDE FOR CORN

John T. Andaloro 1/ and Donald D. Ganske 1/

ABSTRACT

ACCENT (formerly known as DPX-V9360) is a new herbicide for postemergence grass and specific broadleaf weed control in field corn from Dupont Agricultural Products. ACCENT is a member of the sulfonylurea class of chemistry inhibits the biosynthesis of valine and isoleucine, which are necessary for cell division, by inhibiting the enzyme acetolactate synthase. This enzyme system is specific to plants so mammals are not at risk. ACCENT has an acute oral LD50 of >5,000 mg/kg and is not a skin sensitizer. ACCENT has not shown any mutagenic, carcinogenic, nor teratogenic effects in any of the completed acute and chronic studies. ACCENT has low toxicitiy to fish, daphnia, bobwhite, quail, and mallard ducks.

ACCENT is formulated as a 75% active ingredient. Complete control of the labeled weeds is achieved 2-4 weeks after application although herbicidal effects appear within a few days after treatment. Chlorosis and shoot growth inhibition can be observed 5-7 days after applicaton. Differences in the degree of control or selectivity are based on different rates of metabolism. ACCENT has been evaluated in over 500 field trials by Dupont researchers, university cooperators, and independent contractors. These trials confirm that ACCENT has shown excellent tolerance across a wide number of corn varieties thus there are no varietal restrictions on the ACCENT label. ACCENT appled post emergence at the use rate of .66 oz product/acre (.5 oz ai/a) has excellent broad spectrum activity on both perennial and annual grasses as well as on several key broadleaf weeds (Table 1). Post emergence applications from the 2 to 6 leaf stage and post directed applications for 6 to 10 leaf corn are currently labeled. The use of a crop oil concentrate or a non-ionic surfactant is required. The addition of liquid nitrogen fertilzer (e.g. 28-0-0, 32-0-0) to the spray solution may improve control of certain weed species.

Crops normally rotated following ACCENT-treated corn have not shown injury. The ACCENT label currently requires a 10 month interval from application of ACCENT to replanting of soybeans, wheat, popcorn, sweet corn, barley, dry beans and oats. A 12 month recropping interval is required for alfalfa.

The ACCENT label prohibits its use after the application of any formulation of soil-applied COUNTER, since unacceptable corn injury may occur. This is the result of an organophosphate interaction. However, the use of other organophosphate soil insecticides prior to ACCENT application is permitted. In addition, the ACCENT label prohibits application of foliar organophosphates within 7 days before or 3 days after ACCENT application.

1/ Development Representatives, Dupont Agricultural Products, Barley Mill Plaza, P.O. Box 80038, Wilmington, DE, 19880-0038

TABLE 1

WEED SPECTRUM CONTROLLED BY ACCENT AT .66 OZ PRODUCT/ACRE

GRASSES	SIZE RANGE HEIGHT (INCHES)
Shattercane	4-12
Johnsongrass	
seedling	4-10
rhizome	8-12
Sorghum	4-12
Foxtails	
giant	2-4
yellow	2-4
bristly	2-4
green	1-4
Fall panicum	2-4
Barnyardgrass	2-6
Broadleaf signalgrass	1-2
Sandbur	2-4
Woolly Cupgrass	2-4
Quackgrass	4-8

BROADLEAVES	HEIGHT (INCHES)
Morninglory	
ivyleaf	2-3
tall	1-2
pitted	1-2
Pigweed	
smooth	1-4
redroot	1-4
Smartweed, annual	1-4
Jimsonweed	1-3

Optimum herbicidal activity for this size range can be achieved with ACCENT at .66 oz product per acre. However weeds which exceed these height ranges by 50% may be partially controlled with rates between .66 and 1.33 oz product per acre.

Canada Thistle Control in Wheat

Mark S. Causey and Frank J. Webb[1]

ABSTRACT

Field experiments were conducted in 1989 and 1990 to evaluate clopyralid and thifensulfuron + tribenuron for their activity on Canada thistle (Cirsium arvense (L.) Scop) in wheat (Triticum aestirium). Control ratings were obtained only for Canada thistle. The wheat crop was planted conventionally in a clean seedbed each year. The plot design was a random complete block with three replications. The experiment was conducted at a different location each year in New Castle County, Delaware on Matapeake silt loam soil. Thifensulfuron + tribenuron was tested at rates of 0.23 and 0.28 lb a.i./A alone and at 0.23 lb a.i./A in tank-mixes with either .38 lb a.i./A 2,4D ester or dicamba at .13 lb a.i./A. Clopyralid was tested alone at a rate of .33 lb a.i./A. Treatments which contained thifensulfuron + tribenuron alone or in combination with dicamaba or 2,4D ester all provided in excess of 91% control. Clopyralid alone had a control rating of 91.7% in 1989. In 1990 treatments containing thifensulfuron + tribenuron alone or clopyralid alone provided 90 and 93% control respectively. In the 1989 study when thifensulfuron + tribenuron was tank-mixed with either dicamba or 2,4D ester, no difference in control ratings was experienced, however, in 1990 when thifensulfuron + tribenuron was tanked-mixed with either dicamba or 2,4D ester, control ratings were significantly lower than when thifensulfuron + tribenuron was applied alone.

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EFFECTIVENESS OF CLOPYRALID FOR THE CONTROL OF BROADLEAF WEEDS IN VEGETABLE CROPS

W. P. Cowgill, Jr. and B. A. Majek[1]

Abstract. Clopyralid effectively controls many perennial and annual broadleaf weeds including Canada thistle [Cirsium arvense (L.) Scop.], hairy galinsoga [Galinsoga ciliata (Raf.) Blake], common cocklebur (Xanthium strumarium L.), and common ragweed (Ambrosia artemisiifolia L.). The rate required to control seedling annual weeds was much lower than the rate required to control perennial weeds. Canada thistle was controlled by 0.3 kg/ha applied postemergence. Annuals, such as hairy galinsoga, were controlled by rates as low as 0.05 kg/ha. Postemergence applications of clopyralid to cole crops, onion crops, and asparagus caused no phytotoxic response and did not reduce crop yield or quality.

INTRODUCTION

Broadleaf weeds continue to be a significant problem in major vegetable production areas of the USA. Canada thistle and other perennials are primarily problems in perennial vegetable crops. Annual broadleaf weeds, such as hairy galinsoga, common cocklebur, common ragweed, eastern black nightshade (Solanum ptycanthum Dun.), and others are major problems in annual vegetable crops.

METHOD

Field experiments were conducted in 1987, 1988, and 1989 on muck soil in Warren County, and on coarse-textured mineral soils in Cumberland and Salem Counties, New Jersey. Clopyralid, 3,6-dichloro-2-pyridinecarboxylic acid, was evaluated as a postemergence herbicide in asparagus, onions, and several cole crops at between 0.035 and 0.84 kg/ha. Cabbage, broccoli, cauliflower, brussels sprouts, collards, kale, mustard greens, and Chinese cabbage were included in the cole crops evaluated. All experiments were evaluated for phytotoxicity, efficacy and effect on yield.

RESULTS AND DISCUSSION

Cole crops (Table 1) and asparagus (Table 2) were not injured by postemergence clopyralid applications of 0.42 and 0.84 kg/ha, respectively. Onions (Table 2) were not injured by two postemergence applications of 0.28 or 0.42 kg/ha per application alone or in combination with methazole. Canada thistle control was acceptable in asparagus one year after clopyralid was applied postemergence at 0.28 kg/ha in June when the weed was 50 cm tall (Table 3). Lower rates provided temporary control, but results were not satisfactory one year after treatment. Sensitive annual broadleaf weeds, including hairy galinsoga, common cocklebur, common ragweed, and eastern black nightshade, were controlled by postemergence applications of between 0.035 and 0.20 kg/ha

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Table 1. Cruciferae crop tolerance and yields following postemergence clopyralid application

Crop		Clopyralid (hg/ha)[1]					LSD (0.05)
		0.0[2]	0.1	0.2	0.3	0.4	
Cabbage	% inj.	0	-	0	-	0	8
	hg/ha	32,928	-	30,240	-	34,048	9,632
Cauliflower	% inj.	0	0	0	-	0	NA
	hg/ha	84,398	51,946	60,712	-	80,096	25,386
Collards	% inj.	0	0	-	0	-	NA
Broccoli	% inj.	-	-	-	-	0	7
Brussels sprouts	% inj.	-	-	-	-	0	7
Bok Choy	% inj.	-	-	-	-	0	3
Chinese cabbage	% inj.	-	-	-	-	0	10
Mustard	% inj.	-	-	-	-	0	3
Kale	% inj.	-	-	-	-	0	3

[1] DCPA applied at planting at 8 kg/ha
[2] Hand-weeded control

Table 2. Liliaceae crop tolerance and yield following postemergence clopyralid application

Crop		Clopyralid (hg/ha)					LSD (0.05)
		0.0[1]	0.1	0.2	0.3	0.4	
Asparagus	% inj.	0	0	0	-	0	NA
	kg/ha	1,329	1,263	1,604	1,690	-	344
Onion-yellow[2]	% inj.	0	0	0	-	0	9
	kg/ha	12,800	11,400	15,000	-	11,400	4,000
Onion-red[2]	% inj.	0	0	0	-	0	10
	kg/ha	16,200	13,800	15,600	-	13,000	3,800
Onion-green bunching[3]	% inj.	0	-	-	0	-	7
Leek[3]	% inj.	0	-	-	25	-	9

[1] Hand-weeded control
[2] Dry bulb; methazole applied postemergence at 0.55 kg/ha
[3] DCPA applied at planting at 8 kg/ha

Table 3. Broadleaf weeds controlled by postemergence clopyralid applications

Weed	Control ratings	Clopyralid (kg/ha) 0	0.05	0.1	0.2	0.3	LSD (0.05)
Aster, white heath	%	0	-	-	-	75	8
Cocklebur, common	%	0	-	93	100	-	18
Galinsoga, hairy	%	0	100	100	-	100	NA
Goldenrod, Canada	%	0	-	-	-	68	16
Lambsquarter, common	%	0	8	10	0	63	24
Mugwort	%	0	-	-	68	-	13
Nightshade, eastern black	%	0	-	100	-	100	NA
Pigweed, smooth	%	0	13	20	30	-	24
Purslane, common	%	0	0	0	0	-	7
Ragweed, common	%	0	-	-	90	90	33
Shepherdspurse	%	0	-	0	-	0	9
Smartweed, Pennsylvania	%	0	-	-	-	-	15
Thistle, Canada	%	0	-	35	85	-	20
Velvetleaf	%	0	10	7	20	-	22

(Table 3). Injury was similar to those observed following the application of 2,4-D. Symptoms included epinastic responses, swelling of the growing point, and brittleness followed by death of sensitive weed species. Smooth pigweed (Amaranthus hybridus L.), common lambsquarter (Chenopodium album L.), common purslane (Portulaca oleracea L.), common chickweed [Stellaria media (L.) Vill.], and velvetleaf (Albutilon theophrasti Medik.) were not controlled by clopyralid.

Clopyralid applied postemergence caused no injury to several vegetable crops, including asparagus, onions, and cole crops. Canada thistle was controlled by 0.28 kg/ha. Sensitive annual weeds were controlled by lower rates of the herbicide. Certain common broadleaf weeds and grass weeds are not controlled; therefore, clopyralid should be evaluated in combination with other herbicides to increase the spectrum of weeds controlled.

GROWTH RESPONSE OF YOUNG PEACH TREES TO COMPETITION WITH SEVERAL GRASS SPECIES

W. V. Welker[1] and D. M. Glenn[2]

ABSTRACT

The growth of young peach trees is adversely affected by competition from weeds and adjacent vegetation. The response of young peach trees to three levels of competition from three grass species was studied for 2 years. Trees were grown in three different size vegetation-free squares (1,2 and 3 meters on a side) within solid stands of three different grass species ['Kentucky 31' tall fescue (Festuca arundinacea Schreb.), orchardgrass (Dactylis glomerata L.), and perennial ryegrass (Lolium perenne L.)]. There was a direct relationship between the size of the vegetation-free area and the growth of the peach tree for both the first and second years of the study. There was no effect on growth associated with grass species during the first year. The grass species adjacent to the vegetation-free area had a significant impact upon growth of the peach trees during the second year. 'Kentucky 31' was the most competitive grass, followed by orchardgrass, while perennial ryegrass was the least competitive with the peach trees.

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NEW HERBICIDES FOR THE CONTROL OF TRIAZINE-RESISTANT WEEDS IN NO-TILL CORN

R. L. RITTER1/

ABSTRACT

Triazine-resistant smooth pigweed (Amaranthus hybridus L.) is a major weed problem in the mid-Atlantic, northeastern, and upper midwest regions of the United States. Localized infestations of triazine-resistant common lambsquarters (Chenopodium album L.) are starting to become widespread through these regions as well. Yet, the spread of triazine-resistant giant foxtail (Setaria faberi Herrm.) has been minimal since its discovery in 1984. To date, management strategies of these weeds in no-tillage corn (Zea mays L.) have relied upon a blanket preemergence herbicide application, such as metolachlor, to provide early-season suppression. For control of escaped triazine-resistant broadleaf weeds, a postemergence application of herbicides such as dicamba or 2,4-D is generally required. For control of triazine-resistant giant foxtail escapes, the only postemergence herbicide that has provided some degree of control until recently is paraquat, applied post-directed. Over the past several years, a number of experimental herbicides have been evaluated for activity on those weeds in corn. The discussion, though, will be limited to control of triazine-resistant smooth pigweed and giant foxtail.

For triazine-resistant smooth pigweed, V-53482 has provided excellent preemergence activity. For postemergence control of this weed, CGA-136872, DPX-V9360, pyridate, and thifensulfuron have provided good to excellent control.

For triazine-resistant giant foxtail, preemergence applications of the microencapsulated formulations of alachlor or EPTC, as well as preemergence applications of clomazone, have provided good control. DPX-V9360 has also provided good to excellent postemergence control of this annual grass species.

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ANNUAL WEED CONTROL IN CORN WITH SULFONYLUREA HERBICIDES

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ABSTRACT

Field experiments were conducted in 1989 and 1990 to evaluate several sulfonylurea herbicides and spray adjuvants for annual grass and broadleaf weed control in field corn (Zea mays L.). CGA-136872 and thifensulfuron were evaluated for velvetleaf (Abutilon theophrasti Medik.) and triazine-resistant common lambsquarters (Chenopodium album L.) control. DPX-V9360, DPX-E9636, and DPX-79406 were evaluated for control of large crabgrass [Digitaria sanguinalis (L.) Scop.], foxtail (Setaria spp.), wild mustard (Sinapsis arvensis L.), and common ragweed (Ambrosia artemisiifolia L.). The velvetleaf and large crabgrass experiments were conducted on a gravelly loam with 4.0% organic matter while control of the other species was evaluated on silt loams with 4.5% organic matter. A randomized complete-block design with four replications was used in each experiment. Herbicide treatments were applied in water to 10 by 25 ft plots using 80015 flat spray tips mounted on a compressed air bicycle sprayer calibrated to deliver 25 gpa of spray solution.

Velvetleaf control with 0.57 oz ai/A of CGA-136872 was similar to that obtained with postemergence applications of bromoxynil at 0.38 lb ai/A or dicamba at 0.5 lb ai/A, and better than that obtained with 0.06 oz ai/A of thifensulfuron. The addition of 4% (v/v) 28% N to the spray solution improved velvetleaf control with both sulfonylurea herbicides when a nonionic surfactant was used. When applied with 1% (v/v) crop-oil concentrate, only thifensulfuron applications benefited from the addition of 28% N. Similar rates of CGA-136872 and thifensulfuron provided excellent control of triazine-resistant common lambsquarters with few differences among spray additives.

DPX-V9360 and DPX-E9636 at 0.50 oz ai/A with 1/4% (v/v) of nonionic surfactant provided excellent foxtail and wild mustard control when applied early postemergence. The control of these species was similar to that obtained with 2 lb ai/A cyanazine applied at the same time. However, rates of DPX-V9360 and DPX-E9636 up to 1.0 and 0.75 oz/A respectively did not control common ragweed. Combinations of 0.50 oz/A of DPX-V9360 with 0.9 lb ai/A of atrazine or 0.25 lb/A of dicamba provided excellent common ragweed control. However, wild mustard and foxtail control were not as good as when DPX-V9360 was applied alone. The combination of bromoxynil at 0.25 or 0.38 lb/A with 0.5 oz/A of DPX-V9360 improved common ragweed control compared to DPX-V9360 alone but did not provide the same level of control as cyanazine.

Postemergence application of DPX-V9360 at 0.75 oz/A controlled large crabgrass as well as 2 lb/A of cyanazine in 1989. Control with DPX-E9636 and DPX-79406 at 0.75 oz ai/A was better than with cyanazine. Application of 2 lb/A of cyanazine, 0.75 oz/A of DPX-V9360, or 0.5 oz/A of DPX-E9636 and DPX-79406 when large crabgrass was in the cotyledon to four-leaf stage failed to provide acceptable control in 1990. However, good large crabgrass control was obtained with these rates of the sulfonylurea herbicides when applied 6 days later.

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ALFALFA AND ORCHARDGRASS CONTROL IN NO-TILL CORN

N. L. Hartwig[1]

ABSTRACT

Glyphosate, 2,4-D, atrazine, simazine and dicamba treatments were applied in various combinations to a three year old alfalfa/grass stand on the Penn State Agronomy Farm starting in the fall of 1987. The soil was a Murrill Silt Loam (Typic Hapludult) with a pH of 7.0. All treatments were applied with a tractor mounted small plot sprayer with 80015 extended range flat fan nozzles at 187 kPa and 187 l/ha of water. A blanket treatment of Bullet[2] at 4 lb ai/A was applied preemergence on 5/4/89. 'Pioneer 3475' corn was planted in 4.57 by 6.1 m plots with a six row no-till planter in 76 cm rows on May 9, 1988 and May 22, 1989 with 110 kg/ha of 10-30-10 fertilizer in the row. No additional nitrogen was applied in 1988 since corn followed alfalfa but in 1989, 154 kg/ha nitrogen was sidedressed on June 26. The alfalfa was 25 to 30 cm and orchardgrass 15 to 20 cm tall and both were green and leafy when fall treatments were applied in 1987. Early spring atrazine was applied March 29, 1988 when alfalfa was just breaking dormancy. All pre treatments were applied May 11, 1988 when both alfalfa and orchardgrass were 25 to 30 cm.

Corn growth and yields were drastically reduced in 1988 due to the driest growing season in 100 years. Alfalfa control was 89% or better for any treatment that contained 2,4-D LVE or dicamba in the form of Marksman[3] applied in the fall followed by atrazine + simazine at 2.92 + 1 lb/A preemergence. There was considerable alfalfa recovery growth by June 28 where Marksman was used in the fall. Even the addition of 2,4-D to the mixture didn't improve alfalfa control. The addition of glyphosate controlled 80 to 97% of the grass with little recovery growth later in the summer. Atrazine at 0.92 lb/A in the fall followed by atrazine + simazine at 2 + 1 lb/A preemergence gave almost complete control of both alfalfa and grass. This treatment was also one of highest yielding in the study. Corn stands were not affected by any of the treatments. Corn height and yield were generally significantly greater where fall applied glyphosate + 2,4-D LVE effectively controlled both alfalfa and grass.

The only preemergence treatments that effectively controlled alfalfa were those that contained 2,4-D LVE. Even dicamba in Marksman wasn't quite as effective as 2,4-D and where triazines were used alone the control of alfalfa was the worst. Grass control was generally not as good as from fall treatments containing glyphosate but were usually not significantly different from the fall treatments.

The lack of alfalfa and grass control carried over into the next growing season. The best alfalfa and orchardgrass control was obtained from fall treatments containing 2,4-D LVE and glyphosate followed by triazines in the spring. Corn heights and yields were the greatest for these treatments for both the first and second years after treatment. Generally corn heights and yields were only significantly reduced by reduced alfalfa and orchardgrass control in the dry year of 1988 and in 1989 most treatments were not significant from each other.

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[2] Bullet = alachlor + atrazine @ 2.5 + 1.5 lb ai/gal

[3] Marksman = K salt of dicamba + atrazine @ 1.1 + 2.2 lb ai/gal

INTRODUCTION

The primary "weeds" in this trial were a two year old stand of alfalfa (Medicago sativa L. 'Saranac AR') and orchardgrass (Dactylis glomerata L. 'Pennlate') seeded in 1985. The alfalfa stand was still very good and normally would not have been rotated to corn (Zea mays L.) however healthy alfalfa should have put the herbicides more to the test. There was also a small amount (<10%) of yellow foxtail (Setaria lutescens L.), yellow nutsedge (Cyperus esculentus L.) and orchardgrass.

This is a continuation of a study done in a different area in 1986 which showed that when atrazine [6-chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine] @ 2.2 kg ha^{-1} was split out and applied early preplant (EPP) on March 25, '86 followed by simazine (6-chloro-N,N'-diethyl-1,3,5-triazine-2,4-diamine) + (atrazine, Marksman[4], or Marksman + 2,4-D [(2,4-dichlorophenoxy)acetic acid] low volatile ester (LVE) corn yields were up to 30 bu more per acre than when the total amount of herbicide was applied as a single preplant (PP) treatment on April 28,'86 (1). If there was that much benefit from applying 2.2 kg of atrazine EPP to suppress the growth of alfalfa and other weeds, what might the benefit be if alfalfa, orchardgrass and other perennial weeds were killed in the fall? To answer this question, treatments 1 to 6 (Table 1) were added to this study started in 1987.

Fall applications of glyphosate [N-(phosphonomethyl)glycine] (Sept. 20 to Oct. 20) have been shown to effectively control orchardgrass (2). Treatments 1 to 3 are three rates of glyphosate + 2,4-D LVE applied in the fall (Oct. 14, 1987) to see how this mixture works on alfalfa, orchardgrass and other perennial weeds. This is the best treatment if orchardgrass or other perennial grasses are part of the hay stand and a fall (mid-Oct.) application date has proven to be the best for central Pennsylvania (2).

The total amount of herbicide applied for treatments 4 to 6 is exactly the same as treatments 7 to 9 and 10 to 12 (Table 1). Treatments 10 to 12 are the total of the individual herbicides applied as a single tank mix on May 11, 1988, just after corn planting on May 9, 1988. In treatments 4 to 6, atrazine + simazine @ 2.2 + 1.1 kg ha^{-1} were applied pre and the rest was applied in the fall (Oct. 14, '87). Basically we were interested in seeing what Marksman and Marksman + 2,4-D LVE would do if applied in the fall. Treatment 4 had an amount of atrazine equivalent to that contained in the Marksman applied in the fall.

For treatments 7 to 9, atrazine @ 2.2 kg ha^{-1} was split out and applied EPP (March 29,'88) to weaken the alfalfa and other weeds for the rest of the treatment applied Pre (May 11, '88). This is Penn States best recommendation where quackgrass is a significant problem which it often is in an old alfalfa field.

Treatments 10 to 12, where the whole dose was applied at once are a check for the other treatments to see if there was any value in splitting out a portion of each treatment and applying it in the fall or early spring. In treatment 10, atrazine + simazine @ 3.2 + 1.1 kg/ha^{-1} was applied pre to obtain the same total atrazine and simazine contained in the other treatments.

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[4] Marksman = K salt of dicamba + atrazine @ 1.1 + 2.2 lb ai/gal

MATERIALS AND METHODS

This trial was conducted at the Agronomy Research Farm at Rock Springs, PA. The soil was a Murrill silt loam (Typic Hapludult) containing about 16% sand, 67% silt, 14% clay and 2.5% organic matter. The area was limed to a pH of 7.0 before seeding the alfalfa and orchardgrass in 1985.

Corn 'Pioneer 3475' was planted in 76 cm rows with a 6-row John Deere Max-emerge no-till planter on May 9, 1988. A row fertilizer (110 kg ha^{-1} of 10-30-10) was applied with the planter. No additional nitrogen was applied since it was felt that the killed alfalfa would provide all the nitrogen necessary for normal growth. Since 1988 turned out to have the driest June and July in 100 years, nitrogen was surely not limiting.

Fall treatments were applied October 14, 1987 after a hard frost (-2°C) the night before. The alfalfa was 25 to 30 cm and orchardgrass 15 to 20 cm tall and both were green and leafy at the time.

Early spring atrazine was applied March 29, 1988 when alfalfa was just breaking dormancy. All pre treatments were applied May 11, 1988 when both alfalfa and orchardgrass were 25 to 30 cm.

In 1989, the whole trial area was treated with a blanket treatment of Bullet[5] to control annual weeds without providing further control of alfalfa or orchardgrass so the control of these species by the initial treatments could be evaluated the second year.

All treatments were applied with a tractor mounted small plot sprayer with 80015 extended range flat fan nozzles at 187 kPa and 187 l/ha of water.

Out of fear of losing the trial, it was irrigated once with 50 l m^{-2} of water with an overhead irrigation system in late June 1988.

The alfalfa and orchardgrass yields were determined by harvesting all top growth from a 0.5 m^2 area from each plot in August or September 1988 and 1989. A sub-sample was saved from random plots for dry weight determination. Corn stand and grain yields were measured for three of the four middle rows of a six row plot 4.6 by 6.7 m in size. ANOV was run on percent control, alfalfa and grass dry matter yields and corn stand, height and grain yields with the SAS statistical package as a randomized complete block design with four replications.

RESULTS AND DISCUSSION

Corn growth and yields were drastically reduced in 1988 due to the driest growing season in 100 years. Subsoil moisture was available since the rainfall for the previous five years was reasonably normal. If the corn was able to get off to a good start and develop a root system deep enough to tap into this subsoil moisture, corn yields of 100 bu/A were still possible without irrigation. With one irrigation of 50 l m^{-2} of water in late June, potential yields were probably increased to 125 bu/A.

Alfalfa control was 89% or better for any treatment that contained 2,4-D LVE or dicamba in the form of Marksman applied in the fall when rated two days after corn planting on May 11, 1988 (Table 1). There was considerable alfalfa recovery growth by June 28 where Marksman was used

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[5] Bullet = alachlor + atrazine @ 2.5 + 1.5 lb ai/gal

in the fall. Even the addition of 2,4-D to the mixture didn't improve alfalfa control. The same rate of 2,4-D applied with glyphosate in the fall did a better job of controlling alfalfa except at the lowest rate of 0.25 + 0.5 lb ai/A. Also, the addition of glyphosate controlled 80 to 97% of the grass with little recovery growth later in the summer. The most amazing treatment was atrazine at 0.92 lb/A in the fall followed by atrazine + simazine at 2 + 1 lb/A preemergence. Although it took half the summer, both alfalfa and grass was almost completely controlled by fall. This was one of the highest yielding treatments in the study.

Corn stands were not affected by any of the treatments. Corn height and yield were generally significantly greater where fall treatments (T2 to T4) effectively controlled both alfalfa and grass.

The preemergence treatments had not been applied yet on May 11 so there was no control from these at this point in time. Atrazine at 2 lb/A had been applied on March 29 which provided up to 18% grass control but no alfalfa control. Alfalfa yields later in the summer indicated that the only preemergence treatments that effectively controlled alfalfa were those that contained 2,4-D LVE. Even dicamba in Marksman wasn't quite as effective as 2,4-D and where triazines were used alone the control of alfalfa was the worst. Grass control was generally not as good as from fall treatments containing glyphosate but were usually not significantly different from the fall treatments.

Corn heights and yields were significantly reduced as a result of excessive competition from alfalfa and grass early in the growing season for the spring treatments.

The lack of alfalfa and grass control carried over into the next growing season as one might expect (Table 2). Treatments 2 to 4 provided almost total control of alfalfa and orchardgrass and corn height and yield were among the highest in 1989 when moisture was not a limiting factor. Generally alfalfa and orchardgrass control was good for all treatments and there was seldom significant reductions in corn growth and yields. If 1989 had been a little drier, one might have expected greater competition from the uncontrolled alfalfa and orchardgrass.

In conclusion, the best alfalfa and orchardgrass control can be obtained from fall treatments containing 2,4-D LVE and glyphosate followed by triazines in the spring. Corn heights and yields were the greatest for these treatments for both the first and second years after treatment. Generally corn heights and yields were only significantly reduced by reduced alfalfa and orchardgrass control in the dry year of 1988 and in 1989 most treatments were not significant from each other.

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Table 1: First year alfalfa and orchardgrass control results and corn growth and yield following treatments applied fall 1987 and spring 1988.

No.	Treatment	Application Rate	Alfalfa[a] Control 5/11	Alfalfa[a] Yield 6/28	Alfalfa[a] Yield 9/2	Grass[a] Control 5/11	Grass[a] Yield 9/2	Corn Stand	Corn Height	Corn Yield
		(lb ai/A)	(%)	(lb/A)	(lb/A)	(%)	(lb/A)	(plants/A)	(cm)	(bu/A)
1.	Glyphosate + 2,4-D LVE (Fall) + Atrazine 4L + Simazine 4L (Pre)	.25 + 0.5 + 2.92 + 1.0	89 a[b]	364 b-e	139 b-e	80 c	21 c	22,579 a	122 ab	89 ab
2.	Glyphosate + 2,4-D LVE (Fall) + Atrazine 4L + Simazine 4L (Pre)	0.5 + 0.5 + 2.92 + 1.0	89 a	170 cde	116 b-e	95 ab	183 abc	23,595 a	133 a	106 a
3.	Glyphosate + 2,4-D LVE (Fall) + Atrazine 4L + Simazine 4L (Pre)	1.0 + 0.5 + 2.92 + 1.0	94 a	80 de	58 de	97 a	61 c	23,668 a	142 a	98 a
4.	Atrazine 90DF (Fall) + Atrazine 4L + Simazine 4L (Pre)	0.92 + 2.0 + 1.0	50 b	35 e	9 e	86 bc	2 c	22,288 a	143 a	106 a
5.	Marksman[c] (Fall) + Atrazine 4L + Simazine 4L (Pre)	1.4 + 2.0 + 1.0	93 a	444 bc	255 ab	0 e	486 a	22,143 a	109 bc	83 abc
6.	Marksman[c] + 2,4-D LVE (Fall) + Atrazine 4L + Simazine 4L (Pre)	1.4 + 0.5 + 2.0 + 1.0	96 a	404 bcd	249 abc	0 e	133 bc	21,998 a	103 bc	60 cd
7.	Atrazine 4L (E. Spr.) + Simazine 90DF + Atrazine 90DF (Pre)	2 + 1.0 + .92	0 c	948 a	341 a	3 e	127 bc	20,110 a	74 de	57 cd
8.	Atrazine 4L (E. Spr.) + Simazine 90DF + Marksman[c] (Pre)	2 + 1.0 + 1.4	0 c	320 b-e	104 cde	18 d	171 abc	22,869 a	108 bc	89 ab
9.	Atrazine 4L (E. Spr.) + Sim. 90DF + Marksman[c] + 2,4-D LVE (Pre)	2 + 1.0 + 1.4 + .5	0 c	55 e	37 e	18 d	417 ab	20,764 a	103 bc	70 bc
10.	Atrazine 90DF + Simazine 90DF (Pre)	2.92 + 1.0	0 c	594 b	324 a	0 e	181 abc	20,255 a	70 e	41 de
11.	Marksman[c] + Atrazine 90DF + Simazine 90DF (Pre)	1.4 + 2.0 + 1.0	0 c	239 cde	197 a-d	0 e	137 bc	21,344 a	71 e	30 e
12.	Marksman[c] + 2,4-D LVE + Atrazine 90DF + Simazine 90DF (Pre)	1.4 + 0.5 + 2.0 + 1.0	0 c	65 de	75 de	0 e	449 ab	19,892 a	94 cd	60 cd

[a] Alfalfa and orchardgrass yields for June 28 and September 2 are reported on a dry matter basis.

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

[c] Marksman = K salt of dicamba + atrazine @ 1.1 + 2.2 lb ai/gallon.

Table 2: Second year alfalfa and orchardgrass control results and corn growth and yield following treatments applied fall 1987 and spring 1988.

No.	Treatment[a]	Application Rate (lb ai/A)	Alfalfa Control 7/3 (%)	Alfalfa Yield 8/20 (lb/A)	Orchardgrass Control 7/3 (%)	Orchardgrass Yield 8/20 (lb/A)	Corn Injury (%)	Corn Stand (plants/A)	Corn Height (cm)	Corn Yield (bu/A)
1.	Glyphosate + 2,4-D LVE (Fall) + Atrazine 4L + Simazine 4L (Pre)	0.25 + 0.5 + 2.92 + 1.0	59 c[b]	57 bc	99 a	25 b	40 a-d	18,150 a	148 abc	109 ab
2.	Glyphosate + 2,4-D LVE (Fall) + Atrazine 4L + Simazine 4L (Pre)	0.5 + 0.5 + 2.92 + 1.0	94 ab	16 c	100 a	2 b	20 cd	21,054 a	160 ab	125 a
3.	Glyphosate + 2,4-D LVE (Fall) + Atrazine 4L + Simazine 4L (Pre)	1.0 + 0.5 + 2.92 + 1.0	97 ab	2 c	100 a	2 b	19 cd	21,707 a	158 ab	125 a
4.	Atrazine 90DF (Fall) + Atrazine 4L + Simazine 4L (Pre)	0.92 + 2.0 + 1.0	100 a	1 c	100 a	0 b	14 d	21,635 a	167 a	133 a
5.	Marksman[c] (Fall) Atrazine 4L + Simazine 4L (Pre)	1.4 + 2.0 + 1.0	80 abc	22 c	81 a	441 ab	28 bcd	19,747 a	147 a-d	133 a
6.	Marksman[c] + 2,4-D LVE (Fall) + Atrazine 4L + Simazine 4L (Pre)	1.4 + 0.5 + 2.0 + 1.0	96 ab	8 c	79 a	657 a	24 bcd	20,546 a	150 ab	108 ab
7.	Atrazine 4L (E.Spr) + Simazine 90DF + Atrazine 90DF (Pre)	2.0 + 1.0 + 0.92	6 d	115 ab	96 a	88 ab	48 abc	20,764 a	126 cde	116 a
8.	Atrazine 4L (E.Spr) + Simazine 90DF + Marksman[c] (Pre)	2.0 + 1.0 + 1.4	28 d	106 ab	98 a	144 ab	41 a-d	20,618 a	138 b-e	121 a
9.	Atrazine 4L (E.Spr) + Simazine 90DF + Marksman[c] + 2,4-D LVE (Pre)	2.0 + 1.0 + 1.4 + 0.5	74 abc	25 c	80 a	338 ab	35 a-d	20,038 a	150 ab	120 a
10.	Atrazine 90DF + Simazine 90DF (Pre)	2.92 + 1.0	6 d	112 ab	98 a	25 b	53 ab	19,239 a	124 de	120 a
11.	Marksman[c] + Atrazine 90DF + Simazine 90DF (Pre)	1.4 + 2.0 + 1.0	4 d	162 a	96 a	54 ab	60 a	18,586 a	118 e	85 b
12.	Marksman[c] + 2,4-D LVE + Atrazine 90DF + Simazine 90DF (Pre)	1.4 + 0.5 + 2.0 + 1.0	64 bc	19 c	83 a	441 ab	31 a-d	19,965 a	145 a-d	109 ab

[a] Treatment timings: Fall - 10/14/87, E. Spring - 3/29/88, and Pre - 5/11/88. A blanket application of Bullet at 4.0 lb ai/acre was made 5/4/89.

[b] Column means followed by the same letter are not significantly at the 5% level (P=0.05) according to Duncan's Multiple Range Test.

[c] Marksman = K salt of dicamba + atrazine @ 1.1 + 2.2 lb ai/gal

CONTROL OF QUACKGRASS WITH CGA-136872

D. B. Vitolo, M. D. Johnson, G. Gillespie and S. W. Pruss[1]

ABSTRACT

CGA-136872 is a sulfonylurea herbicide developed by CIBA-GEIGY Corporation for control of various grass and broadleaf weeds in corn (Zea mays L.).

CGA-136872 was evaluated at eleven sites in New York, Pennsylvania, and Michigan for quackgrass (Agropyron repens [L.] Beauv.) control in corn in 1990. The specific objective of these field trials was to evaluate various application timings, including split and early preplant applications, examine the effects of several adjuvants, and determine quackgrass populations in test sites treated with CGA-136872.

Overall control of quackgrass with CGA-136872 was excellent. CGA-136872 applied at 40 g ai/ha to 10 to 20 cm quackgrass provided 95.5 % control when averaged across nine trials rated at least 40 days after application. Split applications of CGA-136872 at 20 g ai/ha early postemergence followed by 20 g ai/ha late post-emergence provided 97 % control when averaged across four trials. Early preplant applications of CGA-136872 alone or in combination with atrazine + metolachlor provided excellent quackgrass control. Tank-mixes of CGA-136872 with atrazine increased the speed of quackgrass control when compared with CGA-136872 alone.

The addition of liquid nitrogen (28 % UAN) with either Crop oil, X-77, or Sun-it and CGA-136872 did not consistently improve quackgrass control compared to the additives alone. The addition of 9.3 l/ha of liquid nitrogen increased quackgrass control in one trial but had no effect in a second trial.

Quackgrass culms increased from $91/m^2$ to $527/m^2$ over a 120 day period in untreated corn plots. Quackgrass stands treated with CGA-136872 at 40 g ai/ha early postemergence were reduced from 84 culms/m^2 to $30/m^2$ over the same 120 day period.

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Postemergence Grass Control in Field Corn with Nicosulfuron and Primasulfuron

Mark S. Causey and Frank J. Webb[1]

453.6

ABSTRACT

Field experiments were conducted in 1988, 1989 and 1990 to evaluate both nicosulfuron and primasulfuron for their activity on Gramineae in field corn (Zea mays L.). The experiments were performed on a sandy loam soil at the University of Delaware's Agricultural Experiment Station near Georgetown. Control ratings were obtained for both broadleaf and grass weed species. The corn crop was planted conventionally in a clean seedbed each year. No preemergence herbicides were applied for either broadleaf or grass weeds. The plot design was a random complete block with four replications. Primasulfuron was tested at rates of .013, .018, .027 and .036 lb a.i./A and nicosulfuron at rates of .016, .031, .047 and .062 lb a.i./A. Crop oil concentrate was used as an adjuvant with nicosulfuron and a 80-20 non-ionic surfactant was used with primasulfuron. All four treatments of nicosulfuron provided in excess of 94% control of large crabgrass (Digitaria sanguinalis (L.) Scop) while the four primasulfuron treatments provided from 31.6 to 38.9% control of large crabgrass. Primasulfuron provided in excess 91% control of common ragweed (Ambrosia artemisiifolia L.) at all four rates. The range of control of common ragweed with nicosulfuron was from 34.2 at the low rate to 52.9% at the higher rate. Nicosulfuron provided 64.6 to 79.6% control of common lambsquarters (Chenopodium album L.) while all four treatments of primasulfuron provided in excess of 80% control. It is concluded that both products are equal on shattercane, but nicosulfuron is far superior to primasulfuron on large crabgrass. Primasulfuron does control both common ragweed and common lambsquarters better than nicosulfuron.

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ANNUAL GRASS CONTROL WITH DPXV-9360 COMBINATIONS

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ABSTRACT

Postemergence herbicides frequently control fewer weed species than are present growing in association with a crop. Total species control can often be achieved only by using more than one herbicide. Efficient production can best be accomplished by mixing herbicides and applying them simultaneously. These studies were conducted in corn (Zea mays L. 'Pioneer 3378' [R]) to determine if mixtures of DPXV-9360 (nicosulfuron) with several broadleaf herbicides would control annual grasses and if adjuvants were necessary in the spray mix. Herbicide mixtures were applied at the 4- to 5-leaf stage of corn and 1- to 3-leaf stage of large crabgrass (Digitaria sanguinalis L.). Studies in 1989 were conducted at Painter and were less extensive than those in 1990 which were conducted at both Painter and Holland. In 1989, 2,4-D and dicamba reduced the activity of DPXV-9360 against large crabgrass; activity of dicamba mixtures but not to 2,4-D mixtures was partially restored by the addition of 0.25% (v/v) surfactant. Atrazine or atrazine + dicamba mixtures with DPXV-9360 plus surfactant controlled large crabgrass comparable to control from DPXV-9360 plus surfactant. Bromoxynil did not influence large crabgrass control from DPXV-9360. In 1990, highest control of large crabgrass generally occurred when mixtures contained surfactant or crop oil concentrate (1% v/v) but control from mixtures did not always equal that achieved with DPXV-9360 alone or with adjuvants. The magnitude of response to treatments was often greater at Painter than at Holland. These studies confirm that large crabgrass control will likely be higher from DPXV-9360 plus surfactant than from mixtures of DPXV-9360 with broadleaf herbicides.

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LONG-TERM CONTROL OF QUACKGRASS IN CORN FOLLOWING POSTEMERGENCE APPLICATIONS OF CGA-136872 AND DPX-V9360

P. C. Bhowmik and B. M. O'Toole[1]

ABSTRACT

Controlling quackgrass [Elytrigia repens (L.) Nevski.] in field corn is a challenge because of its perennial growth habit. Currently there are two new postemergence compounds that are effective in quackgrass control. Experiments were initiated in 1988 to evaluate long-term control of quackgrass in field corn. In one study, three rates (35, 70 and 105 gm ai/ha) of DPX-V9360 and three growth stages of quackgrass were examined. In the second study, five rates of DPX-V9360 (17, 35, 70, 105 and 140 gm ai/ha) and five rates of CGA-136872 (10, 15, 20, 24, and 30 gm ai/ha) were evaluated at the four- to six-leaf stage of quackgrass. These studies were continued in 1989 for regrowth study. Both studies were also repeated in 1989 and regrowth studies were continued in 1990.

Each plot was 2.0 by 4.6 m and treatments were replicated three times in a randomized complete block design. Corn 'Agway 584S' was planted May 11, 1988 and April 27, 1989. Treatments were applied on June 3, 21 and July 1, 1988 and on June 2, 19, and 29, 1989, respectively, when the quackgrass was at the two- to three-leaf, four- to six-leaf, and seven- to ten-leaf stage. Treatments were applied with a CO_2-backpack sprayer at a pressure of 152 kPa in 187 L/ha. X-77 was added at 0.25% (v/v) to all treatments in all studies. Quackgrass shoot number/400 cm^2, dry weight, and control were determined at various times in each year. Quackgrass control was rated in July and August. Regrowth of quackgrass in the second year from 1988 and 1989 studies was examined by quackgrass shoot counts, shoot fresh weights, and quackgrass rhizome regrowth after incubation.

In 1988 study, DPX-V9360 applied at the four- to six-leaf stage of quackgrass gave better quackgrass control (99%) than the applications made at the one- to three-leaf stage (61%) 5 WAT. Regrowth study in 1989 demonstrated that, plots which had been treated at the four- to six-leaf stage showed the greatest long-term quackgrass control (85%) compared to the control (46%) obtained from the application made at one- to three-leaf and seven- to ten-leaf stage). Similar results were noted in 1990 regrowth study.

In the second trial, DPX-V9360 and CGA-136872 at all rates controlled quackgrass effectively 5 to 10 WAT. Regrowth of quackgrass in 1989 showed better long-term control with DPX-V9360 than with CGA-136872 treatments. Quackgrass control the following May (1990) was excellent in all treatments. Shoot regrowth and rhizome numbers were greater with CGA-136872 treatments than with DPX-V9360 treatments. In general, long-term quackgrass control was better with DPX-V9360 than with CGA-136872.

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INTERACTION BETWEEN POSTEMERGENCE APPLICATIONS OF CGA-136872 AND SOIL APPLIED INSECTICIDES IN CORN

M. D. Johnson, D. B. Vitolo, J. D. Abbott, C. M. Moseley, S. W. Pruss, and P. J. Porpiglia[1]

ABSTRACT

Greenhouse and field trials were conducted in 1988-1990 to evaluate the potential for soil insecticides to interact with CGA-136872 to cause corn (Zea mays L.) injury and to determine if this interaction could be favorably managed.

A 1988 field test first demonstrated that postemergence applications of CGA-136872 could interact with terbufos applied at planting to cause unacceptable corn injury when either product alone was safe. Greenhouse tests showed that only organophosphate soil insecticides had the potential to interact with CGA-136872, and those ranked: terbufos > fonofos > phorate > chlorpyrifos. Field tests in 1989 and 1990 supported this ranking, but showed that CGA-136872 applied over terbufos was the only combination to result in unacceptable levels of corn injury when labeled rates of the insecticides and CGA-136872 were used. This terbufos x CGA-136872 interaction was observed approximately 60% of the time. Fonofos and phorate have shown the potential to interact with CGA-136872 in the field, but typically only at higher than labeled rates or when the CGA-136872 is applied within 20 days after planting. There has been little evidence of an interaction between chlorpyrifos and CGA-136872 in field tests. All corn hybrids tested have shown susceptibility to injury from the interaction between CGA-136872 and terbufos.

Interactions between terbufos and CGA-136872 were reduced, but not eliminated, by applying CGA-136872 late-post rather than early-post, applying the terbufos in a band rather than in-furrow, and by using a controlled release formulation rather than the 15G formulation of terbufos.

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EFFECT OF VIRUS DISEASES ON CORN AS INFLUENCED BY VARIETY, JOHNSONGRASS CONTROL METHOD, AND INSECTICIDE APPLICATION

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ABSTRACT

Field experiments were conducted to evaluate the effect of variety, method of johnsongrass (Sorghum halapense (L.) Pers.) control, and insecticide application on development of Maize Dwarf Mosaic Virus and Maize Chlorotic Dwarf Virus diseases in field corn (Zea mays (L.). The research was conducted near Blacksburg, VA on a Ross silt loam of 2.0% organic matter content and soil pH 5.9. The experimental design was a 3-way (2x5x2) factorial of corn variety x johnsongrass control method x insecticide application. Levels within each factor were 1) corn variety: SS-565 (virus susceptible) and SS-844 (virus tolerant), 2) johnsongrass control method: DPXV-9360, CGA-136872, glyphosate, mechanical, and control, and 3) insecticide: methomyl plus esfenvalerate and no insecticide. Application rates for DPXV-9360, CGA-136872, glyphosate, methomyl, and esfenvalerate were .040, .035, 2.00, .100, and .055 kg ai/ha, respectively. Applications were made to 8-9 leaf corn and 30-40 cm johnsongrass using 220 L/ha at a pressure of 210 kPa with 8003 flat fan tips. Visual evaluations of corn vigor reduction and johnsongrass control were made throughout the growing season.

Significant effects of corn variety and johnsongrass control method on disease severity and corn yield were observed. In later evaluations, virus damage was 40 and 13% in susceptible and tolerant varieties, respectively. Virus expression was greater in plots where johnsongrass was controlled with glyphosate (29%) than in plots where johnsongrass was controlled via CGA-136872, DPXV-9360, or mechanical means (8, 6, and 3%, respectively). Virus symptoms were greater for both corn varieties where johnsongrass was controlled than where no johnsongrass control was implemented. These values were 56 and 24% for the susceptible variety in plots receiving johnsongrass control and no control, respectively, and 15 and 11% for the tolerant variety in plots receiving johnsongrass control and no control, respectively. Corn yields were closely correlated with disease severity, and were reduced by 20-30% in response to severe virus infection.

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CORN VARIETAL TOLERANCE TO VIRAL DISEASE AS INFLUENCED BY CGA-136872 APPLICATIONS TO JOHNSONGRASS

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ABSTRACT

Maize Dwarf Mosaic Virus (MDMV) and Maize Chlorotic Dwarf Virus (MCDV) are insect transmitted viral diseases of johnsongrass [Sorghum halapense (L.) Pers.] that also infect corn (Zea mays L.). Field observations have shown that selective postemergence control of johnsongrass with sulfonylurea herbicides can increase the incidence of these diseases in corn. Insects feed on johnsongrass which is the primary host of both MDMV and MCDV. When the johnsongrass is controlled, the contaminated insect vectors move to the secondary host, corn, and transmit the diseases during the normal feeding process. The resulting symptoms (discolored and stunted corn) can easily be misinterperated as herbicide injury since the the insect vectors are not very mobile and infection is usually limited to the herbicide treated area.

Many seed corn companies have varieties that are resistant to MDMV and MCDV but field testing for tolerance has been limited to trials where corn is grown in the presence of actively growing johnsongrass. Thus, research was initiated in Maryland, Virginia, and West Virginia to determine if genetic tolerance to MDMV and MCDV would be adequate when infected johnsongrass was selectively controlled with postemergence applications of CGA-136872. A total of eighteen hybrids were tested in five replicated field trials.

Average disease levels ranged from very low for a reportedly "virus resistant" variety to extremely high for a known susceptible hybrid. Four of the varieties had excellent tolerance at all locations while several others displayed resistance that varied with location. Numerous varieties were intermediate in tolerance that might be adequate under less severe disease conditions. The use of virus tolerant varieties can prevent the development MDMV and MCDV in corn following johnsongrass control.

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Potential for Cultivation and/or Band Application for Full Season Weed Control in Corn (Zea mays L.)

Lynn D. Hoffman, Greg W. Roth and Joanne Stellingwerf[1]

Three field experiments were conducted in 1989 and 1990 to evaluate band and broadcast herbicide applications and cultivation for weed control in conventional and no-till corn. In the 1989 trial, corn yields were not different under conventional tillage with either a broadcast herbicide (5.6 L Bicep[2]/ha plus 1.13 kg/ha glyphosate in no-till treatments), a band herbicide plus cultivation, or a single cultivation. Adding a cultivation to the broadcast herbicide treatment also did not improve yields. In no-till treatments, yields were approximately 1250 kg/ha higher where a broadcast herbicide was used compared to a band application with a cultivation. Corn yields obtained with a full rate broadcast herbicide were more than 2500 kg/ha greater compared to a single cultivation in no-till. The ineffectiveness of band applications and cultivation under no-till was due to increased competition from quackgrass (*Agropyron repens* (L.) Beauv.) and yellow nutsedge (*Cyperus esculentus* L.). The 1990 trials consisted of factorial arrangements of tillage (no-till and conventional), cultivation (none and a single cultivation at V6), full and half herbicide rates (5.6 and 2.8 L Bicep/ha plus 1.13 kg/ha glyphosate in no-till treatments), and broadcast and band herbicide placement. The experiment was conducted at two locations that varied in weed pressure-- one was planted into wheat stubble and had significant weed pressure from yellow nutsedge, green foxtail (*Setaria viridis (L.)* Beauv.), redroot pigweed (*Amaranthus retroflexus* L.) and dandelion (*Taraxacum officinale*) and the second was planted into soybean stubble that had little weed pressure. Cultivation had no significant impact on yields in either study. In both studies, a significant tillage by method interaction indicated no yield difference between banding and broadcast applications under tilled conditions, but a marked yield advantage to broadcast applications under no-till. This difference averaged 1250 kg/ha in the low weed pressure study following soybeans and approximately 1900 kg/ha in the study following wheat. Adding a cultivation to the band treatment did not overcome the negative effect of banding in no-till in either of the two studies. In both studies there was no yield advantage to using the higher herbicide rate, even under no-till conditions. The results of these studies confirm that responses to cultivation on the well drained Hagerstown soils used in this study are negligable and that band herbicide applications are most suited for corn production systems that include tillage.

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[2]Bicep is a mixture of 0.40 kg metolachlor and 0.32 kg atrazine per liter.

CULTIVATION AND BAND APPLICATION OF HERBICIDE IN MAIZE

Jane Mt. Pleasant[1]
and
Carl Bannon[2]

Concern over the potential environmental impact of pesticide use has renewed interest in mechanical weed control. Cultivation effectively controls weeds in row crops but three or four cultivations may be needed for acceptable control in the absence of herbicides. Weeds in the row can be particularly difficult to control with cultivation alone. A field experiment was conducted to determine if a rotary hoe and/or band application of herbicide in combination with one cultivation would control weeds in corn as well as a broadcast application of herbicide.

The experiment was established at two sites in New York in 1990: Aurora Research Farm in Cayuga County and a private farm in Madison County. Five treatments were applied in a randomized complete block design with four replications at each site. Treatments were: 1) broadcast herbicide; 2) broadcast herbicide-plus-cultivation; 3) band herbicide-plus-rotary hoe-plus-cultivation; 4) rotary hoe-plus-cultivation; and 5) rotary hoe-plus-reduced rate broadcast herbicide. The broadcast herbicide treatment used atrazine (l lb ai/A) and pendimethalin (1.5 lb ai/A) at Aurora and atrazine (l lb/A) and metolachlor (2 lb ai/A) in Madison County. Similar rates were applied in a ten-inch band over the corn row. The reduced rate herbicide treatment was applied broadcast at one-third the full rate.

There were no differences in corn grain yields among treatments at either site, but weed levels differed by treatment at both locations. In Madison County the broadcast herbicide treatment had the lowest weed cover (3%) and the rotary hoe-plus-cultivation the highest (15%). At this site broadleaf weeds dominated all treatments except the rotary hoe-plus-reduced broadcast treatment where grasses comprised most of the weed population.

At Aurora, broadcast herbicide had the highest weed cover (31%). Weed cover in the other four treatments ranged from 8 to 20%. At this site hedge bindweed (Calystegia sepium (L.) R. Bt.) and yellow nutsedge (Cyperus esculentus L.) were common weeds. They were not controlled by atrazine plus pendimethalin alone but the rotary hoe and/or cultivation reduced their levels in all other treatments.

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REDUCING ATRAZINE RATES FOR ANNUAL BROADLEAF WEEDS IN CORN

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ABSTRACT

Two strategies for reducing atrazine rates were evaluated at seven sites in 1989 and 1990. The first strategy was to apply reduced rates of atrazine postemergence with and without crop-oil concentrate (COC). Similar rates of atrazine were also applied preemergence for comparison. The second strategy was to apply alternate herbicides postemergence alone, and with reduced rates of atrazine. The alternate herbicides were dicamba at 0.5, pendimethalin at 1.5, bromoxynil at 0.25, bentazon at 0.5 with COC at 1% (v/v), and pyridate at 0.45 or 0.90 lb ai/A.

Conventional tillage was used at all sites. Preemergence treatments were applied on the day of planting or within 3 days after planting. Postemergence treatments were applied when corn (Zea mays L.) had four true leaves. Spray solutions were applied with a CO_2 backpack sprayer delivering 20 gpa at 30 psi. The experimental design was a randomized complete block design with four replications. Control data was collected for common lambsquarters (Chenopodium album L.), redroot pigweed (Amaranthus retroflexus L.), smooth pigweed (Amaranthus hybridus L.), wild mustard (Sinapsis arvensis L.), common ragweed (Ambrosia artemisiifolia L.), and velvetleaf (Abutilon theophrasti Medik.). Triazine-resistant biotypes of common lambsquarters and smooth pigweed were present at some sites. Weed control ratings were transformed to the arcsine and subjected to analysis of variance. Two sets of orthogonal contrasts were made. One set to examine the atrazine timing and rate main effects and their interactions. The second set to determine differences among the alternate herbicides and how the addition of atrazine affected weed control. The interactions of alternate herbicides and the addition of atrazine were also analyzed.

Dicamba was the only alternate herbicide that gave good control of the triazine-resistant smooth pigweed. All the alternate herbicides gave good control of the triazine-resistant common lambsquarters. Atrazine at 0.5 lb/A postemergence with COC performed as well as 1.0 or 1.5 lb/A preemergence for all species except for wild mustard and velvetleaf. Atrazine applied preemergence at 0.5 lb/A gave excellent wild mustard control but 1.0 lb/A of atrazine with COC was required postemergence for excellent control. Velvetleaf was not adequately controlled by preemergence atrazine applications up to 1.5 lb/A and 1.0 lb/A with COC was required postemergence for adequate control. An alternate herbicide with atrazine at 0.5 lb/A controlled each of the weed species as well as, or better than 1.5 lb/A of atrazine preemergence. Adding atrazine at 0.5 lb/A to the alternate herbicides improved the level and spectrum of control.

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REDUCED HERBICIDES RATES IN CORN[1]

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ABSTRACT

Within the general concept of sustainable agriculture, the use of reduced herbicide rates may be a solution to lower the impact herbicides have on production costs and on environmental pollution. Several standard herbicides were evaluated in corn (Zea mays L.) at the Adelphia Research Center, Freehold, New Jersey in 1990. The objective of this study was to determine whether reduced herbicide rates can provide satisfactory weed control as the weed control of the full rate.

The study consisted of three replicates in a randomized block design. Four rows of corn var. 'Midstates 747' were planted May 24 in a Sassafras loam soil with pH 6.3 and 1.9% organic matter. Plot size was 3.6 by 5.7 m. Treatments included applications of 0.25x, 0.5x, 0.75x, and 1x rates (1x = recommended full rate) of premixes of metolachlor, alachlor, cyanazine, and pendimethalin with atrazine, and metolachlor followed by either 2,4 D amine or dicamba + atrazine premixes. Herbicides were applied preemergence (PE), delayed preemergence (DPE), and postemergence (PO) on May 25, June 7, and June 18, respectively. The most prevalent weeds on the site included redroot pigweed (Amaranthus retroflexus L.), common lambsquarters (Chenopodium album L.), ivyleaf morningglory (Ipomoea hederacea L. Jacq.), and fall panicum (Panicum dichotomiflorum Michx.). Weed control ratings were made July 16, 1990.

We observed that 0.75x rate (PE) of metolachlor + atrazine provided similar control to the full rate (1x) for all weeds evaluated. Alachlor + atrazine at 0.25x (PE) followed by 0.25X (DPE) resulted in the same control as 1x (PE). Good weed control was obtained with 0.25x alone except for fall panicum. No differences in weed control of 1x and sequential applications of 0.25x (PE) followed by 0.25x (DPE) of cyanazine + atrazine or pendimethalin + atrazine resulted. The same pattern was evident with metolachlor (0.25x PE + 0.25x DPE) followed by 2,4 D amine (PO). The 0.5x metolachlor followed by dicamba + atrazine showed the same potential to control weeds as the full rate of metolachlor.

This preliminary study indicated that the 0.5x rate of most of the herbicides evaluated provided the same degree of weed control as the full rate.

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[1] New Jersey Agric. Exp. Stn. Publication No. J-15472-1-90.

[2] Res. Assoc., Res. Prof. Weed Sci., and Grad. Student, respectively, Crop Sci. Dept., Rutgers Univ., New Jersey.

Influence of Tillage and Prior Year Weed Control on Herbicide Efficacy in Corn (*Zea mays* L.)

Greg W. Roth, Joanne Stellingwerf, and Lynn D. Hoffman[1]

Four field experiments were conducted to determine the influence of prior weed control levels on the efficacy of combinations of atrazine and metolachlor applied at various rates. In two studies, 0, 75 and 100% weed control levels were established in 1989 using nonselective herbicides. In 1990, tillage treatments were imposed across the weed control levels. The tillage subplots were further divided into subplots that recieved four rates of Bicep[2] applied preemergence at 0, 2.1, 3.2 and 4.2 L/ha. No-till treatments also recieved gramoxone at 0.51 kg/ha. Broadleaf and grass weed control ratings and population data were collected at four and eight weeks after planting. Corn yields and moisture contents were determined at harvest. Results of these experiments indicated that both tillage and prior years weed control interact to determine the herbicide rate where acceptable control and optimum yields occur. Where tillage and 100% weed control were imposed together optimum yields were achieved at both locations with the 2.1 L/ha Bicep rate. Where no control was applied in the previous year, the tilled plots reached maximum yields at the 3.2 L/ha rate. Similar responses occured in the no-till treatments, except that yields reached a maximum at the 4.2 L/ha rate in the plots that had good control in the previous year. Where there was no control, the maximum rate of 4.2 L/ha used in the study was not enough to achieve maximum yields. Responses to the herbicide treatments were generally greater at the Landisville site, where the soil weed seed population was about 10 times greater than at the Rock Springs location. These results confirm recommendations that higher rates of herbicide are needed under no-till conditions and that both weed control in the previous year and soil weed seed population affect the need for herbicides. Response data from two additional on-farm studies supported these results. No weed control or yield response to increasing rates of metolachlor from 0.825 kg/ha to 3.3 kg/ha applied with 1.1 kg/ha atrazine preemergence was measured in a no-till field with a history of excellent weed control. In another no-till corn field with a history of serious fall panicum (*Panicum dichotomiflorum* Michx.) infestations, adequate control was achieved with only a combination of tillage and at least 1.65 kg/ha metolachlor in combination with 1.1 kg/ha atrazine. Overall, these studies suggest that consideration of anticipated weed pressure and the use of tillage can both contribute to lower herbicide use and improved profitablity.

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STUDIES ON THE GERMINATION REQUIREMENTS OF NODDING BEGGARTICKS (BIDENS CERNUA L.)

Diane L. Benoit[1]

ABSTRACT

Nodding beggarticks (Bidens cernua L.) is an important weed in carrot fields in organic soils of Quebec. Field emergence studies indicated that this species had a short emergence period in early spring (from the last week in April to the third week of May). The purpose of this experiment was to characterize the germination requirements of nodding beggarticks. A factorial experiment with four repetitions was set up in 1988 where the factors under investigation were nine germination temperatures (5, 10, 15, 20, 30°C constant, 20-5°, 25-10°, 30-15°C alternating), two solutions (absence or presence of KNO_3) and intact vs nicked seeds of different ages (1984 to 1988). Although all seeds were still viable, none germinated at 5° or 10°C regardless of the treatments. The presence of KNO_3 did not influence the germination of nodding beggarticks. Nicked seeds, where the envelop around the embryo was damaged, germinated faster than nicked seeds where the embryo was undamaged. Intact seeds did not germinate eventhough they were viable regardless of their age. Alternating temperatures stimulated germination of intact seeds. Thus, it seems probable that seeds which have overwintered on the soil surface as well as seedbed preparations early in the spring may damage the seed coats of nodding beggarticks and stimulate their germination resulting in large seedling populations in the spring.

SURVEY OF NOXIOUS THISTLE SPECIES IN SELECTED COUNTIES IN MARYLAND

Philip W. Tipping[1]

ABSTRACT

A survey of three Central Maryland counties to determine the average density and relative abundance of four noxious thistle species was conducted in 1989. The area surveyed included Washington, Frederick, and Carroll Counties, which comprise historically the region most affected by introduced thistle species in the genera Carduus and Cirsium.

The four thistle species that were recorded were musk thistle (Carduus thoermeri Weinm.), plumeless thistle (Carduus acanthoides L.), Canada thistle [Cirsium arvense (L.) Scop.], and bull thistle [Cirsium vulgare (Savi) Tenore.]. Five types of site were sampled (listed in priority): pastures, fields, waste areas, rights-of-way, and other sites such as orchards. A total of 1488 sites were visited with 20 m^2 samples taken at each site.

In Washington County, the most western county, plumeless thistle was the predominate species in pastures and fields. Musk thistle, long considered to be the major problem species here, was found at densities about 1/10 those of plumeless. Canada thistle was the least frequently detected of all species, found at only 10 % of sites. Bull thistle, while detected with increasing frequency from west to east in the survey area, was never found at very high densities.

In Frederick County, the most central county, the average densities of musk and plumeless were lower, but approximately the same for each species in pastures and fields. However, densities of Canada thistle increased relative to more western Washington County at most site types. In this county Canada thistle was detected as often as plumeless thistle.

Carroll County contained the least amount of plumeless and musk thistle of the survey area, but Canada thistle was found most frequently in this most eastern county.

This survey indicates that musk thistle is not as severe a problem as plumeless thistle in Central Maryland. This may be evidence of the regional effectiveness of federal and state biological control efforts to reduce the population of musk thistle. Two beetles, Rhinocyllus conicus Froel., and Trichoserocalus horridus (Panzer), are now well established in the survey area. Both species prefer musk to plumeless thistle, illustrating the need for new biological agents which preferentially attack plumeless thistle. This survey also noted relatively high populations of Canada thistle in certain areas which may confirm anecdotal evidence that Canada thistle is becoming an increasing problem in Maryland.

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BLUEBERRY AND BUNCHBERRY COMPETITION IN LOWBUSH BLUEBERRY FIELDS

David E. Yarborough and Prasanta C. Bhowmik

ABSTRACT

Bunchberry (Cornus canadensis L.) is increasing in density and distribution in lowbush blueberry fields (Vaccinium angustifolium Ait.) in Maine and Nova Scotia. Replacement series experiments to assess competitive effects of bunchberry were established on native stands of blueberries at Blueberry Hill Farm in Jonesboro, ME in 1986 and 1987. Ten 0.42 M^2 quadrats on prune and crop fields with cover ratings where c=crop, blueberry and w=weed, bunchberry at 100c/0w, 75c/25w, 50c/50w, 25c/75w, 0c/100w. Fruit yield was harvested in August and all above-ground growth was cut, species separated and dry weight determined. In the field study relative yield total of the dry weight was greater than 1 and showed an increase in dry weight with increasing proportion of bunchberry. Blueberry relative yield of dry weight was greater, but bunchberry relative yield was equal or less. Regression of individual vs associate dry weight yield indicates blueberry is as or more aggressive than bunchberry. Blueberry fruit number, berry yield and leaf and stem weight decreased with increasing bunchberry density. Blueberries are competitive with bunchberry when grown together but in native fields open areas among clones allow faster growing bunchberry to spread with out competition.

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INFLUENCE OF THE HERBICIDE SAFENER CGA-154281 ON GLUTATHIONE AND GLUTATHIONE-S-TRANSFERASE IN CORN

C. K. Cottingham[1] and K. K. Hatzios[2]

ABSTRACT

Detoxication of chloroacetanilide herbicides occurs primarily by conjugation of the herbicide with reduced glutathione catalyzed by glutathione-S-transferase (GST). Herbicide safeners are believed to confer protection to crop plants by increasing GST activity and/or glutathione levels. This study was designed to determine the effects of the safener CGA-154281 [4-(dichloroacetyl)-3,4-dihydro-3-methyl-2H-1,4-benzoxazine] on these factors in corn varieties which display differential tolerance to the herbicide metolachlor.

In a greenhouse experiment CGA-154281 when formulated with metolachlor (CGA-180937) was shown to be effective in safening corn against metolachlor. Glutathione levels were somewhat elevated relative to control levels in corn treated with metolachlor alone but were not affected when the safener was present. No differences in glutathione levels were observed between the metolachlor tolerant variety, 'Cargill 7567' and the metolachlor sensitive variety, 'Northrup-King 9283'. The effects of CGA-154281 concentration on GST activity were tested in laboratory experiments utilizing a liquid culture method. For both corn hybrids treatment with 1 μM CGA-154281 resulted in a 30% stimulation of GST activity. A differential response to safener concentration was observed for the two corn varieties. Some inhibition of GST activity was observed for 'Cargill 7567' at higher doses of CGA-154281 while neither additional enhancement nor inhibition was observed for 'Northrup-King 9283'. In metabolism studies with excised apical sections of corn seedlings imbibed with 1μM CGA-154281 a similar enhancement of metolachlor conjugation was observed without an increase in glutathione content. Induction of GST activity was increased to twice that of controls by imbibing seeds with CGA-180937.

This study supports the hypothesis that the herbicide safener CGA-154281 acts by enhancing GST activity and metolachlor metabolism in corn. It does not however indicate a direct effect of this safener on the glutathione status of treated corn plants. That GST activity was most affected by the combination of herbicide and safener suggests the participation of both phytochemicals in the induction mechanism.

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EFFECT OF TEMPERATURE AND SAFENERS ON GLUTATHIONE LEVELS AND GLUTATHIONE S-TRANSFERASE ACTIVITY IN CORN

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ABSTRACT

Studies were conducted to determine the biochemical aspects of chloroacetanilide injury to corn and the mechanism by which safeners maintain herbicide tolerance, even at reduced temperatures. The objectives of these studies were threefold: one, determine if glutathione (GSH) content varied in corn plants grown at three different temperatures in safener -treated and non-treated plants; two, determine whether glutathione S-transferase (GST) activity varied in plants grown at different temperatures; and three, determine whether GST activity is sensitive to low temperatures *in vitro*. The herbicide safeners CGA-154281 [4-(dichloroacetyl)-3,4-dihydro-3-methyl-2H-1,4-benzoxazine] and dichlormid [2,2-dichloro-*N, N*- di-2-propenylacetamide] were used with the herbicides metolachlor [2-chloro-N-(2-ethyl-6-methylphenyl)-n-(2-methoxy-1-methyl)acetamide] or acetochlor [2-chloro-N-(ethoxymethyl)-N-2-ethyl-6-methylphenyl)acetamide], respectively, to determine the mechanisms of corn tolerance. CGA-154281 significantly increased GSH levels in corn seedlings grown at 27° C compared to non-safened seedlings. However, significant differences were not seen at 17 or 37° C. Dichlormid increased GSH levels at all growing temperatures. Both CGA-154281 and dichlormid increased GST activity significantly at all growth temperatures. The safener-induced GST activity was maintained at *in vitro* incubation temperatures of 5 and 15° C for acetochlor and metolachlor respectively. In contrast, GST activity from non-safened tissue was essentially absent at these temperatures. Therefore, greater GST activity following safener treatment may result in higher levels of herbicide metabolism even at low temperatures.

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LIFE FORMS AND XYLEM WATER POTENTIAL OF 94 TAXA AT HEMPSTEAD PLAINS, NEW YORK

Richard Stalter,[1] Dwight T. Kincaid,[2] and Eric E. Lamont[3]

ABSTRACT

The flora of Hempstead Plains, Long Island, New York, was sampled from April 15, 1986 to October 15, 1986 with 171 vascular plants identified. These taxa were arranged in a Raunkiaer life form spectrum. Hemicryptophytes are the most abundant (38%), with chamaephytes the least abundant (2%) life form category. Xylem water potential for 94 taxa was measured using a pressure chamber on 12 middays from May 1986 through May 1987 for a total of 1202 stems. The frequency distribution of water potential was highly statistically significant for positive skewness and for leptokurtosis. Generally, there is a wide range of xylem water potential for each life form category during each season of the year. Scarlet oak (Quercus coccinea), a phanerophyte and dewberry (Rubus flagellaris), a chamaephyte, developed water potentials in winter as low as -45 bars and -58.5 bars, respectively. Cryptophytes and hemicryptophytes had an extremely wide range of water potential during spring drought (-40.5 to -0.1 bars).

INTRODUCTION

Hempstead Plains, once encompassing approximately 24,300 ha, is located on Long Island, New York, USA (40 deg. 44 min. N, 73 deg. 37 min. W). One portion of the original plains bordering an abandoned runway on the southern portion of Mitchell Field, approximately 8 ha in size, is the least disturbed area of plains vegetation. The vegetation of this 8 ha tract was studied by Stalter & Lamont[16] who identified 171 vascular plants during the 1986 growing season.

This study reports on the water relations of life forms present in the 8 ha tract at Hempstead Plains (Mitchell Field). Our objectives were to determine the ranges of midday xylem water potential and to test for homogeneity among mean water potential for 94 taxa from five life form categories over all seasons of the year. These 94 species are the most common plants, and they comprise about 55% of the 171 taxa identified by Stalter and Lamont.[16] Generally, we know little about the comparative water relations among a large number of plants in a discrete community[2-12]. Moreover, we know of few studies dealing with the water relations of life form categories[8].

Raunkiaer[20] classified plants into five major life forms based on the position of the perennating bud which enables the plant to survive during unfavorable seasons. These major categories of life forms are phanerophytes, chamaephytes, hemicryptophytes, cryptophytes, and therophytes. Phanerophytes are woody plants with buds over 250 mm above the ground. Woody vines, tall shrubs, and trees fit within this category. Chamaephytes have buds exposed above the ground

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but below 250 mm above the ground. Low shrubs and cushion plants are included within this category. Hemicryptophytes have their buds located at the soil's surface. Perennial and biennial herbs fall within this life-form group. Cryptophytes have their perennating tissue in rhizomes, tubers, and bulbs which are located well below the surface of the ground. Therophytes are annual plants which survive unfavorable seasons in the form of seeds. Plant life forms and related concepts continue to develop and to be used in the study of vegetation dynamics[5,11].

Deciduous leaves of drought intolerant species generally wilt when water deficits decline to around -15 bars water potential[7]. Evergreen leaves show no immediately visible signs of water stress at -15 bars[6]. Water potential measurements under normal conditions in the growing season have yielded results ranging from -1 bars in aquatic plants, to -7 bars in chickweed (Stellaria media)[13] to -4 to -10 bars in several species of Viola in New England[3], to -24 bars in American Holly (Ilex opaca)[15] to -52 bars in spruce (Picea pungens)[13].

SITE DESCRIPTION

Hempstead Plains is situated on outwash deposits of the last Wisconsin glacier. Two soil groups, Haven Variant Association and Hoosic Variant Association, were identified at the study site[17]. Haven Variant soils are deep, well-drained and medium textured, occupying nearly level to gently sloping outwash plains. Hoosic Variant soils are deep, very gravelly and well drained.

Climatically, Hempstead Plains is classified in the Coastal Division of New York State[9]. The average annual temperature is 11.6 degrees C, with an average rainfall of 1.13 m/yr. Hurricanes and summer droughts have been recorded periodically. The average length of the growing season is 187 days with the shortest recorded duration being 158 days and the longest duration being 217 days.

VEGETATION

Broomsedge bluestem (Andropogon virginicus) and little bluestem (A. scoparius) were the dominant plants at Hempstead Plains in 1986. Grass-leaved goldenrod (Solidago graminifolia) is the most common goldenrod followed by Canadian goldenrod (S. canadensis). Aster (Aster pilosus) is common throughout and especially conspicuous when in flower. Fescue (Festuca spp.), poverty grass (Danthonia spicata), orchard grass (Dactylus glomerata), Indian grass (Sorghastrum nutans), along with little bluestem and broomsedge bluestem are present the year round and demonstrate the importance of grasses at Hempstead Plains[16]. Lance-leaved violet (Viola lanceolata), wild indigo (Baptisia tinctoria), St. John's-wort (Hypericum perforatum), Queen Anne's lace (Daucus carota), Green's rush (Juncus greenei), hawkeeds (Hieracium) spp., and sedge (Carex pensylvanica) are also common and/or dominant in portions of this tract. The invasion of alien species, crab grasses (e.g. Digitaria ischaemum, D. sanguinalis, and foxtail grass Setaria faberii) on disturbed sites reflects the gradual change that is occurring in the Plains vegetation[16].

METHODS

The vegetation of an 8 ha tract of Hempstead Plains was collected on a weekly basis beginning on April 12, 1986, terminating on October 15, 1986. A

of Gleason & Cronquist.[4] Bailey[1] was used to identify cultivated species. The species were arranged in a Raunkier life form spectrum. Proportions of species in each of the five life forms were calculated (Table 1).

Leaves and twigs of 94 species represented by 50 or more plants in a 8 ha tract at Hempstead Plains were harvested during 12 sample periods beginning May 30, 1986 terminating May 1, 1987. Leaves and twigs were excised near midday and xylem water potential was measured with two cross-calibrated Scholander type pressure chambers, one reading to -40 bars and the other to -100 bars (Soilmoisture Corp., Santa Barbara, CA). We were able to make large numbers of measurements within several hours by using two chambers and three investigators.

RESULTS

Hemicryptophytes, the largest life form category, comprise 38 percent of the plains flora. Chamaephytes are least represented (Table 1).

Water potentials for phanerophytes and chamaephytes are lowest in winter while the protected hemicryptophytes and cryptophytes are highest (least water stressed) in winter. Generally, therophytes are the least water stressed of all life form spectra though some therophytes e.g. Deptford pink (Dianthus armeria), may develop water potentials as low as -49 bars when in flower or in fruit. There is a great deal of variability of water potential within each life form category for each date, in each season (Table 3). An exception to this generalization is the fact that water potentials were not measured for therophytes in winter. Generally, the frequency distributions were highly statistically significant for skewness and for leptokurtosis for each life form category for each season (Table 3). This tendency toward skewness and kurtosis held true in winter under blizzard conditions (see 22 January 1987 in Table 3).

Water potentials for all life form spectra were lowest (i.e. under the greatest amount of water stress) in winter and highest during late July, early September and early October, 1986. Chamaephytes experienced greatest water stress, especially in winter when dewberry (Rubus flagellaris) developed a mean water potential of -58 bars. The plains species tested in five life form categories developed significantly different water potentials during the yearly test period; extremes were greatest for chamaephytes.

The frequency distribution was highly statistically significant ($P < .01$) for negative skewness and for leptokurtosis for the entire data set ($g1 = 1.9$; $g^2 - 7.6$;), as well as on 7 of the 12 sample days and for the different life forms. Relative to normal probability distributions, our samples had more extremely low water potential values, and had more values clumped around the mean. Water potentials were highest in the fall and were lowest in the winter (Tables 2 & 3). The means for the seasons were heterogeneous (single classification ANOVA, $F = 11.2$ ***, df 3,1198); over all seasons, the means for the five life forms were heterogeneous (single classification ANOVA, $F = 12.2$ ***, df 4,1197); and within each season, the means for the life forms were heterogeneous ($P < .01$ in all cases; Table 3).

During the growing season, mean water potentials for all species varied from -17 to -9.3 bars (Table 3). Plains species develop significantly different water potentials during any test period (Table 2).

There are few phanerophytes and chamaephytes at Hempstead Plains. Most plains species (hemicryptophytes, therophytes and cryptophytes) have their perennating tissue protected during the unfavorable part of the growing season. Strategies such as underground protection of meristematic tissue linked to variations in the seasonality of growth, and combined with differential water

relations, may assist in the extraction of soil water and allow survival and growth during drought induced water stress. The presence of the predominantly herbaceous vegetation at Hempstead Plains may involve water relations as well as life history strategy, and stage in succession.

Table 1. Frequencies of species in Raunkiaer Life Forms for Hempstead Plains, Long Island N.Y. (171 species).

Site	Number of Species	Frequency (Percent) Ph	Ch	H	Cr	Th
Hempstead Plains	171	26	3	66	34	42
Long Island, NY		(15%)	(2)	(38)	(20)	(25)

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Table 2. Dates, sample sizes, and means for xylem water potential measured at Hempstead Plains.

DATE	NO. SPECIES	NO. SAMPLES	MEAN (-bars)	SD	Skew	Kurtosis
30 May 30 1986	25	92	-15.3	7.26	- **	+ **
9 June 1986	40	181	-10.4	3.97	NS	+ *
27 June 1986	37	89	-17.0	8.55	- **	+ **
22 July 1986	45	132	-12.5	4.99	+ *	NS
29 July 1986	54	149	- 9.3	4.22	NS	NS
2 September 1986	53	138	- 7.9	3.78	NS	NS
3 October 1986	46	120	- 7.9	4.12	- **	+ **
14 November 1986	20	56	-13.8	7.90	- **	+ **
11 December 1986	19	54	- 8.3	5.91	- **	+ **
22 January 1987	10	28	-24.3	12.01	- **	+ **
6 March 1987	13	38	-15.1	9.79	- **	+ **
1 May 1987	40	125	- 9.2	9.16	+ **	NS

Table 3. Midday xylem water potentials for Raunkiaer life forms, Hempstead Plains, New York.

A. Means in Xylem Water Potential

LIFE FORM	SPRING	SUMMER	FALL	WINTER	OVERALL
Phanerophytes	-10.1	-13.1	-11.9	-15.8	-12.7 n = 305 CV 53%
Chamaephytes	-11.3	-10.7	- 0.9	-20.1	-14.2 n = 33 CV 107%
Hemicryptophytes	-12.4	-11.4	- 9.3	- 6.9	-11.5 n = 350 CV 50.3%
Cryptophytes	-10.5	-10.4	-10.1	- 6.2	-10.2 n = 414 CV 59.2%
Therophytes	- 9.2	- 9.5	- 6.2	absent	- 8.6 n = 100 CV 66.8%

SEASONAL TOTALS

Means	- 11.0	- 11.1	- 9.7	- 14.2
CV (%)	49%	56.2%	63.5%	76.7%
N	423	502	157	120

GRAND TOTAL
Grand Mean -11.2 bars
CV = 59.5%
n = 1202

B. Ranges in Xylem Water Potential

LIFE FORM	SPRING	SUMMER	FALL	WINTER
Phanerophytes	-19 to -1	-22.5 to -1	-45. to -4	-39 to -3
Chamaephytes	-14.3 to -8	-20 to -4.5	-1 to -0.8	-58.5 to 1.5
Hemicryptophytes	-40.5 to -0.5	-40 to -1	-18 to -1	-10 to -3.5
Cryptophytes	-34 to -0.1	-40 to -1	-26.5 to-1.5	-14 to -2
Therophytes	-11.2 to -7.5	-49 to -0.6	-12 to -1	absent

TIMING OF OUST APPLICATION AFFECTS SURVIVAL OF HARDWOOD REGENERATION: NORTHWESTERN PENNSYLVANIA

Stephen B. Horsley[1]
Larry H. McCormick[2]

ABSTRACT

Dense ground covers of hayscented (Dennstaedtia punctilobula (Michx.) Moore) and New York (Thelypteris noveboracensis L.) fern, perennial grasses, and sedges (Carex spp.) interfere with establishment of advance regeneration of black cherry (Prunus serotina Ehrh.) and red maple (Acer rubrum L.) in the Allegheny hardwood forest of northwestern Pennsylvania. Oust herbicide (sulfometuron methyl) controls hayscented and New York fern and reduces the amount of grass and sedge originating in the forest floor seed bank when applied at the rate of 2 oz of product/acre between early July and early October. Measurements made in formal studies and observations made in commercial operations suggest that hardwood species may differ in sensitivity to Oust. In 1989, we initiated a small plot experiment to determine the effects of timing of Oust application, surfactant addition, and seedling size on black cherry and red maple seedlings of several sizes. A similar experiment, which is reported separately, was conducted in central Pennsylvania.

Oust was applied with or without surfactant (0.5% Valant X-77 Spreader) at the rate of 2 oz of product/acre in early July, early August, early September, and early October to three size catagories (new germinants, <1', 1-3') of marked black cherry and red maple seedlings. Survival and damage of treated seedlings were compared with a no herbicide control one year after treatment.

Survival of black cherry seedlings was affected by herbicide treatment and month of application. Application of 2 oz/ac of Oust reduced survival in all size classes. The degree of damage and mortality was dependent upon time of Oust application. Survival was lowest following early July applications, increased with early August or early September applications, and was highest and not significantly different from the no-herbicide control with early October applications. Addition of surfactant generally reduced seedling survival below that of the no-herbicide control or Oust alone treatments.

Red maple was much less sensitive to Oust with or without surfactant than black cherry. Application of Oust to new germinants resulted in trends similar to those observed with black cherry. Seedling mortality was high even on no-herbicide control plots. Larger red maple seedlings showed little sensitivity to Oust with or without surfactant. The only exception was Oust + Surfactant applied in early July where survival was significantly less.

The results suggest that where there are significant numbers of black cherry seedlings, applications made late in the growing season resulted in the largest number of surviving seedlings. Surfactant should not be included in the herbicide mix since it significantly reduced survival of black cherry at all application times.

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TIMING OF OUST APPLICATION AFFECTS SURVIVAL OF HARDWOOD REGENERATION: CENTRAL PENNSYLVANIA

Larry H. McCormick[1]
Stephen B. Horsley[2]

ABSTRACT

Regeneration of hardwoods in central Pennsylvania is often impeded by dense ground covers of ferns and perennial grasses which invade forest sites following harvest cuts. Oust herbicide (sulfometuron methyl), which effectively controls ferns and grasses, has been used operationally in forest management in Pennsylvania since 1987. Reports on the effects of Oust on seedlings of desired hardwood species present at the time of herbicide applications are conflicting. In some instances, Oust has not produced any detrimental effects on desired tree seedlings while in other instances Oust has caused seedling mortality or severe stunting. These conflicting results may be due to differences in species sensitivity to Oust, the time of Oust application, presence of a surfactant in the spray mix, or size/age of the seedlings. These factors were evaluated by a set of similar experiments conducted in northwestern and central Pennsylvania. This abstract reports on the research conducted in central Pennsylvania; the northwestern Pennsylvania work is reported separately.

Oust was applied with or without surfactant (0.5% Valant X-77 Spreader) at the rate of 2 oz of product/acre in early July, early August, early September, and early October to three size categories (new germinants, < 1', 1-3') of red maple (Acer rubrum L.) and two size categories (new germinants, 1-3') of white ash (Fraxinus americana L.) to evaluate the tolerance of these species to Oust. Survival and damage of treated seedlings were compared with a no herbicide control one year after treatment. Similar measurements were taken on northern red oak (Quercus rubra L.) and black oak (Quercus velutina Lam.) seedlings present in the red maple and white ash plots, although there were not enough for statistical testing.

Red maple showed little sensitivity to Oust irrespective of the month of application or the presence of surfactant. Survival of red maple seedlings was high (>85%) for all three size categories of treated seedlings. White ash was more sensitive to Oust. White ash mortality was high with applications made from early July through early September. Early October application of Oust resulted in lower mortality of white ash. Addition of surfactant to Oust significantly increased damage and mortality of white ash. New germinants of white ash appeared to be more sensitive to Oust than older, larger seedlings. Northern red oak and black oak were not sensitive to application of Oust alone. Survival was less when Oust + Surfactant was applied, particularly with early July applications. These results suggest that sites containing white ash regeneration should receive late summer or early fall applications of Oust without surfactant.

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CONTROL OF HAYSCENTED FERN SPORE EMERGENCE WITH SULFOMETURON

John W. Groninger and Larry H. McCormick[1]

ABSTRACT

Partially cut hardwood stands in Pennsylvania frequently develop a hayscented fern [Dennstaedtia punctilobula (Michx.) Moore] dominated understory. Fern interference and overbrowsing by deer prevents the establishment of desirable hardwood seedlings frequently leading to regeneration failures. Previously fern free areas can be colonized by wind dispersed spores Ferns developing from spores produce a perennial rhizome during their first year and can become sexually mature in three years. Ferns developing from spores have been observed in recently partially cut central Pennsylvania oak stands. Preventing the development of these individuals can be crucial in maintaining a stand's regeneration potential. Sulfometuron is currently used to control hayscented ferns when applied to fronds and unfoliated rhizomes. Its ability to control spore emergence is unknown.

A greenhouse study was conducted to determine the effectiveness of varying rates of sulfometuron in controlling hayscented fern spore emergence. Sulfometuron was tested at rates of .025, .05, .1 and .21 kg ai/ha plus an untreated control. The herbicide treatments were applied to mineral soil samples prior to inoculation with hayscented fern spores collected from fertile fronds. Inoculated soil samples were placed under a 55% plastic mesh shade cloth and spore emergence status was evaluated after 52 days.

Sulfometuron effectively controlled hayscented fern spore emergence at all rates tested. Abundant prothalli (the second observable stage of fern emergence) were present in all untreated controls.

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ELECTRICAL CONDUCTIVITY OF TWO GLYPHOSATE-CONTAINING HERBICIDES AT FIVE CONCENTRATIONS.

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ABSTRACT: Measuring conductivity of spray solutions of amine herbicides helps assure proper mixing prior to application thus providing additional quality control to operational herbicide programs. Electrical conductivity was determined for seven concentrations (0 - 15% v:v) of Accord® and Accord® CR herbicides in aqueous solution with three concentrations (0 - 1% v:v) of either Cide-Kick II™ or Ortho X-77 Spreader® surfactants. Conductivity ($\mu S\ cm^{-1}$) of these solutions, determined at five solution temperatures (5 - 25°C) increased 737.7 $\mu S\ cm^{-1}$ and 164.9 $\mu S\ cm^{-1}$ for each 1% increase in herbicide concentration and each 1°C increase in temperature. Conductivity decreased 212.3 $\mu S\ cm^{-1}$ for each 1% increase in surfactant concentration. The conductivity of Accord CR was 100.5 $\mu S\ cm^{-1}$ greater than Accord; conductivity of Cide-Kick II was 82.3 $\mu S\ cm^{-1}$ greater than X-77. Results of this study will appear in the Southern Journal of Applied Forestry in 1991. The equations presented will enable foresters to verify proper concentration and mixing of these herbicide and surfactant solutions for temperatures likely to occur in the field if water source conductivity is $\leq$ 300 $uS\ cm^{-1}$.

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[1] The authors thank John Bryant, David Dow, Anthony Filauro, William Halteman, and Maxwell McCormack Jr. for critical reviews of this manuscript; the University of Maine's Cooperative Forestry Research Unit for laboratory facilities; and the Monsanto Agricultural Company for funding.

FIRST-YEAR RESPONSE OF NORTHERN MIXED CONIFER STANDS TO RELEASE APPLICATIONS OF IMAZAPYR AND COMBINATIONS

D. I. Maass[1]

Abstract

Treatments of low rates imazapyr alone and tank mixes with a surfactant, glyphosate and triclopyr reduced broadleaf stems from 72% to 96%, while treatments with glyphosate and triclopyr alone reduced stem numbers by 63% and 64% in this study of applications to a ten year old forested clearcut in Maine. Fir and spruce height growth rates were 0.1 to 0.2 feet in the first year with applications of imazapyr. Fir biomass grew in the glyphosate and imazapyr treatments grew better than the control.

Introduction

Imazapyr {(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl}- 3-pyridinecarbocylic acid}[2] has been used in Maine on 19 different sites in 75 different treatments between the years 1985 to 1988. Trials were established to determine efficacy and injury level at different rates and as tank mixes for release of northern conifers, site preparation and roadside brush control. For release, lower rates have reduced injury, but have lowered efficacy on some species.

This series of treatments was established to examine differences in efficacy and conifer injury at varying low rates of imazapyr applied alone, with a surfactant[3] and as a tank mix with glyphosate (N- (phosphonomethyl) glycine)[4], and triclopyr ([(3,5,6- trichloro-2-pyridinyl)oxy} acetic acid)[5]. These trials were designed to minimize cost and environmental input of products.

Methods

The treatments (Table 1) were applied to a forested clearcut about ten years after harvest near Endless Lake in T3R9NWP about 45 miles north of Bangor. They were applied aerially on September 5 and 6th, 1989 during evening sessions using RD- 5's nozzles on a Bell 47 Helicopter. The triclopyr treatments were applied at 8 gallons per acre. All the others were applied at 5 gallons per acre. All treatments were applied to five acre blocks without replication.

The treatments for each block were selected randomly. Because the blocks were not treated consecutively, care was taken to assure treatments were applied as planned.

The basis for comparison of treatments will be changes in broad leaf species and growth of conifers within each treatment. To examine these changes, sixteen sample points were established in each block consisting of a milacre plot and a 1/150A plot. These were distributed on a grid pattern throughout the treatment area. The permanent plot centers were established before any data was collected. Each plot center was labelled with block and plot number.

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1 Associate, The Irland Group, Augusta, Maine

2 Arsenal Applicators Concentrate ®

3 CideKick II ®

4 Roundup ®

5 Garlon 4 ®

Table 1. Treatment list: ounces of imazapyr product per acre

Imazapyr alone	Imazapyr w/ Surfactant @ .25% v/v	Imazapyr w/ Glyphosate (1 lb/A)	Imazapyr w/ Glyphosate (1.5 lb/A)	Imazapyr w/ Triclopyr (1.5 lb/A)
x	2	2	2	x
x	4	4	4	x
6	6	6	6	6

Glyphosate product alone @ 2 lbs/A
Triclopyr product alone @ 2 lbs/A control
Untreated control

The milacre plot will be used to monitor changes in broad leaf species survival and height by examining changes stem count of each species present and an estimate of height. The larger concentric plot will be used to measure changes in survival and growth of the released conifers. It was divided into four quadrats based on ordinal directions. This is equivalent to a 1/600 A plot. The dominant individual of each conifer present in each quadrat was marked and height and diameter at 6 inches was measured. The plots were will be measured for two growing seasons following treatments. This paper reports on the first growing season following treatment measured in June, 1990 at the end of the height expansion for the year.

Results

From general observation, the treatments appeared to be successful. There seemed to be uniform application throughout each block and across the treatment area.

All treatments had acceptable levels of control. While the control increased the number of hardwood stems per plot by 15%, the chemical treatments reduced hardwood stems from 63% to 96% (Table 2). The glyphosate and triclopyr alone treatments reduced hardwood stems at 63% and 64%, while treatments with imazapyr reduced stems by at least 71%. Generally stem reduction increased with increased amount of imazapyr applied, but imazapyr at six ounces was marginally better than imazapyr at two or four ounces. Imazapyr alone at six ounces reduced the number of stems per plot by 87% in the first year. The imazapyr and surfactant combination reduced stems by 73% to 80%, while combinations with glyphosate reduced stems from 82% to 90%. Combinations with triclopyr reduced stems from 71% to 96%.

Table 2. Percent Loss in Hardwood Stems

	No Imazapyr	Imazapyr @ 2 oz.	Imazapyr @ 4 oz.	Imazapyr @ 6 oz.
No other products	-14.8	---	---	87.1
Surfactant @ .25% v/v	---	72.8	80.4	79.9
Glyphosate @ 1 lb.	---	86.0	82.4	82.5
Glyphosate @ 1 1/2 lbs.	---	84.7	93.3	89.6
Glyphosate @ 2 lbs.	62.8	---	---	---
Triclopyr @ 1 1/2 lbs.	---	71.7	70.7	95.7
Triclopyr @ 2 lbs.	63.8	---	---	---

Cherry (Prunus pensylvanica L.) and aspen (Populus spp. L.) were the easiest to control and all treatments were successful with these species. There was some variation in red maple (Acer ruburm L.) stem reduction with the glyphosate alone treatment having the smallest reduction at 16% and imazapyr and surfactant having the largest reduction of 94% and 95%. Moose maple (Acer pensylvanicum L.) was also relatively easily controlled for most treatments, with reductions better than 82%. Glyphosate alone and triclopyr alone had reductions of moose maple of 26% and 40% respectively.

There was more variation in control of beech (Fagus grandifolia Ehr.). Reductions in per cent of stems per plot varied from 35% for triclopyr alone to 95% for imazapyr at 4 ounces in combination with glyphosate. Imazapyr and surfactant combination resulted in a lower reduction than other combinations.

Growth of spruce (Picea spp. A. Dietr.) and fir (Abies Balsamea (L.) Mill.) is inhibited by imazapyr at rates exceeding 4 ounces per acre (Schaertl, 1991). We would expect to see less growth occurring at higher rates of imazapyr than at low rates. This generally the case (Tables 3 and 4). In the control, fir grew 0.5 feet and spruce grew 0.3 feet. Most of these trees are under stress due to competition. In the glyphosate treatment, fir grew at a modest rate of 0.1 feet and spruce 0.5 feet, while in the triclopyr alone treatment, fir grew 0.5 and spruce grew 0.4 feet. With the exception of one treatment, fir and spruce grew between 0.1 and 0.2 feet for the first growing season after treatment in the blocks treated with combinations with imazapyr. The combinations of triclopyr and imazapyr had very modest growth on spruce and fir and seemed to be most inhibited. Injury rates were highest amongst these treatments. The negative growth of the spruce in the triclopyr and imazapyr at 6 ounces is due to mortality due to insects and little positive growth on other trees. Only in the treatment of the combination of imazapyr at 2 ounces and glyphosate at 1 lb. did fir growth compare to that of the control.

Table 3. Fir Growth in Feet

	No Imazapyr	Imazapyr @ 2 oz.	Imazapyr @ 4 oz.	Imazapyr @ 6 oz.
No other products	0.5	---	---	0.1
Surfactant @ .25% v/v	---	0.1	0.1	0.0
Glyphosate @ 1 lb.	---	0.5	0.0	0.1
Glyphosate @ 1 1/2 lbs.	---	0.2	0.2	0.1
Glyphosate @ 2 lbs.	0.1	---	---	---
Triclopyr @ 1 1/2 lbs.	---	0.1	0.1	0.0
Triclopyr @ 2 lbs.	0.5	---	---	---

Table 4. Spruce Growth in Feet

	No Imazapyr	Imazapyr @ 2 oz.	Imazapyr @ 4 oz.	Imazapyr @ 6 oz.
No other products	0.3	---	---	0.1
Surfactant @ .25% v/v	---	0.2	0.2	0.1
Glyphosate @ 1 lb.	---	0.2	0.2	0.2
Glyphosate @ 1 1/2 lbs.	---	0.2	0.2	0.2
Glyphosate @ 2 lbs.	0.5	---	---	---
Triclopyr @ 1 1/2 lbs.	---	0.1	0.0	-0.2
Triclopyr @ 2 lbs.	0.4	---	---	---

Imazapyr injury on spruce and fir consists of no or little bud break or small needles or both in the growing season following application. Some burning of the needles also occurs. Observations from prior applications indicate that the trees recover after two or three growing seasons. White pine (Pinus strobus L.) were not as susceptible to injury at these rates as the spruce and fir.

Estimates of biomass were calculated using diameter squared times height. First year firm and spruce biomass growth are shown in Tables 5 and 6. These estimates demonstrate the importance of diameter growth. Those treatments in which diameter did not grow very much also had poor biomass growth. It is apparent, that we should not rely solely on height growth as measures of response.

Fir in all the treatments grew as well as or better than the fir in the control. However, spruce in the control grew better than the spruce in all but two of the treatments. The best fir and spruce growth occurred in the glyphosate and imazapyr combinations.

Table 5. Fir Biomass Growth

	No Imazapyr	Imazapyr @ 2 oz.	Imazapyr @ 4 oz.	Imazapyr @ 6 oz.
No other products	.003			.003
Surfactant @ .25% v/v	---	.007	.004	.003
Glyphosate @ 1 lb.	---	.019	.017	.018
Glyphosate @ 1 1/2 lbs.	---	.008	.021	.009
Glyphosate @ 2 lbs.	.008	---	---	---
Triclopyr @ 1 1/2 lbs.	---	.011	.007	.001
Triclopyr @ 2 lbs.	.005	---	---	---

Table 6. Spruce Biomass Growth

	No Imazapyr	Imazapyr @ 2 oz.	Imazapyr @ 4 oz.	Imazapyr @ 6 oz.
No other products	.008			.002
Surfactant @ .25% v/v	---	.005	.001	.004
Glyphosate @ 1 lb.	---	.002	.005	.008
Glyphosate @ 1 1/2 lbs.	---	.004	.012	.004
Glyphosate @ 2 lbs.	.000	---	---	---
Triclopyr @ 1 1/2 lbs.	---	.003	.005	-.028
Triclopyr @ 2 lbs.	.001	---	---	---

Conclusions

Applications of low rates of imazapyr and tank mixes with glyphosate and triclopyr were as effective or better than the commonly used applications of either glyphosate or triclopyr in reducing broad leaf competition in a northern mixed conifer clearcut. Height growth of the desirable spruce and fir was reduced in the first growing season with rates of 4 or 6 ounces of imazapyr. Fir biomass growth was best in combinations of glyphosate and imazapyr.

Literature Cited

Schaertl, G.R. 1991. Glyphosate and imazapyr interact to reduce competition, but may injure spruce and fir in Maine. Proc. NEWSS. Vol. 45. (in press).

EFFECTS OF CLEARCUTTING AND FOREST FLOOR DISTURBANCE ON ESTABLISHMENT AND SURVIVAL OF RASPBERRY

M. R. Roberts and H. Dong[1]

ABSTRACT

Disturbed (forest floor removed) and undisturbed (control) plots were monitored over two growing seasons to determine the effects of forest floor disturbance on reproduction of raspberry (Rubus spp.) and other woody species. In May 1988, 30 pairs of 1-m^2 plots were established after clearcutting in a northern hardwood stand in central New Brunswick, Canada. In one plot of each pair, the forest floor was removed to the mineral soil to simulate logging disturbance. The other plot was left undisturbed as a control. After treatment, there were 2 million and 316,000 germinable raspberry seeds/ha in the soil seed bank in the undisturbed and disturbed plots, respectively. In the first year, most germination of raspberry occurred by early June in the disturbed plots. Germination peaked about one month later in the undisturbed plots. At the end of the growing season, total germination was 304 and 123 on the disturbed and undisturbed plots, respectively. Survival was 60% on the disturbed plots as compared to 48% on the undisturbed plots. These patterns are probably related to the more favorable seedbed and microclimate provided by the exposed mineral soil on the disturbed treatment. Most of the raspberry stems observed in this study were red raspberry (Rubus strigosus Michx.).

After one year, the residual seed bank was sampled from areas that were covered to exclude seedfall during the previous year. There were 471,000 germinable seeds/ha in the undisturbed plots and 41,000 in the disturbed plots. In the second year, total germination and survival were greater on the undisturbed plots than the disturbed plots, the opposite pattern from the first year. The larger number of seeds in the residual seed bank and delayed germination on the undisturbed plots probably accounted for this difference.

At the end of two years, the total density of woody species was 434,930 and 246,960 stems/ha on the disturbed and undisturbed plots, respectively. Raspberry accounted for 64% of the stems on the disturbed plots and 45% on the undisturbed plots. On both treatments, over 75% of the raspberry stems were apparently vegetative sprouts from the rhizomes of the first year germinants. In the second year, total vegetative cover was similar on the two treatments but differed by height class. Cover was greater on the undisturbed plots in the 0-10 cm and 10-30 cm height classes but was greater in the disturbed plots in the >30 cm height class. The >30 cm height class was composed mostly of raspberry.

On the disturbed plots, raspberry would probably provide more intense competition for commercial tree species such as yellow birch (Betula alleghaniensis Brit.). However, germination, survival and height of yellow birch were also greater on the disturbed plots than the undisturbed plots. If reproduction of yellow birch is desired, then forest floor disturbance is recommended in spite of the risk of increased raspberry competition.

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Effect of Various Landscape Geotextiles on Weed Root Development

J. F. Derr and B. L. Appleton[1]

ABSTRACT

Landscape fabrics are being developed as alternatives to solid polyethylene plastic because their porosity permits water and gas exchange. Four polypropylene fabrics (Weed Barrier, Typar, Duon and Magic Mat), three perforated polyethylene films (Weed Control, WeedBlock and Weedstop) and one polyethylene/polyester fabric (Weed-X) were compared to solid brown polyethylene (2.5 mil), shredded pine bark mulch and an untreated control for suppression of bermudagrass [*Cynodon dactylon* (L.) Pers.] and large crabgrass [*Digitaria sanguinalis* (L.) Scop.) shoot and root development. Plastic pots (3.8 L) were filled with pine bark:sand, 4:1 v/v. Fabric and film pieces were stapled to the pot rim and a 2.5 cm depth of pine bark placed above the materials. Large crabgrass seed or 3 bermudagrass stolons were placed atop the mulch in each pot. Shoot fresh weight and root weight below the fabric or film were recorded two months after study initiation, and the study was repeated.

No treatment completely inhibited large crabgrass or bermudagrass shoot growth as weed roots either developed in the mulch layer above the materials or penetrated down through the fabrics and films. Weed-X reduced bermudagrass shoot fresh weight more than any other fabric or film except Weed Control and Magic Mat. Weed-X reduced large crabgrass shoot fresh weight more than the other materials except Weed Control and solid brown polyethylene. No large crabgrass and few bermudagrass roots penetrated solid brown polyethylene. Fewer bermudagrass and large crabgrass roots penetrated Weed-X and Weed Control than all other materials except for solid brown polyethylene. In order of least to greatest bermudagrass root penetration, the treatments were: solid brown polyethylene, Weed-X, Weed Control, Weedstop, Magic Mat, Weed Barrier, Typar, WeedBlock and Duon. For large crabgrass, the order from least to greatest root penetration was: solid brown polyethylene, Weed-X, Weed Control, Magic Mat, Weedstop, Typar, Weed Barrier, WeedBlock and Duon. Fabrics or perforated films that restrict weed root penetration should provide greater weed control than materials allowing greater root penetration.

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RESPONSES OF FIELD AND CONTAINER GROWN ILEX, RHODODENDRON, TAXUS, AND CRAPE MYRTLE TO BENTAZON

J. Ray Frank[1] and C. E. Beste[2]

ABSTRACT

Field and container weed control experiments were conducted during 1990 using one or two applications of bentazon at 1.1 kg/ha to field grown 'Heller's' Japanese holly (Ilex crenata 'Helleri') and Roseum Elegans rhododendron (Rhododendron catawbiense cv Roseum Elegans). The same rates of bentazon and a 2.2 kg/ha rate were also applied to container-grown 'Hicks' yew (Taxus x media Rehd. 'Hicksii'), 'Rubra' crape myrtle (Lagerstroemia indica 'rubra') and 'Hellers' Japanese holly.

No significant phytotoxicity or size reduction was observed on field grown 'Hellers' Japanese holly with one or two treatments of bentazon at 1.1 kg/ha. Significant phytotoxicity and reduction in growth was observed on field grown 'Roseum Elegans' rhododendron.

Phytotoxicity to 'rubra', crape myrtle, and 'Hicks' yew grown in containers was not apparent with bentazon treatments up to 2.2 kg/ha but a significant size reduction was observed at the end of the growing season. Phytotoxicity to 'Hellers' Japanese holly grown in containers was significant and a significant reduction in plant size was observed. One application of bentazon at 1.1 kg/ha in field plots controlled yellow nutsedge (Cyperus esculentus L.) 90% while two treatments at 1.1 kg/ha controlled 98% of the yellow nutsedge.

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SELECTIVITY OF CLOPYRALID IN WOODY ORNAMENTALS

J.F. Ahrens[1]

ABSTRACT

Several field and one container experiment were conducted from 1985 to 1990 with clopyralid sprayed over the top or on the basal foliage of a number of woody ornamentals. Rates of application ranged from 0.14 to 0.56 kg/ha in 270 L/ha.

Bird vetch (Vicia cracca L.) and horseweed (Conyza canadensis (L.) Cronq. rosettes were controlled at 0.14 kg/ha. However, in the summer, 0.28 kg/ha was needed to kill horseweed over 20 cm tall. Control of mugwort (Artemesia vulgaris L.) was over 90% with clopyralid at 0.56 kg/ha in June or July. However, the best control (over 95%) was with split applications at 0.14 or 0.28 kg/ha in June or July plus September.

Ornamentals that tolerated the single or double applications of clopyralid without visible injury included yew (Taxus cuspidata densiformis) arborvitae (Thuja occidentalis nigra 'Dark American'), Andorra juniper (Juniperus horizontalis plumosa compacta) and white spruce (Picea glauca). Eastern hemlock (Tsuga canadensis), Douglas fir (Pseudotsuga menziesii) and fraser fir (Abies fraseri) developed curled needles on the youngest growth of some plants, especially at 0.56 kg/ha but the injury was tolerable and growth and vigor were not visibly affected. Temporary tip chlorosis also was observed in the hemlock. The addition of X-77 surfactant at 0.25% v/v did not affect woody plant response or the control of mugwort or horseweed.

In another experiment tender growth of Hicks yew (Taxus media hicksi) exhibited slight to moderate twisting from an August application of clopyralid at 0.15 to 0.45 kg/ha, indicating that yew cultivars may vary in their tolerance. Other actively growing woody ornamentals that were not injured by clopyralid at 0.14 to 0.56 kg/ha included field-grown Juniperus virginiana 'Skyrocket', and container-grown Mugho pine (Pinus mugo mughus) and Rhododendron 'Roseum Elegans'. Combining clopyralid with oxyfluorfen, sethoxydim or isoxaben did not affect injury to Eastern hemlock, 'Skyrocket' juniper or to Taxus cuspidata densiformis in the field.

The effectiveness of clopyralid in controlling troublesome weeds in the Asteraceae and Fabaceae families and its apparent safety in many woody ornamentals could make it a valuable future tool in the landscape and nursery industries.

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COMMON GROUNDSEL INTERFERENCE IN CONTAINER-GROWN NURSERY CROPS

Susan M. Mulgrew[1]

ABSTRACT

Common groundsel (*Senecio vulgaris* L.) is frequently found infesting nursery crops in the Northeast. It is considered particularly troublesome in container-grown crops because it begins growing in containers stored in overwintering houses, prior to spring applications of preemergence herbicides. Common groundsel also germinates in late summer and early autumn, when many spring-applied preemergence herbicides are no longer active. Although common groundsel is frequently found in Northeast nurseries, its affect on the growth of nursery crops has not been established.

Common groundsel interference was determined in container-grown boxwood (*Buxus sempervirens* L. 'Wintergreen'), euonymus [a variegated sport of *Euonymus fortunei radicans* (Seibold ex Miq.) Rehd.], and Sargent juniper (*Juniperus chinensis sargentii* A. Henry). Bare-root liners of each species were planted in 3.8 L and 7.5 L containers between February 23, 1990 and March 1, 1990. Three-week-old groundsel seedlings were transplanted into the containers at rates of 0, 1, 2, 3, and 4 weeds/container on February 26 (euonymus and juniper) and February 28 (boxwood). Any additional weeds that germinated in the containers during the experiment were removed by hand. Nursery crop growth index [(height + width.1 + width.2)/3], where width.1 and width.2 are measurements taken in north-south and east-west directions, was used to determine the effect of groundsel interference on the growth of the nursery crops. Growth indices were measured on February 28 (0 weeks) and 2, 4, and 6 weeks after transplanting (WAT) the groundsel seedlings. Since the groundsel plants had set seed and some had begun to senesce by 6 WAT, the experiment was terminated after the 6 WAT measurement. The experiment was conducted in a polyhouse where the temperatures were maintained between 22°C (day) and 12°C (night).

Common groundsel did not interfere with the growth of euonymus, but reduced the growth of boxwood 2 through 6 WAT. The decrease in boxwood growth was linear at 4 and 6 WAT (Table 1). There was also a linear decrease in juniper growth at 4 and 6 WAT (Table 2).

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Table 1 Effect of common groundsel and container size on the growth index of 'Wintergreen' boxwood.

Treatment	mean growth index (cm)[a]			
	0 WAT[b]	2 WAT	4 WAT	6 WAT
Weeds/container				
0	10.1	11.3	14.9	16.1
1	10.9	12.5	16.1	17.5
2	10.5	11.8	14.6	15.4
3	10.1	11.1	13.8	15.2
4	10.6	11.6	14.5	15.0
Treatment significance				
Weeds	NS[c]	**	**	**
Linear	-	NS	*	*
Quadratic	-	NS	NS	NS
Container size	NS	*[d]	*[d]	NS

[a]Growth index is determined by (height + width.1 + width.2)/3. Width.1 and width.2 are measurements taken in north-south and east-west directions.
[b]WAT = weeks after transplanting common groundsel seedlings into containers.
[c]NS, *, ** = Nonsignificant or significant at P = 0.05 or 0.01, respectively.
[d]The interaction of weeds and container size was not significant at P = 0.05.

Table 2. Effect of common groundsel and container size on the growth index of Sargent juniper.

Treatment	mean growth index (cm)[a]			
	0 WAT[b]	2 WAT	4 WAT	6 WAT
Weeds/container				
0	16.9	17.8	19.0	19.9
1	15.3	16.0	16.6	18.2
2	15.6	16.4	17.0	17.8
3	15.5	16.1	16.7	17.3
4	14.9	15.8	16.2	16.9
Treatment significance				
Weeds	NS[c]	NS	**	**
Linear	-	-	**	**
Quadratic	-	-	NS	NS
Container size	NS	NS	NS	NS

[a]Growth index is determined by (height + width.1 + width.2)/3. Width.1 and width.2 are measurements taken in north-south and east-west directions.
[b]WAT = weeks after transplanting common groundsel seedlings into containers.
[c]NS, *, ** = Nonsignificant or significant at P = 0.05 or 0.01, respectively.

SELECTIVITY OF SULFONYL UREA HERBICIDES IN WOODY ORNAMENTALS

John F. Ahrens[1]

ABSTRACT

The potential for herbicide leaching to ground water led us to evaluate low rate sulfonyl urea herbicides for selectivity in woody ornamentals. In one experiment chlorimuron 9, 18 and 36 g/ha, thifensulfuron 17.5, 35 and 70 g/ha and CGA-136872 20, 40 and 80 g/ha were sprayed over ornamentals in 270 L/ha a month after planting and reapplied in May for two more seasons. All were tank-mixed with oryzalin 1.12 kg/ha to control annual grasses. The plants included arborvitae (Thuja occidentalis 'Little Giant') yew (Taxus cuspidata densiformis), Eastern hemlock (Tsuga canadensis), Rhododendron 'Nova Zembla' and Cotoneaster salicifolia 'Repandens.'

The sulfonyl urea herbicides gave postemergence and short preemergence control of certain broadleaf weeds, notably corn chamomile (Anthemis arvensis L.) but residual control 2 to 3 months after weeding, especially with thifensulfuron often was no better than with oryzalin alone.

Chlorimuron and CGA-136872 at all rates injured cotoneaster excessively but thifensulfuron injury was temporary. Arborvitae and yew often exhibited early season chlorosis with recovery from the sulfonyl ureas whereas hemlock was unaffected by any treatment. Only CGA-136872 at 80 g/ha significantly injured rhododendron with early veinal chlorosis and increased mortality.

Chlorimuron and CGA-136872 were evaluated in other experiments. CGA-136872 at 40 or 80 g/ha + X-77 0.25% v/v in April suppressed field horsetail (Equisetum arvense L.) for 2 months and quackgrass (Agropyron repens (L.) Beauv.) for 3 months with no injury to dormant Eastern white pine (Pinus strobus). Chlorimuron at 9 to 36 g/ha in June suppressed field horsetail for 1 month without injury to actively growing white pine. Chlorimuron at 9 or 18 g/ha in October controlled seedling horseweed (Conyza canadensis (L.) Cronq.) and injured newly planted but not established Densiformis yew. Chlorimuron at 9 or 18 g/ha + X-77 at 0.25% v/v also controlled seedlings of pigweed (Amaranthus spp.) and horseweed in July with no injury to fraser fir (Abies fraseri). Container-grown mugho pine (Pinus mugo mughus) and Rhododendron 'Roseum Elegans' were unaffected by chlorimuron at 9 to 36 g/ha.

It appears that these herbicides can be safely used in a number of woody ornamentals. Chlorimuron and CGA-136872 deserve further evaluation.

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TOLERANCE OF DIRECT-SEEDED CUTFLOWERS TO PREEMERGENCE HERBICIDES

A.F. Senesac[1/] and J.C. Neal[2]

ABSTRACT

Field grown cutflowers are an increasingly important and profitable component of many roadside market operations in New York. Most of the preemergence herbicides registered for cutflowers are applied postemergence to transplants, but there is interest in direct seeding some of the most popular species. However, there is very little information about plant tolerance of the more commonly used herbicides with this method of planting.

Two field studies were conducted in 1989 and 1990 at the Long Island Horticultural Research Laboratory to examine the tolerance of Zinnia (Z. elegans) and Celosia (C. cristata) to several preemergence herbicides. In 1989, the fresh weight of celosia was significantly reduced by all herbicide treatments: metolachlor at 1.7 or 3.4 kg/ha, oryzalin at 1.7 or 3.4 kg/ha, napropamide at 1.7 or 3.4 kg/ha, or pronamide at 0.84 or 1.7 kg/ha. Oryzalin and metolachlor were more injurious than pronamide and napropamide. Zinnia was also initially injured by all of these treatments, however, serious yield loss only occurred at the higher rate of metolachlor. In 1990, a similar pattern of injury and yield reduction occurred in both species, except that celosia was more tolerant of metolachlor. In 1990, treatments were applied immediately after planting or were delayed for five days. The data indicates that delaying application did not increase safety of any of the herbicides. The results of these studies indicate that tolerance to these preemergence herbicides is marginal at best when these species are direct seeded and that selectivity would be enhanced by either a much longer post seeding delay in application or by the use of transplants.

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PREEMERGENCE HERBICIDES ON CONTAINER GROWN NURSERY STOCK

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ABSTRACT

Herbicides used to control weeds in container grown ornamentals must overcome three obstacles. Most of the media used today have a very high organic matter content, the plants are frequently irrigated, and uniform distribution of granular materials is difficult to obtain in the confined areas common to container production nurseries. The herbicide formulations used in this study were designed to overcome one or more of these obstacles. Metolachlor + simazine in a 4:1 ratio and 5% granular formulation was applied at 2.2, 4.4, and 8.8 kg ai/ha. Three 2% granular formulations of oxadiazon were applied at 2.2 and 4.4 kg ai/ha. They were the standard Ronstar[2/] formulation with an 18/40 particle size, on a Biodac carrier with an 18/40 particle size, and on a Biodac carrier with a 16/30 particle size. A ready-to-use 1% microencapsulated formulation of trifluralin was applied through a hose and garden spray nozzle at 2.2 and 4.4 kg ai/ha. Granular materials were spread in individual pots by hand.

Each treatment was applied to six species of newly potted rooted cuttings of woody ornamental shrubs: yellowtwig dogwood (Cornus sericea L.), border forsythia (Forsythia X intermedia Zab.), Cascade azalea (Rhododendron spp.), Van houtte spirea (Spiraea X Vanhouttei[C. Briot(Zab.)]), dwarf Korean lilac (Syringa Meyeri C.K. Schneid), and leatherleaf viburnum (Viburnum rhytidophyllum Hemsl.). Each treatment was replicated three times and there were four pots per replication. All containers were handweeded prior to herbicide application. The granular materials were applied on June 11 and 12, 1990 and the trifluralin was applied on June 21. Weed counts and phytotoxicity ratings were made 6 (time 1) and 14 (time 2) weeks after the trifluralin application. All weeds were removed during the first rating. Purslane (Portulaca oleracea L.)was the predominant weed in the containers, so it was counted separately from the other broadleaved weeds and grasses, which included carpetweed (Molluga verticillata L.), common chickweed (Stellaria media [L.(Cyr)]), sheperdspurse (Capsella bursa-pastoris [L.(Medik.)]), yellow rocket (Barbarea vulgaris R. Br.), smooth crabgrass (Digitaria ischaemum [Schreb.(Muhl.)]), large crabgrass (Digitaria sanguinalis [L.(Scop.)]), and yellow foxtail (Setaria lutescens [Weigel(Hubb.)]).

The results of the weed counts are presented in Table 1. The numbers represent the average number of weeds per pot within each treatment. A more accurate measure of weed control than simple numbers would have been weedweight. Weeds in untreated pots grew much larger than weeds in treated pots. Also, many of the weeds in the pots treated with the granules were growing right at the edge of the pots, indicating their may have been a problem with uniformity of distribution. This did not occur with the trifluralin treatment, which was applied as a spray. The numbers of purslane and grass plants was equal to or higher at time 1 than time 2 for all but one treatment. Apparently, most of the seeds capable of germination germinated early.

Metolachlor + simazine provided some control of purslane early, but by 14 weeks after treatment (WAT) only the highest rate of application resulted in a lower weed count than the control. The other broadleaves and grasses were controlled equally well at 6 and 14 WAT, irrespective of rate of application. This may be a result of the low solubility of the simazine allowing it to remain in the weed seed germination zone for a long period.

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Both rates and all formulations of oxadiazon provided more than 50% control of grasses at time 1, and all but the low rate of the 16/30 Biodac formulation provided total control at time 2. At time 1, at the low rate of application, the commercial formulation of oxadiazon (Ronstar) provided better control of the purslane than the oxadiazon on the Biodac carrier. At the higher rate of application the control of the purslane was better, but there was no difference between formulations. At time 2, all treatments provided excellent control of the purslane except the 18/40 mesh Biodac, which provided about 50% control. At time 1 and time 2 the high rate of the commercial formulation provided better control of the other broadleaved weeds than the low rate or either rate of the other formulations.

Both rates of trifluralin provided excellent control of purslane throughout the study. Its control of the other broadleaved weeds was excellent at time1, and very good 14 weeks. Both rates provided excellent control at time 1. At time 2 the high rate provided total control and the low rate no control.

The lilac could not be rated for injury because of generally poor, erratic growth. None of the herbicides except trifluralin caused any visual injury symptoms on any of the plants. At time 1, some plants of all species treated with trifluralin had slightly chlorotic, burned, or curled leaves. In almost all cases new growth developed beyond the injured leaves, making the injury less noticeable. Several of the treated dogwoods also seemed to be rooting poorly, as they were loose in the pot. At time 2 there were no visual symptoms of injury to any of the plants. However, an examination of the root systems of several dogwood and forsythia plants from each treatment showed the root systems of the trifluralin treated plants were smaller than those from the other treatments. Apparently there was enough water and fertilizer applied to support normal top growth even with a reduced root system.

Table 1. Weed control provided by preemergence herbicides applied to six species of container grown ornamentals. The numbers represent the average weed count per container. Herbicides were applied in mid- to late June and counts were made 6 and 14 weeks after the last application. All weeds were removed from the pots at the first rating period.

		Purslane		Other Broadleaves		Grasses	
Chemical	Rate (kg ai/Ha)	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2
Control	0.0	3.0	0.9	0.9	2.9	1.5	0.3
Metolachlor + Simazine	1.7 + 0.4	2.0	1.3	0.5	1.4	0.4	0.1
Metolachlor + Simazine	3.5 + 0.9	1.9	1.1	0.2	1.2	0.1	0.1
Metolachlor + Simazine	7.0 + 1.8	1.6	0.6	0.3	1.5	0.1	0.1
Oxadiazon (Ronstar) 18/40	2.2	0.7	0.2	0.5	0.9	0.7	0.0
Oxadiazon (Ronstar) 18/40	4.4	0.5	0.1	0.3	0.4	0.7	0.0
Oxadiazon (Biodac) 18/40	2.2	1.3	0.5	0.5	1.3	0.7	0.0
Oxadiazon (Biodac) 18/40	4.4	0.5	0.2	0.5	0.7	0.6	0.0
Oxadiazon (Biodac) 16/30	2.2	1.1	0.1	0.6	2.4	0.7	0.1
Oxadiazon (Biodac) 16/30	4.4	0.6	0.2	0.5	0.7	0.7	0.0
Trifluralin	2.2	0.2	0.1	0.1	0.6	0.1	0.3
Trifluralin	4.4	0.1	0.0	0.1	0.4	0.0	0.0

The Effect of Nutrient Availability on Competition between Velvetleaf and Kidney Beans

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ABSTRACT

A field experiment was initiated in 1989 to determine the relationship between velvetleaf (Abutilon theophrasti Medik.) density and yield of kidney beans (Phaseolus vulgaris L. 'Redkloud'). Beans were planted in the second week of June, with 21, 28, and 35 kg/ha of N, P, and K, respectively, banded on one side of the bean row, and 0, 1, 4, 16 or 64 velvetleaf/m^2 sown close to the row on the other side. Velvetleaf growth was not vigorous, and bean yield showed only a slight response to velvetleaf density: a linear regression predicted that 33 velvetleaf/m^2 would decrease bean yield by 5%. In a different experiment, velvetleaf showed a ten-fold increase in mean dry weight per plant in response to a nearby fertilizer band. This observation, together with soil test results indicating low levels of P and K, suggested that velvetleaf would be more competitive if given access to more nutrients. In 1990 treatments designed to provide velvetleaf with more nutrients were added to the experiment. In these "+F" treatments, in addition to banding NPK as in 1989, 44 and 83 kg/ha of P and K, respectively, were broadcast and incorporated prior to planting, and velvetleaf was sown on the same side of the row as the fertilizer band. Other treatments (-F) were unchanged from 1989. Early-emerging velvetleaf in the +F plots produced more than ten times as much dry weight by mid-August as in -F plots. In the +F plots only, bean dry weight in August showed a slight linear decrease with increasing velvetleaf density. When grown in the greenhouse at three levels of P, sole velvetleaf showed a proportionately greater increase in dry weight and height in response to P than did sole beans. Field and greenhouse results both suggest that the amount of fertilizer available to velvetleaf and to beans is important in determining the degree to which velvetleaf will interfere with bean growth.

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SHARPSHOOTER EFFICACY IN COVER CROP BURN-DOWN AND POTATO VINE-KILL

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ABSTRACT

Potassium salts of medium chain length, saturated fatty acids are being developed as a herbicide under the trade name Sharpshooter. It is nonselective, and works on contact by disrupting cell membranes. Action is rapid, often progressing from water-soaking to necrosis of affected tissue within a few hours. Translocation appears not to occur. The primary focus of this study was to determine how Sharpshooter compared with currently used nonselective herbicides in cover crop regulation. A preliminary greenhouse study conducted in the winter of 1989 indicated that, at 4 and 8% (v/v) rates, Sharpshooter could provide effective (>70%) control of hairy vetch (Vicia villosa L.) and rye (Secale cereale L.) but performed inadequately (<70%) with red clover (Trifolium pratense L.) and red fescue (Festuca rubra L.). In the spring of 1990 Sharpshooter efficacy was evaluated in the field. Six herbicide treatments were applied to 2 stages of rye (46cm and 76cm). The treatments included 1) an untreated check, 2) paraquat (.56 kg a.i./ha), 3) glyphosate (1.68 kg a.i./ha), 4)Sharpshooter-8% (v/v), 5) Sharpshooter-12% and 6) Sharpshooter-8% applied twice. Both glyphosate and paraquat performed better than all Sharpshooter treatments. Glyphosate provided complete control and paraquat was more than 85% effective at both stages of rye growth. At the earlier stage, 52, 65 and 78% control of rye was obtained with 8, 12 and the duplicated 8% applications of Sharpshooter, respectively. At the later stage there was no difference in control regardless of Sharpshooter rate; both provided approximately 75% control. Two applications of Sharpshooter (8+8%) did not provide better control at the later stage than did the single application. A second study was conducted in September of 1990 to compare Sharpshooter to paraquat for potato vine-kill. Sharpshooter was applied at 8 and 12% (v/v) rates and paraquat was applied at .56 kg a.i./ha. All 3 treatments provided more than 97% control, suggesting that Sharpshooter may be effective as a potato desiccant.

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WEED CONTROL IN POTATOES WITH DPX-E9636, GLUPHOSINATE AND PARAQUAT

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ABSTRACT

Broadleaved weeds and quackgrass (Agropyron repens L.) simultaneously infest many fields in the Northeast. While several herbicides provide good control of most broadleaved weeds in Maine potato (Solanum tuberosum L.) fields, effective grass herbicides are limited. Herbicides are needed which allow consistent quackgrass control, preferably at the same time that broadleaved weeds are being controlled.

DPX-E9636, gluphosinate, and paraquat were applied alone or in combination with metribuzin or linuron in 1990 field experiments at Presque Isle, Maine. Weed pressure consisted of mustard spp. (primarily Brassica campestris L.), lambsquarters (Chenopodium album L.) and quackgrass at the following average densities: 244, 28 and 94 per m^2, respectively. The potato variety used was 'Katahdin'. In one experiment, DPX-E9636 was evaluated alone as a postemergence (POST) treatment at rates ranging from 0.018 to 0.069 kg ai ha^{-1} or as a POST tank-mix with metribuzin (0.28 to 0.42 kg ai ha^{-1}). Additional treatments provided an evaluation of DPX-E9636 as a preemergence (PE) tank-mix with linuron. In a second experiment, gluphosinate was applied at groundcrack (GCK) at two rates (0.56 and 0.84 kg ai ha^{-1} either alone or tank-mixed with 0.56 kg ai ha^{-1} metribuzin. Additional treatments included paraquat (0.28 kg ai ha^{-1}) applied at GCK either alone or with 0.56 kg ai ha^{-1} metribuzin.

In the first experiment, DPX-E9636 resulted in slight chlorosis and leaf curling of the potato foliage at 14 days after treatment (DAT), but not at 36 DAT. Injury increased significantly with application rate. All metribuzin and linuron treatments provided excellent broadleaved weed control. DPX-E9636 (POST) provided fair mustard control by 13 DAT and excellent control by 36 DAT. The lowest DPX-E9636 rate provided fair lambsquarters control while the remaining rates provided good control. DPX-E9636 (POST) provided excellent quackgrass control by 36 DAT regardless of rate; however, PE applications were not effective. Treatments which effectively controlled quackgrass generally had significantly higher yields than those which did not. In the second experiment, GCK treatments containing gluphosinate or paraquat resulted in significant leafburn of potato. Injury symptoms for gluphosinate were more severe and long lasting. All treatments provided good to excellent season-long mustard control except for gluphosinate without metribuzin. The higher gluphosinate rate provided good quackgrass control by 10 DAT. Tank-mixes with metribuzin improved mustard and quackgrass control by both paraquat and gluphosinate. Although all gluphosinate treatments appeared to decrease yields, only the 0.84 kg ai ha^{-1} treatments were significantly lower than the handweeded check.

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TOLERANCE OF OF CAULIFLOWER AND BROCCOLI TO METOLACHLOR

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ABSTRACT

Metolachlor, a widely used preemergence herbicide, could be a useful tool for weed control in crucifers. Early season plant stunting has been observed in some crucifers with high rates of metolachlor . Although actual yield loss may not occur, a delay in harvest maturity can be a result of this stunting.

Field studies were conducted over a three year period at two locations: Riverhead, L.I. and Freeville, New York to examine the effect that post-transplant applications of metolachlor have on total yield and harvest maturity of cauliflower(Brassica oleracea italica L.) and broccoli (Brassica oleracea botrytis L.) cultivars. On Long Island, cauliflower cultivars 'Snow Crown'(1988-1990) and 'Snowball Imperial'(1988) and 'Andes'(1989-1990) were transplanted bare root in the summer into Riverhead Sandy Loam. Metolachlor was applied 48 hours postplant and irrigated immediately. At Freeville, cauliflower 'Snow Crown' and 'Andes'(1989-1990) and broccoli 'Emperor' and Green Comet' (1989-1990) were sown in transplant cells in the greenhouse and planted in the spring in Eel silt loam.

On Long Island, both cultivars were harvested over a period of several weeks in the fall. Curd weight of either cultivar in any of the three years was not significantly reduced by metolachlor rates of up to 4.48 kg/ha In 1988 and 1990, the time to harvest maturity was also not adversely affected. In 1989, the wettest of the three years, the time to maturity was significantly delayed by metolachlor rates of 1.68 kg/ha or more.

At Freeville, both cauliflower and broccoli were harvested in a more concentrated time period during the summer. Neither total yield nor the time to maturity were significantly affected by metolachlor rates ranging from 1.68 to 4.48 kg/ha.

At both locations, some early season plant stunting was observed, especially at the higher rates. However in only one year and at one site, 1989 on Long Island, was the plant stunting severe enough to result in a harvest delay. It appears from the results of these studies that cauliflower and broccoli can tolerate metolachlor fairly well under a variety of conditions, but that some plant stunting and harvest delay can occur under very wet soil conditions.

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Clopyralid and Pyridate for Postemergence Broadleaf Weed Control in Crucifers

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ABSTRACT

Field studies were conducted in 1990 at the Vegetable Crops Research Farm in Freeville, NY, to determine the effects of postemergence treatments of clopyralid and pyridate on weed control, crop injury, and yield in cabbage (Brassica oleracea var. capitata), broccoli (Brassica oleracea var. italica) and cauliflower (Brassica oleracea var. botrytis). All plots were treated with trifluralin (0.84 kg ai/ha) applied preplant incorporated for grass control. In cabbage, clopyralid (0.21 and 0.42 kg ai/ha) and pyridate (0.50 and 1.00 kg ai/ha) were applied alone and tank-mixed at 3 (Epost) and 5 (Lpost) weeks after transplanting (May 30). Four cabbage cultivars were evaluated and included: Tastie, Super Dane, Bravo, and Hinova. In broccoli (Emperor and Green Comet) and cauliflower (Snow Crown and Andes), both herbicides were applied alone and in combination at the lower rates, but only at the earlier timing. Broadleaf weed species in the experimental sites included redroot pigweed (Amaranthus retroflexus L.), common lambsquarters (Chenopodium album L.), hairy galinsoga (Galinsoga ciliata (Raf.) Blake, and common purslane (Portulaca oleracea L.). In the cabbage study, control of redroot pigweed was 95% or better with both herbicides regardless of rate or timing. Tank-mixed treatments also gave excellent control. In the broccoli and cauliflower studies, greater than 95% control of common lambsquarters, hairy galinsoga and common purslane was also observed. Injury from pyridate was observed as chlorosis of treated leaves, while no visual injury resulted from clopyralid. All three crucifers tested were sensitive to pyridate, with cabbage being least and broccoli the most sensitive. However, injury symptoms generally decreased after 3 weeks. In cabbage, Tastie was most susceptible to injury, but the high rate of pyridate applied Epost caused the most injury to all cultivars. With cauliflower and broccoli, injury was greatest in Andes and Green Comet, respectively. Injury from pyridate did not correlate with reduced yields in three out of the four cabbage cultivars. Yields in all cultivars except Hinova were not reduced. Hinova, however, was the latest maturing cultivar, and this may have played a role in the yield response to the herbicide treatments. In cauliflower and broccoli, no significant reductions in yield occurred with any postemergence herbicide treatment.

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Potential Diphenylether Herbicides for Use in Snap Beans

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Abstract

The loss of dinoseb and chloramben has necessitated the development of alternative methods of controlling broadleaf weeds in snap beans (Phaseolus vulgaris L.). The objective of this research was to evaluate preemergence (PRE) and postemergence low dose applications of acifluorfen, fomesafen and lactofen on crop phytotoxicity and weed control in snap beans (var. 'Labrador'). The herbicides were applied at different rates and timings based on known potential phytotoxicities. Rates were: acifluorfen 0.07 to 0.56 kg ai/ha PRE and at the 1st trifoliate; fomesafen 0.28 to 0.56 kg ai/ha PRE, 1st trifoliate, and prebloom; and lactofen 0.14 to 0.56 kg ai/ha PRE and at ground crack. Metolachlor (1.7 kg ai/ha PRE) was applied to the experimental site and the study was irrigated (2.5cm) after both the PRE and the ground crack timings. Greater than 25% crop injury occurred when acifluorfen was applied at 0.56 kg PRE and at 0.42 and 0.56 kg at the 1st trifoliate. Fomesafen injury, generally half that observed with acifluorfen, was evident at 0.56 and 0.42 kg applied PRE and at the 1st trifoliate, respectively. Stands were significantly reduced in the lactofen ground crack treatments. Lactofen injury (19-63%) at harvest, occurred with 0.56 kg PRE and with 0.14, 0.28 and 0.56 kg at ground crack. In spite of partial control resulting from the metolachlor application, all preemergence treatments provided season-long control of redroot pigweed (Amaranthus retroflexus L.) and common lambsquarters (Chenopodium album L.). Control of wild buckwheat (Polygonum convolvulus L.) was excellent with fomesafen at all rates and timings. Applied postemergence, 0.07 kg (acifluorfen), 0.14 kg (lactofen), and 0.28 kg (fomesafen) effectively controlled redroot pigweed. Postemergence control of common lambsquarters and wild buckwheat required at least 0.28 kg of acifluorfen for adequate control. Despite evident crop injury in several cases, yields were reduced only when acifluorfen (0.42, 0.56 kg) was applied at the 1st trifoliate and when lactofen (0.56 kg) was applied at ground crack. Yields of fomesafen-treated beans were equal to or greater than yields of the handweeded controls.

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DIVERSITY AND SPREAD OF SEDGE WEEDS IN NEW YORK MUCK ONIONS

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ABSTRACT

Yellow nutsedge (Cyperus esculentus L.) has recently become the worst weed in New York muck onions (Allium cepa L.) and threatens the state's industry. Prevention of infestations is the only practical method of controlling this weed in muck onions at present and in the near future. The importance of seed in spread of yellow nutsedge in muck fields was studied by examining 1) emergence and growth of seedlings and tuber sprouts from collected soil, and 2) viability of field-collected seeds. Soil and mature sedge inflorescences were collected September-October 1989 from New York State muck and mineral soil fields infested with yellow nutsedge. Tuber sprouts from 10 sampled fields were grown to maturity in the greenhouse. Plants from nine of the fields initiated floral development. However, the percentage of plants that formed inflorescences varied among counties and among fields within a county, ranging from 11% to 100% for a field.

In greenhouse studies, sedge seedlings emerged from screened soil of three muck fields, one field each from Genesee, Orange, and Oswego Counties (western, southeastern, and central New York respectively); seedlings from two fields were grown to maturity. Genesee County plants produced tubers but did not flower, and were identified as yellow nutsedge. Orange County plants were from soil of an abandoned muck field. All plants flowered and produced seeds, but formed neither underground rhizomes nor tubers; they were identified as the annual Cyperus odoratus L. Seeds collected from these Oswego and Orange County fields, and from a Madison County (central New York) field, germinated in the greenhouse. Plants from Oswego County seed were all yellow nutsedge; plants from Orange County seed were yellow nutsedge and C. odoratus; plants from Madison County seed were yellow nutsedge and a perennial species of Carex. In addition, sedge seeds collected from five muck and three mineral soil fields in 1989 were viable after one year dry storage.

In order to study sedge species diversity in muck fields, young sedge plants were collected from an Oswego County onion field in 1990 and grown to maturity in the greenhouse. Plants collected include yellow nutsedge; Cyperus odoratus; a perennial, Scirpus pedicellatus Fern.; and several perennial species of Carex, most of which did not flower the first year. Only yellow nutsedge produced tubers. These studies indicate that yellow nutsedge in muck onion fields produces viable seeds which can survive in the soil. Other annual and perennial sedges are also present in muck fields and produce viable seeds, but yellow nutsedge is the most important sedge weed problem. Current studies are quantifying the viability of yellow nutsedge seeds collected from muck fields during late summer and fall of 1989 and 1990.

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PREEMERGENCE WEED CONTROL IN NEW YORK MUCK ONIONS

L.A. Ellerbrock and A.W. Westman[1]

ABSTRACT

On-farm experiments at five locations in New York in 1990 involved evaluation of pendimethalin, propachlor, metolachlor, and bromixynil for early season weed control in muck onions (Allium cepa L.). Treatments were evaluated for weed control and effect on onion stands, early onion growth, and bulb yield. Preemergence pendimethalin at 2.2 to 4.4 kg ha^{-1} reduced stand, early growth, and yield in one experiment when application was followed by heavy rain and very wet soil conditions. A similar application in another experiment did not cause onion injury. Early postemergence pendimethalin at 2.2 to 4.4 kg ha^{-1} had little or no effect on onion growth, and weed control was good in all five locations. Preemergence propachlor at 6.6 kg ha^{-1} + early postemergence pendimethalin at 2.2 kg ha^{-1} reduced early onion growth in one of three locations but did not affect bulb yield. Addition of fluazifop-p-butyl at 0.2 kg ha^{-1} and a nonionic surfactant to an early postemergence application of pendimethalin at 2.2 kg ha^{-1} did not affect onion growth. Onion bulb yield was not affected by early postemergence metolachlor at 2.2 kg ha^{-1} in two locations, but metolachlor at 3.3 kg ha^{-1} did reduce yield in one location, whereas weed control was only fair. Onion stands, early growth, and bulb yield were not affected by early postemergence applications of from 0.3 to 0.4 kg ha^{-1} bromoxynil nor by early postemergence applications of from 0.1 to 0.4 kg ha^{-1} bromoxynil + pendamethalin at 2.2 kg ha^{-1}. Early postemergence applications of bromoxynil at relatively low rates gave variable levels of weed control. Prostrate spurge control was excellent in one case, whereas control of shepherdspurse and other mustard species was poor.

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THE EFFECT OF LIGHT INTENSITY AND WAVELENGTH TRANSMITTANCE OF PLASTIC MULCHES ON YELLOW NUTSEDGE

P.E. Neary and B.A. Majek[1]

ABSTRACT

Observations in the field have indicated that yellow nutsedge is capable of penetrating black plastic mulch. Once above the mulch the nutsedge can benefit from the soil warming provided by the mulch and full sunlight, depending on the crop canopy. Yellow nutsedge does not readily penetrate plastic mulches that transmit light, including clear plastic mulch. It is hypothesized that mulches that transmit relatively small amounts of light can suppress yellow nutsedge by not allowing it to penetrate the mulch and grow under full sunlight. The objective of the 1990 experiments was to determine the effect of low light transmitting degradable mulches and a wavelength selective mulch, that transmits approximately 50% of the solar infrared radiation while allowing only 20% of the photosynthetically active radiation (PAR), on the growth of yellow nutsedge. The field experiment included two different crops to determine the effect of crop canopy on potential nutsedge suppression. The results of the greenhouse study indicated that plastic mulches transmitting relatively small amounts of light suppressed yellow nutsedge growth and tuberization. The results of the field experiment are similar to the greenhouse study but there are differences between the pepper and melon crops, due to differences in crop canopy. The degradable plastic mulches; BL-NT27, XQ-1573, XQ-1571 and BL-NV15 suppressed early season nutsedge growth compared to the bareground and clear plastic mulch in both the peppers and melons. However, by the end of the season, in the peppers, BL-NT27 was the only degradable plastic mulch that significantly reduced nutsedge tuberization compared to the bareground and clear plastic mulch plots. BL-NT27 was still intact compared to the other degradables that had completely degraded, earlier in the season, allowing subsequent nutsedge emergence and growth. IRT-76 plastic mulch also reduced nutsedge tuberization in the peppers. The melon canopy was much denser than the pepper canopy and it covered a greater portion of the plastic mulched row. BL-NV15, which was completely degraded in the peppers by the end of the season, was still 80-90% intact in the melons. Therefore, BL-NV15 along with BL-NT27 and IRT-76 significantly suppressed nutsedge tuberization. The results of these studies indicate that plastic mulches that transmit small amounts of light can potentially suppress yellow nutsedge.

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SOIL FUMIGANTS AND HERBICIDES FOR WEED CONTROL UNDER CLEAR PLASTIC MULCH IN VEGETABLE CROPS

B. A. Majek and P. E. Neary[1]

ABSTRACT

The influence of clear plastic mulch on the emergence of ten summer annual weeds was evaluated in 1989 and 1990. The population of nine weeds was affected by the mulch in at least one of the two years. Large crabgrass, giant foxtail, common purslane, barnyardgrass, and fall panicum populations were higher under the mulch. Common ragweed, velvetleaf, and common lambsquarter populations were lower under the mulch than in tilled soil. Pennsylvania smartweed populations were unaffected by the mulch. Smooth pigweed populations were decreased the first year and increased the second year of the experiment. Melons and eggplants responded to transplanting through clear plastic mulch with higher early yields and higher total yields when weeds were controlled under the mulch. Oxyfluorfen or clomazone banded under the mulch before transplanting at 0.44 kg/ha or 0.55 kg/ha, respectively, effectively controlled all the annual weeds under the clear plastic mulch. Neither herbicide caused injury to either crop. Metham injected into the trickle irrigation system or 1,3-dichloropropene plus chloropicrin shanked into the soil immediately before the plastic was laid also effectively controlled the weeds, but the fumigants were less consistent. Metham did not reach the edges of the plastic, which resulted in some weed growth that was rooted where the trickle irrigation did not wet. Application problems reduced the effectiveness of the 1,3-dichloropropene plus chloropicrin treatment in 1990.

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RESPONSE OF CUCUMBERS, SNAP BEANS, AND WEEDS TO RYE ALLELOCHEMICALS AND SPRING-PLANTED COVER CROPS

W.R. Chase, A.R. Putnam, and B.H. Zandstra[1]

Three allelochemicals believed to be released from the breakdown of rye, 2,4-dihydroxy-1,4(2H)-benzoxazin-3-one (DIBOA), 2(3H)-benzoxazolinone (BOA), and 2,2'-oxo-1,1'-azobenzene (AZOB) were assayed for toxicity on cucumber (Cucumis sativus L.), snap bean (Phaseolus vulgaris L.), barnyardgrass (Echinochloa crus-galli (L.) Beauv.) and garden cress (Lepidium sativum L.). In general, plant-derived DIBOA and BOA were more toxic to the crops than AZOB. In contrast, the microbially-produced AZOB was more toxic to barnyardgrass than to the crops. Combinations of allelochemicals caused either antagonistic or synergistic responses depending on the indicator species and rate of application. The best scenario for good weed control with minimal crop injury would be the rapid conversion of DIBOA/BOA to AZOB.

Spring-planted cover crops were evaluated for their ability to reduce weed populations in cucumber and snap bean during the 1988 - 1990 seasons. Oat (Avena sativa L.), spring barley (Hordeum vulgare L.) and rye (Secale cereale L.) were killed with glyphosate and compared to bare ground and a poplar excelsior (Populus tremuloides Michx.) mulch. In all years, poplar excelsior reduced weed biomass by 23 - 30% at 42 days after seeding the vegetables, compared to bare ground. Spring-planted cover crops reduced weed biomass by up to 78%. Cover crops delayed emergence and maturity of the vegetable crops, but total yields were not reduced.

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RESPONSE OF THREE GRASS SPECIES TO FALL APPLIED BRUSH CONTROL TREATMENTS

Gregory T. Lyman, Larry J. Kuhns, and Arthur E. Gover[1/]

ABSTRACT

Injury to understory grasses from fall applied brush control treatments has been a major concern to Pennsylvania roadside managers. An experiment was conducted to compare the effects of several brush control treatments on tall fescue (Festuca arundinacea Schreb.), red fescue (Festuca rubra L.), and hard fescue (Festuca longifolia Thuill.) (Table 1). Fosamine ammonium (FA) at 8.96 kg/ha was applied alone and in combination with Cidekick[2/] at three carrier volumes to simulate different application equipment. They were 280 l/ha (30 GPA), 560 l/ha (60 GPA), and 840 l/ha (90 GPA). Other treatments included Cidekick and Clean Cut plus Pine[3/] alone, imazapyr, triclopyr, and metsulfuron methyl (MSM) alone and in combination with FA. Plots were 1.2 m by 1.8 m, arranged in a randomized complete block design for each species. Treatments were applied on September 7, 1989 with a CO_2 pressurized test plot sprayer and two 8004E flat fan nozzles spraying the same swath. Temperatures of the air, soil surface, and soil at 8 cm was 30°C, 28°C, and 24°C respectively. On May 31, 1990, the treatments were rated for injury on a scale of 1-10 with a "1" indicating green vigorous turf, "10" indicating dead turf, and >5 unacceptable for roadside turf. Treatments were rated on October 7, 1990 for percent cover.

Hard fescue displayed a higher level of injury on May 31 than red fescue or tall fescue. The treatments on hard fescue that contained FA alone or FA plus Cidekick produced unacceptable injury and were not statistically different from each other (Table 1). Injury from imazapyr at 0.035 kg/ha was considered barely acceptable, but the other treatments containing imazapyr caused moderate to severe injury. Treatments containing MSM, triclopyr, or Cidekick caused little injury. Clean Cut plus Pine provided a somewhat higher injury rating than Cidekick, but was not statistically different. On October 7, plots receiving five treatments had cover ratings of 60% or less: FA in 280 l/ha, FA + Cidekick in 280 l/ha, FA + Cidekick in 560 l/ha, imazapyr at 0.105 kg/ha, and FA plus imazapyr at 0.07 kg/ha. All other test plots had cover ranging from 67-100% cover and were considered satisfactory for roadsides.

On May 31 none of the red fescue plots received a rating greater than 6, and only four treatments received a rating of 5 or more. FA alone at 840 l/ha, imazapyr at 0.105 kg/ha, FA+imazapyr at 0.07 kg/ha, and FA + imazapyr at 0.035 + MSM at 0.042 kg/ha provided an unacceptable degree of injury. None of the other treatments were considered unacceptable. On October 7, all treatments provided 87-100% cover except FA plus imazapyr at 0.07 kg/ha and FA + Cidekick in 280 l/ha, which produced 77% and 80% cover, respectively. These were significantly lower than most of the other treatrments.

Of the tall fescue plots rated in May, only three treatments caused injury that could be considered unacceptable: imazapyr at 0.105 kg/ha, FA plus imazapyr at 0.07 kg/ha, and FA + imazapyr + MSM. In October, all treated areas had 93% cover or better except those treated with FA plus imazapyr at 0.07 kg/ha or FA plus imazapyr plus MSM. Each provided 77% cover, which though it was adequate for a roadside, was significantly lower than all other treatments.

Roadside managers should be aware that these grass species have different tolerances of the fall brush treatments evaluated in this study. While the FA treatments applied in different carrier volumes had little effect on the final cover provided by tall or red fescue, FA at low carrier volumes did reduce hard fescue cover. The addition of Cidekick to FA did not seem to be detrimental to any of species. Cidekick or Clean Cut plus Pine applied alone had little effect on any of the species. Imazapyr at 0.105 kg/ha reduced the final hard fescue cover, but not the cover of red or tall fescue. Imazapyr at 0.07 + FA reduced the final cover ratings of all the species, but hard fescue was the most severely affected. The combination of imazapyr + FA + MSM tcaused a reduction in the cover ratings of tall and hard fescue, but red fescue was not as badly affected. This information can be used when vegetation managers are developing custom applications recommendations for specific sites.

1/ Project Assistant, Professor of Ornamental Horticulture, and Sr. Research Technologist, respectively. Penn State University, University Park, PA 16802.

2/ Cidekick spray adjuvant, JLB International, Vero Beach, Florida.

3/ Clean Cut plus Pine spray oil adjuvant, Arborchem Products Inc., Fort Washington, PA.

TABLE 1: Injury ratings and percent cover for hard fescue, red fescue, and tall fescue treated on Sept. 7, 1989. Injury ratings on May 31, 1990 were on a scale from 1-10 with a "1" indicating green, vigorous turf, a "10" indicating dead turf, and > 5 being unacceptable for roadside turf. Percent cover was visually rated on Oct. 7, 1990.

		Hard Fescue		Red Fescue		Tall Fescue	
Treatment [l/ha]	Application Rate	5/31/90 Injury	10/7/90 Cover	5/31/90 Injury	10/7/90 Cover	5/31/90 Injury	10/7/90 Cover
	kg/ha	(1-10)	(%)	(1-10)	(%)	(1-10)	(%)
Fosamine ammonium (FA) [280]	8.96	7.7	41	3.3	97	3.3	100
FA [560]	8.96	6.0	77	3.0	100	4.0	100
FA [840]	8.96	5.7	93	6.0	100	4.0	100
FA + CideKick[1/] [280]	8.96	5.3	57	2.3	80	2.3	100
FA + CideKick [560]	8.96	7.3	60	3.7	100	2.3	97
FA + CideKick [840]	8.96	6.7	73	4.7	97	2.7	100
Imazapyr [560][2/]	0.035	4.7	100	4.7	97	2.7	100
Imazapyr	0.07	6.3	90	3.0	100	4.7	100
Imazapyr	0.105	9.0	50	5.3	93	6.0	100
Metsulfuron methyl (MSM)	0.021	2.3	97	2.3	100	2.0	100
MSM	0.042	2.0	100	2.0	100	4.0	93
Triclopyr ester (TE)	4.48	2.3	97	1.3	100	2.3	97
FA + Imazapyr	6.72 + 0.035	6.7	80	3.7	97	3.7	100
FA + Imazapyr	6.72 + 0.07	7.0	33	5.7	77	7.0	77
FA + MSM	6.72 + 0.042	3.3	93	4.7	100	2.0	100
FA + TE	6.72 + 0.56	5.0	77	4.3	100	1.3	97
FA + Imazapyr + MSM	6.72 + 0.035 + 0.042	8.3	67	5.0	100	8.3	77
FA + TE + MSM	6.72 + 0.56 + 0.021	3.0	93	2.0	100	1.3	100
CideKick	0.50% v/v	2.7	73	2.7	87	2.0	100
Clean Cut + Pine[3/]	0.50% v/v	4.0	100	3.3	97	4.0	100
L.S.D.(P=0.05)		2.6	32	2.5	19	2.4	15

1/ Cidekick spray adjuvant, added at 0.25% v/v, JLB International, Vero Beach, FL.

2/ The carrier volume for the remaining treatments was 560 l/ha.

3/ Clean Cut plus Pine spray oil adjuvant, Arborchem Products Inc., Fort Washington, PA.

LOW-VOLUME BACKPACK APPLICATION OF GLYPHOSATE FOR BRUSH CONTROL

J. L. Wilhm, J. S. Gabric and H. W. Caldwell

ABSTRACT

Aqueous spray solutions containing 5% and 10% v/v concentrations of glyphosate2 herbicide with 1.5% v/v of a non-ionic surfactant3 were applied through a backpack sprayer to small (<15 ft.) brush. The nozzle used was either an adjustable straight-stream nozzle or a Spraying Systems TXVS-6 ConejetR nozzle modified to spray a straight stream. Applications were made by spraying the foliage in a lateral zig-zag motion from the top to the bottom of the plant being sprayed. Approximately 50% of the foliage is contacted, but not soaked as this is a low-volume application. In small, open branched trees, applications need only be made to one side. In thick foliage or multiple stem root sprouts, applications must be made from several sides to ensure adequate spray coverage. Spray volume per acre will vary with density, but have typically ranged from 10 to 25 gallons per acre.

For most species sprayed, there was no difference in control between the 5% and 10% v/v concentration rates. However, symptoms appeared more quickly on many species with the higher rate. Species controlled by the 5% v/v rate include sassafrass (Sassafrass albidum), black locust (Robinia pseudoacacia), cherry (Prunus serotina), red maple (Acer rubra), red and white oak (Quercus rubra and Q. alba), yellow poplar (Liriodendron tulipifera), sumac (Rhus spp.), redbud (Cercis canadensis), sycamore (Platanus occidentalis), and sweetgum (Liquidambar styraciflua). Ten percent v/v concentrations were needed to control shagbark hickory (Carya ovata) and Eastern red cedar (Juniperus virginiana). Variable results were seen with both rates on mulberry (Morus spp.) and American elm (Ulmus americana). One possible explanation for poor American elm control may be that the small leaves of this species may have prevented sufficient spray coverage of the low-volume spray.

This type of application may be preferable to high-volume handgun applications in low-brush density situations, in rough terrain, in residential areas, or in environmentally sensitive areas. Since the application is specific to brush, desirable understory is maintained and objectionable brown out can be avoided. This technique also offers an alternative to summer basal applications since the straight stream nozzle enables quick applications standing away from the stem rather than next to it.

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3 X-77R Spreader, Valent Corporation

A COMPARISON OF SEVERAL DILUENTS USED BASAL BARK HERBICIDE APPLICATIONS TO CONTROL ASH AND BIRCH

Gregory T. Lyman, Larry J. Kuhns, and Arthur E. Gover[1/]

ABSTRACT

In recent years, several diluents have become available for use in basal bark applications as an alternative to diesel fuel or kerosene. In this study diesel fuel, two commercially used products (Basal Oil[2/] and Rite Way[3/]), a vegetable oil (Soy-Dex[4/]), and a paraffin based petroleum oil (Penetrator[5/]) were evaluated for their control of green ash (Fraxinus pensylvanica Marsh.), and black birch (Betula lenta L.) when used a carrier for triclopyr. Naturally growing stands of ash and birch with stem calipers ranging from 2.54 cm to 10.16 cm were selected for treatment. A solution of 20% Garlon 4[6/] and 80% diluent was used for each of the five diluents. Each diluent was applied at two rates; 1.0 and 2.0 ml solution per 2.54 cm stem circumference. Twenty stems were utilized for each treatment and they were arranged in a randomized complete block design. In early April 1989, the diameter of each stem was measured and recorded, circumference was determined, and the appropriate dose was calculated. The solution was applied evenly around the stem at a height of 30-40 cm using a hypodermic needle and syringe to control accuracy. In September 1989 and 1990, each stem was rated for control on a scale of 0-5 with a "0" being no treatment effect and a "5" indicating no visible living tissue.

The data for stem size was analyzed and there was no significant difference in size between the treatments for each species. The means for injury rating at each rating date are reported in Table 1. In 1989, ash control with Soy-Dex was significantly lower than all other treatments. Virtually complete control was achieved with diesel fuel, Basal Oil, Rite Way, or Penetrator. There was no difference in control for these products at either rate. By 1990, control provided by the low rate of Soy-Dex had decreased and was significantlly different than all other treatments. Injury ratings for the high rate of Soy-Dex increased slightly and were not statistically different than the other diluents. Control provided by diesel fuel, Basal Oil, Rite Way, and Penetrator did not change from 1989 to 1990.

Control of birch was variable between treatments and rates in 1989. The low rate of all diluents provided poorer control ratings when compared to the high rate, yet the only difference that showed significance was between the rates of Soy-Dex. The low rate of Rite Way was significantly better than the low rate of Basal Oil, Soy-Dex, and Penetrator, but not diesel fuel. The low rates of diesel fuel and Rite Way were not significantly different than the high rates of any diluent. The only significant difference between the high rates was between diesel fuel and Soy-Dex. By 1990 the low rate of Soy-Dex was not different than the low rate of Basal Oil or Penetrator, but was significantly lower than all other treatments. All other diluents and rates were not different from each other.

Initially, birch control levels were lower than ash in 1989, but most treatments were similar by 1990. In both species, the 1 ml solution/2.5 cm circumference rate was the most cost efficient. Soy-Dex was the only diluent that was inferior to diesel fuel. All other diluents provided the same level of control when compared to diesel fuel. None of the diluents were superior to diesel fuel. By having no difference in efficacy, vegetation managers can consider other attributes of these diluents when making a control strategy for these two species.

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2/ Basal Oil, Arborchem Products, Inc., Fort Washington, PA

3/ Rite Way, N.G. Gilbert Corporation, Muncie, IN

4/ Soy-Dex vegetable oil adjuvant, Helena Chemical Co., Memphis, TN

5/ Penetrator non-ionic spray adjuvant, Helena Chemical Co., Memphis, TN

6/ Garlon 4 herbicide, an emulsifiable concentrate containing 480 g/l triclopyr.

TABLE 1: Mean injury ratings to green ash and black birch treated in April 1989 with a 20% solution of Garlon 4[1/] in five diluents, and evaluated September 1989 and August and September 1990. Injury was rated on a 0 to 5 scale, with "0" being no treatment effect, and a "5" indicating death of the stem. Each value is the mean of 20 observations.

		Injury Ratings			
	ml solution/ 2.5 cm	Green Ash		Black Birch	
Diluent	stem circumference	9/89	8/90	9/89	9/90
		(----------0-5----------)			
Diesel Fuel	1.0	5.0	5.0	3.8	4.9
Diesel Fuel	2.0	5.0	5.0	4.6	5.0
Basal Oil[2/]	1.0	5.0	5.0	2.6	4.4
Basal Oil	2.0	5.0	5.0	3.5	4.8
Rite Way[3/]	1.0	4.8	4.8	4.3	5.0
Rite Way	2.0	5.0	5.0	4.5	4.9
Soy-Dex[4/]	1.0	4.0	3.6	1.9	3.6
Soy-Dex	2.0	4.0	4.3	3.3	4.3
Penetrator[5/]	1.0	4.8	4.8	3.0	4.6
Penetrator	2.0	4.8	4.9	3.8	4.9
L.S.D. (p=0.05)		0.9		1.2	

1/ Garlon 4 is an emulsifiable concentrate containing the acid equivalent of 480 g/l triclopyr, DowElanco, Indianapolis, IN.

2/ Basal Oil, Arborchem Products, Inc., Fort Washington, PA.

3/ Rite Way, N.G. Gilbert Corporation, Muncie, IN.

4/ Soy-Dex vegetable oil adjuvant, Helena Chemical Co., Memphis, TN.

5/ Penetrator non-ionic spray adjuvant, Helena Chemical Co., Memphis, TN.

USE OF COVER CROPS IN LOW-INPUT WEED MANAGEMENT SYSTEMS FOR CORN PRODUCTION

John R. Teasdale[1]

ABSTRACT

The objective of this research is the development of weed management systems for no-tillage corn production that reduce herbicide and nitrogen inputs. Research emphasis has been placed on annual legume cover crops because of the demonstrated nitrogen contribution to corn. This report summarizes progress from field experiments conducted during 1988 through 1990.

Residue of hairy vetch (Vicia villosa Roth) and crimson clover (Trifolium incarnatum L.) suppressed weed establishment within the first month after corn planting in treatments without residual herbicide. For example, hairy vetch residue suppressed weed density over 3 years by an average of 56% compared to the control treatment. Sufficient weeds became established that weed biomass at tasselling was similar to that in control plots in two out of three years. On the other hand, if hairy vetch remained alive until natural senescence in June, weed density was suppressed by 88% and weed biomass at tasselling was reduced by 61%. Planting corn in 38 cm rather than 76 cm rows and double rather than conventional density improved weed control for selected cover crop treatments. However, no cover crop treatment without herbicide has provided weed control as effective or as consistent as that provided by herbicides.

Cover crops, in some instances, have interfered with corn production. Hairy vetch and crimson clover residue decreased corn stand by 32% and 12%, respectively, during a season with cool, wet conditions for corn germination. Live, unmanaged hairy vetch severely inhibited early corn development and resulted in an 87% yield reduction during a season in which vetch growth extended until late June. Although live hairy vetch provided improved weed control compared to killed hairy vetch, some management with postemergence herbicides may be necessary to prevent excessive interference with corn.

Corn yields from treatments with cover crops and/or narrow row spacing but without herbicides were not significantly different than yield of the standard herbicide treatment in a year with low weed competition but were significantly lower in a year with high weed competition. However, treatments which combined herbicides at reduced rates with cover crops and/or narrow row spacing consistently yielded as well as the standard herbicide treatment. These results suggest that cover crops will need to be integrated with some herbicide technology to achieve consistent no-tillage corn production.

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Weed Control and Cover Crop Management for Ridge-Till Corn

Frank Webb and Mark Causey[1]

ABSTRACT

Field experiments were conducted in 1989 and 1990 at Georgetown, Delaware with different herbicides and rates across three cover crop variables, rye (Secale cereale L.), crimson clover (Trifolium, incarnatum L.) and volunteer cover in ridge-till corn (Zea mays L.). The statistical design was a split-plot arrangement of a randomized complete block design. All plots received two ridge cultivations with a standard ridge-till cultivator. In both years the rye cover interfered with the cultivation process because of the large amount of cover crop residue. Visual nitrogen deficiency was evident in the rye cover plots with a total of 102 lbs of chemical nitrogen applied to all plots. All herbicide treatments yielded significantly higher (Table 1) than the no herbicide plots for both years. The rye cover plots yielded significantly less than the other covers where no burndown herbicide was used even in combination with one x rate of atrazine, metolachlor and 2,4-D applied preemergence for both years due to growth competition with the crop. There were no significant differences between weed control ratings or corn yield with one-half x rates of soil residual herbicides as compared to one x rates. In 1990 crimson clover plots, in combination with any herbicide treatment, produced higher yields than the other covers as a result of a noticeable nitrogen deficiency occurring in the study.

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Table 1. Herbicide and Cover Crop Response in Ridge-Till Corn

		1989					1990			
		6/19	6/19	7/12	9/11	9/12	6/1	9/11	9/11	9/14
Treatment PE	Rate lb/A	Cover Kill	Mares-tail	Lg. Crab-grass	Common Ragweed	Yield bu/acre	Storks-bill	Common Ragweed	Lg. Crab-grass	Yield bu/acre
Rye Cover Bicep 2,4-D E	 2.25 .25	80.0	35.0	62.5	77.3	121.5	99.	90.	77.5	103.
C.Clover Bicep 2,4-D E	 2.25 .25	77.5	35.0	92.5	92.3	140.1	98.	96.5	87.5	134.8
No Cover Bicep 2,4-D E	 2.25 .25	55.0	30.0	86.0	89.8	126.0	95.5	85.	87.5	116.9
No Cover Bicep 2,4-D E	 1.13 .25	52.5	30.0	84.8	75.0	133.3	88.5	82.5	82.5	109.5
C. Clover Bicep 2,4-D E	 1.13 .25	60.0	40.0	78.8	73.8	130.8	91.	87.5	85.	118.3
Rye Cover Bicep 2,4-D E	 1.13 .25	82.5	30.0	50.0	51.3	105.0	92.3	85.	77.5	103.7
Rye Cover Honcho Bicep X-77	 .75 1.13 1.00	84.8	84.5	86.3	89.8	131.5	99.0	88.8	83.8	101.3
C. Clover Honcho Bicep X-77	 .75 1.13 1.00	89.8	99.0	93.8	90.0	133.0	94.8	88.8	86.3	119.3
No Cover Honcho Bicep X-77	 .75 1.13 1.00	88.5	.89.5	93.8	90.0	141.0	92.3	88.8	86.3	110.3
No Cover Gramoxone X-77 Bicep	 .38 .25 1.13	99.	99.	96.0	91.3	134.7	92.3	85.	86.3	100.2
C. Clover Gramoxone X-77 Bicep	 .38 .25 1.13	99.	99.	92.5	92.5	132.2	96.8	82.5	80.	118.7
Rye Cover Gramoxone X-77 Bicep	 .38 .25 1.13	99.0	99.	63.8	70.0	116.4	98.8	89.5	82.5	97.1
No Cover No Herb.	0	0	0	0	0	73.7	0	0	52.5	37.8
C. Clover No Herb.	0	20.	0	0	0	62.1	22.5	0	62.5	23.1
Rye Cover No Herb.	0	22.5	0	0	0	39.4	55.	0	46.3	28.5
LSD (.05)		22.1	21.5	10.4	13.5	20.0	21.3	12.8	12.1	18.0

Biological and Economic Analysis of Ridge Tillage in Corn and Soybeans

B.H. Marose[1], M. Heller[2], T.C. Harris, and V.M. Kibler[3]

ABSTRACT

The technique of planting and cultivating crops on ridges was first developed more than thirty years ago as a soil and water conservation practice in the Mid-west. Today, there is renewed interest in ridge tillage as a means of reducing the economic and environmental costs associated with heavy reliance upon herbicides.

In 1988 a six year project was initiated to evaluate ridge tillage in comparison to no-tillage and conventional tillage systems for a typical corn-soybean rotation under mid-Atlantic coastal plain conditions. The experiment focuses on the economics of production and on the long term changes in weed species and density resulting from substituting varying degrees of tillage for some herbicide inputs.

A nineteen treatment experiment was established at the Chesapeake Bay Foundation's Claggett Farm in Upper Marlboro, Maryland on a silt loam soil. The 20' by 70' plots were arranged in a randomized complete block design with three replications. Plots were established using full size farm equipment including a Buffalo ridge tillage planter-cultivator and no-tillage cultivator.

The six ridge tillage, four no-tillage, and six conventional tillage treatments were selected to allow comparisons within and between tillage systems, between primary and secondary tillage operations, and between banded and broadcast herbicide placement. In addition to the fixed treatments, one variable treatment for each tillage system allows annual modifications in selection and timing of herbicides and secondary tillage practices. The variable treatments reflect a best management approach to minimizing inputs and maximizing returns as weed problems change over time.

Weed counts, weed and crop biomass, and crop yield data are collected and analyzed by analysis of variance using a RCB model. An F-LSD ($p=.05$) is used for general treatment comparisons with contrasts calculated for specific planned comparisons. Correlations are run between weed count, biomass, and yield data. Economic analysis is conducted to compare differences among the nineteen treatments. The budget model used to assess profitability takes into account variable costs, equipment costs, farm size, and equipment age.

In 1988 and 1989 corn yields from ridge tillage plots were comparable to no-tillage and conventional tillage plots with standard management practices. Weed control in ridge tillage was good in most ridge tillage plots. Only in the no herbicide plots did morningglories become a problem within the row. Treatments involving tillage had greater numbers of horsenettle, but lower overall biomass. The variable costs of production, such as herbicide, fuel, and labor, tended to be lower for ridge tillage than for conventional or no-tillage.

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Table 1. Tillage and herbicide treatments used in the biological and economic analysis of ridge tillage in corn and soybeans.

PRIMARY TILLAGE	HERBICIDE	SECONDARY TILLAGE
Ridge	Broadcast - Pre	Ridge + Ridge
Ridge	Broadcast - Pre + Post	Ridge + Ridge
Ridge	Banded - Pre	Ridge + Ridge
Ridge	Banded - Pre + Broadcast - Post	Ridge + Ridge
Ridge	Variable	Variable
Ridge	None	Rotary Hoe + Ridge + Ridge
Ridge	None	Ridge + Ridge
No-Tillage	Broadcast - Pre	None
No-Tillage	Broadcast - Pre	No-till Cultivator
No-Tillage	Broadcast - Pre + Broadcast - Post	None
No-Tillage	Variable	Variable
No-Tillage	None	None
Conventional	Broadcast - Pre	None
Conventional	Broadcast - Pre	Cultivate + Cultivate
Conventional	Broadcast - Pre + Broadcast - Post	None
Conventional	Variable	Variable
Conventional	Banded - Pre	Cultivate + Cultivate
Conventional	None	None
Conventional	None	Rotary Hoe + Cultivate + Cultivate

EFFECTS OF A LEGUME NITROGEN SOURCE ON COMPETITION BETWEEN CORN AND LAMBSQUARTERS

E. Dyck and M. Liebman[1]

ABSTRACT

A two-year field study was undertaken to compare the effects of nitrogen source (legume residue vs. synthetic nitrogen fertilizer) on competition between sweet corn (Zea mays L. 'Sugar Buns') and lambsquarters (Chenopodium album L.). Plots of crimson clover (Trifolium incarnatum L.) were seeded in the spring and after 10 weeks growth were mown and the residue shallowly incorporated. Sweet corn was planted in these plots as well as into plots fertilized with ammonium nitrate at rates of 0, 45, 90, 135, or 180 kg N/ha. The corn rows in half of each plot were also seeded with lambsquarters. Corn and weeds were then thinned to equal densities in all plots. Samples of corn and weeds were taken every two weeks to assess aboveground biomass and tissue nitrogen content. To determine patterns of nitrogen availability, soil samples were also periodically taken from each plot.

In 1989, at two weeks after corn emergence, lambsquarter biomass in the plots treated with crimson clover averaged 70% less than that in 0 N plots. At harvest (10 weeks after emergence), lambsquarters biomass on crimson clover plots remained 30% lower than that on 0 N or ammonium nitrate plots. In contrast, corn grown with legume nitrogen under weedy conditions outyielded weed-infested corn plots treated with 180 kg N/ha. Analysis of 1990 corn and lambsquarter dryweights shows the same trends in terms of suppressed weed growth and increased corn yield (on weed-infested plots) when the legume residue treatment is compared to those utilizing ammonium nitrate.

One possible explanation for this differential effect of nitrogen source on corn and lambsquarters growth involves temporal availability of soil inorganic nitrogen. In 1989, plots treated with crimson clover residue contained significantly less plant-available nitrogen than those treated with ammonium nitrate through the first six weeks after corn emergence. The initial high levels of plant-available N in the soil in synthetic fertilizer plots may favor species capable of rapid, early growth and nutrient capture, such as lambsquarters. On the other hand, a source which releases nitrogen more slowly throughout the growing season, e.g., legume residue, may benefit such crops as corn that exhibit slow initial growth and a delayed requirement for nitrogen.

Results from this study suggest that crop rotations involving legumes may provide significant weed suppression benefits in corn cropping systems.

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CROWNVETCH (CORONILLA VARIA L.) LIVING MULCH'S CONTRIBUTION TO SUSTAINABLE AGRICULTURE

N. L. Hartwig[1]

Generally agriculture as practiced today is sustainable. That is not to say change isn't necessary and certainly desirable when new technology comes along that will make agriculture more efficient, profitable and in harmony with the environment. Any change based solely on making agriculture more in harmony with the environment without improvement in efficiency or profitability will not be economically sustainable. Crownvetch used as a living mulch improves efficiency of farming by providing a living ground cover for corn, small grains, forages and under the right conditions soybeans, for the control of soil erosion without the need for terraces, narrow contour strips and large portions of the farm planted to sod crops each year. Profitability is improved because the farmer has the option of using crownvetch that when once established should never need to be planted again instead of the costly building and maintaining of terraces and nuisance of contour farming with its associated short and point rows. Crownvetch can be managed by using the same herbicides that are in use today for the above crops without fear of losing it completely. It spreads by underground root stocks which allows crownvetch to fill in when overly suppressed. Since it is a legume, crownvetch fixes nitrogen so it doesn't compete with the crop for nitrogen and may under the right circumstances provide some nitrogen to the crop. Most importantly, crownvetch works in harmony with the environment by providing a living carpet to almost eliminate surface water runoff and the loss of soil, fertilizer and pesticides to streams and lakes.

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Potential Herbicide Reduction in Reduced Tillage Potatoes

L.E. Lanfranconi and R.R. Bellinder[1]

ABSTRACT

Field experiments were conducted in 1989 and 1990 to determine the effect of mulch density and herbicide programs on weed suppression and potato (Solanum tuberosum L.) yield. Potatoes were planted into rye (Secale cereale L.) killed at two timings with 1.1 kg ha-1 of glyphosate to achieve 1200 and 1800 kg ha^{-1}, and 1850 and 2300 kg ha^{-1} in 1989 and 1990, respectively. The weed control programs included conventional tillage (CT) plus mechanical cultivation; reduced tillage (RT) with a full (1x) rate of linuron and metolachlor (1.7 ka ai ha^{-1} each) applied 10 days after planting (DAP); RT with a 0.67x rate of metribuzin (0.17 kg ai ha-1) applied two weeks after hilling; and RT alone. All treatments were hilled five weeks after planting. In 1989, mulch density had no effect on redroot pigweed (Amaranthus retroflexus L.) and common lambsquarters (Chenopodium album L.) populations. In the between-row spaces redroot pigweed emergence at 2, 4 and 12 weeks after planting (WAP) was significantly greater where cultivation was used than in undisturbed rye treatments. In the in-row spaces at 4 and 12 WAP redroot pigweed and common lambsquarters responded differently to herbicide rates and tillage. While reducing tillage decreased common lambsquarters populations, redroot pigweed populations decreased only with increasing herbicide rates. In 1990, in both in-and-between-row spaces redroot pigweed and common lambsquarters populations were significantly higher in the CT plots at all timings when compared to the undisturbed rye plots. Weed numbers 12 WAP were significantly reduced as a function of mulch density in 1990. Total weed dry weight at 4, 8 and 12 WAP were significantly higher in CT than in RT. In 1989, total and marketable yields decreased as mulch density increased. Yields were greatest, at both densities, when the 1x rate of herbicides was used. Conventional tillage without herbicides and RT with lower herbicide rates applied after hilling produced equivalent yields. Regardless of mulch density, the lowest yields occurred in the rye mulch system without herbicides. In 1990, mulch densities did not affect yields. Total and marketable yields were significantly higher where rye residues were left undisturbed prior to hilling than when mechanical cultivation for weed control was used. In contrast to 1989, the lowest yield in 1990 occurred in CT plus cultivation treatments.

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EFFECTS OF MULCHES ON WEED CONTROL AND PEPPER YIELD

M.J. Else and F.X. Mangan [1]

ABSTRACT

An experiment was conducted to determine the effect of mulches on yield of peppers (Capsicum annuum L. 'Melody') and growth of weeds. The effect of three-foot wide strips of black plastic mulches was studied in side-by-side blocks in which a stand of hairy vetch (Vicia villosa Roth) and rye (Secale cereale L.) was either mowed and left on the surface of the soil or tilled in. Weed-free treatments were included so that the effects of weeds could be differentiated from other effects of the mulches which could influence yields. In the weed-free plots, yields were higher and production began earlier in the season in tilled plots and in plots with black plastic. Some of the reductions in yield in the no-till treatments may have resulted from difficulties encountered in transplanting into untilled soil, but soil temperature differences also suggest that reduced soil temperatures in these plots was a factor. Yields in the untilled plots increased later in the season. Yields could not be compared among unweeded treatments, because even the mulched plots had weed growth which reduced pepper yields to nearly nothing. The two major weed species present were common lambsquarters (Chenopodium album L.) and large crabgrass (Digitaria sanguinalis L.). Populations of these weeds were inversely correlated with each other, with greater numbers of large crabgrass plants being found in the no-till plots and greater numbers of common lambsquarters plants being encountered in the tilled plots. This experiment has thus yielded some interesting ecological information and the following observations: that difficulties in no-till vegetable transplanting and lower soil temperatures uder cover crop mulches may reduce yields in peppers, and that weed control measures in addition to cover crops alone may be necessary.

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SUBTERRANEAN CLOVER LIVING MULCH IN SUMMER SQUASH[1]

M. Waters and R.D. Ilnicki[2]

ABSTRACT

A second season of data were collected for a field study involving the use of subterranean (sub) clover (Trifolium subterraneum L. 'Mt. Barker') as a living mulch for weed control in summer squash (Cucurbita pepo L. 'Senator'). Results of the first year of the study (1989) indicated that while subclover controlled summer annual weeds as well as the conventional herbicide treatment, it might be too competitive with squash in the early part of the season. Attempts were made in 1990 to alleviate some of the competitive effects of subclover, so that an acceptable squash crop could be produced with limited herbicide inputs.

Treatments used in 1989 and again in 1990 included weed-free (using bensulide and chloramben preemergence) and unweeded checks (both tilled and with no clover present) and a full stand of mowed clover. The remaining treatments in 1990 consisted of a full stand of unmowed subclover, and two treatments designed to reduce in-row competition from subclover with squash while maintaining the weed-suppressing mulch between rows: unmowed subclover with 55 cm strips either killed with glyphosate or tilled, and treated with bensulide and chloramben. Squash was hand-seeded on June 5 into rows 1.8 m apart marked with a no-till corn planter. Preemergence herbicides were applied the following day. Subclover was alive at squash planting, and remained so for about three weeks.

As in 1989, summer annual weed control provided by subclover was comparable to the herbicide-treated check. Unmowed subclover resulted in slightly lower weed biomass than mowed clover. Full stands of both mowed and unmowed clover reduced squash stand, retarded early season growth, and delayed harvest, resulting in lower yields than the herbicide-treated check (the highest-yielding treatment), over the 25-day harvest period. Mowed clover was slightly less competitive with squash in the early weeks of the season than unmowed clover, but there was no significant difference between final yields obtained in the two treatments. Squash plants grown in all of the subclover treatments produced greater quantities of fruit than the untreated check. Among the subclover treatments, yield was significantly improved when clover was removed from the rows, compared to full stands, whether killed with glyphosate or tilled.

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[1]NJ Agric. Exp. Stn. Publication No. J-15274-1-90.
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Use of Subterranean Clover as a Living Mulch in Some Vegetables[1]

R. D. Ilnicki, M. Waters, and A. Enache[2]

ABSTRACT

We have shown that subterranean clover (Trifolium subterraneum) or subclover can be used as a living mulch for weed control in several agronomic crops and we conducted studies this past year to determine whether subclover can be used in vegetables.

Cabbage (Brassica oleracea capitata) and tomato (Lycopersicon esculentum) transplants were set and snapbeans (Phaseolus vulgaris) were planted in early spring on beds previously seeded to subclover the summer before. Treatments included mowed and unmowed subclover with or without herbicides applied in a band over marked rows prior to transplanting or planting. Conventionally-tilled plots with herbicides served as checks.

In cabbage, mowed and unmowed subclover produced excellent control of lambsquarters (Chenopodium album L.) and purslane (Portulaca oleracea L.) with or without herbicides. Yield was highest in mowed subclover without herbicides. Yields were low where subclover was not mowed with no improvement from herbicides. Yields were lowest where glyphosate was used.

Mowed or unmowed subclover with or without herbicides produced excellent control of purslane and fall panicum (Panicum dichotomiflorum Michx.) in tomatoes which was comparabale to the conventionally tilled-herbicide check. Yield was highest where subclover was unmowed without herbicide. Mowing, with or without herbicide, resulted in lower yields. Yields were lowest where glyphosate was used on both mowed and unmowed areas.

Subclover, with and without banded herbicides, effected excellent control of purslane and fall panicum in snapbeans and equal to the conventionally tilled herbicide check. Glyphosate in a band over the row had no detrimental effect as it did in cabbage and tomatoes.

From these studies we conclude that subclover living mulch can be used for weed control in cabbage, tomatoes, and snapbeans.

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[1]New Jersey Agric. Exp. Station Publication No. J-15274-2-90.
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Subterranean Clover and Vetch Mulches for Zucchini Squash and Sweet Corn

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ABSTRACT

Subterranean clover (Trifolium subterraneum L. 'Mt. Barker') and hairy vetch (Vicia villosa Roth) were seeded on October 6, 1989 at Salisbury and established successfully during unusually severe early winter conditions. Sweet corn (Zea mays saccharata L. 'Silver Queen') and zucchini squash (Cucurbita Pepo ovifera (L.) Alef. 'Elite') were no-tillage seeded into these legume mulches on May 2 and June 7, 1990, respectively. Wheat (Triticum aestivum L. 'Saluda') cover crop was plowed and tilled as a conventional tillage treatment and sweet corn and squash were planted on the same day as in the no-tillage treatments. Fertilizer was applied to the soil surface in no-tillage or soil incorporated in the conventional tillage. Supplemental nitrogen was applied to the conventional tillage treatments but not to the legume mulches. The crop mulches were flail mowed after planting and before crop emergence. Each crop had a no-herbicide treatment and two herbicide treatments for each of the three tillage/mulch treatments. The herbicide treatments were as follows: a) sweet corn: metholachlor plus atrazine at 0.55 plus 0.55 kg/ha or 1.1 plus 1.1 kg/ha and b) squash: 3.4 or 6.7 kg/ha bensulide. Hairy vetch was controlled by flail mowing after planting sweet corn or squash. Subterranean clover was temporarily suppressed by glyphosate applied as a 30 cm band over the sweet corn row after flail mowing. After planting squash, the subterranean clover was mowed but the glyphosate band treatment was omitted.

Vetch significantly reduced weed competition in sweet corn and squash compared to conventional tillage. A herbicide-vetch interaction in squash resulted in greater weed growth reduction than that caused by either alone. Subterranean clover provided virtually complete weed control in both sweet corn and squash without herbicides.

Sweet corn yields in no-tillage vetch were equal or greater than conventional tillage. Subterranean clover regrowth in the no-herbicide and reduced herbicide rate treatments, significantly reduced sweet corn yields. The high rate of atrazine and metolachlor killed the sub-clover and sweet corn yields were equal to the vetch treatments. Squash yields were significantly greater in the vetch no-tillage treatments than the conventional tillage treatments. Subterranean clover was competitive with the squash, however, yields were equal to the conventional tillage treatments.

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EFFECTS OF EARLY-SUMMER MANAGEMENT OF FALL-PLANTED COVER CROPS ON WEED CONTROL IN BROCCOLI

F. X. Mangan, S. J. Herbert and G. V. Litchfield[1]

Field research was initiated in 1990 at the University of Massachusetts Research Farm in South Deerfield to study the effects of a fall-planted cover crop combination for reduction of nitrogen and herbicide inputs in broccoli (*Brassica oleracea* var. *italica*). There were three cover crop treatments planted in the fall of 1989: Winter Rye (*Secale cereale*) planted in combination with Hairy vetch (*Vicia villosa*), winter rye alone, and no cover crop. In the spring of 1990 cover crop combinations were either mowed at the surface with the above-ground biomass left on top of the soil or the cover crops were mowed then incorporated into the soil. Each cover crop and tillage treatment was combined factorially with 0 and 112 kg/ha nitrogen and the absence or presence of herbicide. The herbicide DCPA was employed for conventional tillage and no cover crop treatments, and sethoxydim was used for the no-till vetch-rye and rye alone treatments. Weed pressure in this field was moderate. The mowed rye-vetch cover crop no-till treatments with and without the use of sethoxydim provided good weed control and yielded comparable to tilled treatments with herbicide. The mowed rye no-till treatment also gave good weed control, but the yields were less than the treatments with the legume. The addition of sethoxydim provided excellent control of rye plants that had begun to regrow. Nitrogen added from the inorganic (fertilizer) or organic (legume cover crop) source increased the size of the weeds compared to treatments that did not receive nitrogen. Harvest maturity was delayed for the no-till treatments compared to conventionally tilled treatments. It is speculated that lower soil temperatures influencing growth and nitrogen mineralization in the no-till treatments were responsible for this phenomenon.

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FENOXAPROP AND BENTAZON TANK MIXES IN TURF[1]

RICHARD D. ILNICKI AND ADRIAN J. ENACHE[2]

ABSTRACT

Fenoxaprop, a postemergence herbicide for the control of crabgrasses (Digitaria spp.), can not be used safely on newly-seeded turf species. In a preliminary study we have shown that fenoxaprop phytotoxicity can be alleviated by tank mixes with bentazon. We continued this research in 1990, on a different site, to determine whether this combination would alleviate the phytotoxic effect of fenoxaprop on newly-seeded turfgrasses on different soil and climatic conditions.

Three perennial turfgrasses, Kentucky bluegrass (Poa pratensis L.), tall fescue (Festuca arundinacea Schreb.), and perennial ryegrass (Lolium perenne L.) were seeded April 26, 1990. Treatments were applied June 22 (PO1) and July 10 (PO2) using a CO_2-propelled backpack sprayer. Fenoxaprop was applied alone (0.07, 0.10, 0.13, 0.20 kg ai ha^{-1}), or with surfactant at 0.25%, and in combination with bentazon (0.56, 0.84 kg ai ha^{-1}). Stand, vigor, and color of turf grasses as well as control of crabgrass were recorded.

Fenoxaprop alone injured Kentucky bluegrass and tall fescue and only slightly perennial ryegrass regardless when applied. Additions of surfactant did not reduce injury to any of the turfgrasses. Combinations of fenoxaprop plus bentazon, with or without surfactant, decreased the injury effected by fenoxaprop alone. Control of crabgrass by fenoxaprop alone was effective in all three turf species but greater with the higher rates and generally, greater with the early application. Additions of surfactant and/or bentazon to fenoxaprop did not improve significantly crabgrass control.

From this two-year study we concluded that fenoxaprop can be safely used on newly-seeded turfgrasses when tank-mixed with bentazon.

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[1]New Jersey Agric. Exp. Stn. Publication No. J-15173-2-90.
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MULTIPLE APPLICATIONS OF LOW RATES OF FENOXAPROP IN RYEGRASS[1]

R.G. PROSTAK AND R.D. ILNICKI[2]

ABSTRACT

Due to a lack of effective labeled postemergence herbicides for crabgrass (Digitaria sanguinalis L.) control a possible solution might be to expand the times fenoxaprop can be safely applied. Low rates and various schedules of fenoxaprop in ryegrass were evaluated in 1990 at the Adelphia Research Center, Adelphia, New Jersey. The objectives of the study were to (i) to decrease the phytotoxic effect of fenoxaprop when applied earlier in the season than recommended by using multiple sequential low rates and (ii) to determine the effect of multiple low rates on crabgrass control.

All treatments were applied in 260 l of water ha^{-1} at 210 kPa to perennial ryegrass (Lolium perenne L. 'Palmer') using a CO_2 - propelled backpack sprayer. The study consisted of three replications in a completely randomized block design. Treatments included two rates of fenoxaprop (0.034 and 0.045 kg ai ha^{-1}) applied either alone early in the season or sequentially throughout the season. Treatments were applied May 31 (PO_1), June 26 (PO_2), July 18 (PO_3) and August 24, 1990 (PO_4). Turf color and injury were rated and crabgrass control was evaluated four times during the experimental period.

No color differences were observed with any of the treatments regardless of the time of application. Turf injury was observed only with the first application of 0.034 kg ai ha^{-1} (PO_1). The other treatments, both after the first application and subsequent applications, resulted in no turf injury. Applications of 0.034 and 0.045 kg ai ha^{-1} provided crabgrass control in early season but control was poor in late season. The treatment of 0.045 kg ai ha^{-1} applied at (PO_1), (PO_2), and (PO_3) resulted in season long crabgrass control. The remaining treatments resulted in no significant differences between them.

This preliminary study indicated that by using multiple sequential low rates we can expand the time of fenoxaprop application before and after that recommended by the manufacturer without causing turf injury and still obtain good crabgrass control.

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Crabgrass Control in Golf Course Fairway Turf.

F.S. Rossi and J.C. Neal [1]

Abstract

High intensity turfgrass management practiced on golf course fairway turf requires consistent and effective crabgrass (*Digitaria* spp.) control. Typically, this is achieved with preemergent herbicides, however, failure of these herbicides is well known due to variable environmental conditions and misapplication. We evaluated the efficacy of several postemergent herbicides for crabgrass control in fairway turf. A field study was conducted with 3 applications of fenoxaprop applied at 14 day intervals at 0.03, 0.04, 0.06 kg ai/ha in 300 L/ha and 0.04 kg ai/ha in 997 L/ha, one application of dithiopyr at 0.28 or 0.56 kg ai/ha and at 0.56 kg ai/ha in combination with fenoxaprop at 0.04 kg ai/ha, and 3 applications of MSMA applied at 14 day intervals at 1.12 kg ai/ha with and without a safener. Initial applications were made when crabgrass was in the 3 leaf stage. Fenoxaprop alone at 0.06 kg ai/ha and at 0.04 in combination with dithiopyr at 0.56 kg ai/ha provided exceptional (>95%) season long control. Fenoxaprop at 0.04 kg ai/ha applied in 300 or 997 L/ha provided excellent control (>90%). Previous research has shown reduced phytotoxicity to putting green turf from high volume applications of fenoxaprop at 0.04 kg ai/ha. Dithiopyr at 0.28 or 0.56 kg ai/ha provided acceptable control (>85%) from one application. Fenoxaprop at 0.03 and MSMA at 1.12 kg ai/ha without the safener required 3 applications to provide acceptable control. However the safener, applied with MSMA, significantly reduced efficacy. This study indicates available options for excellent crabgrass control in fairway turf include, fenoxaprop alone at 0.06, 0.04 kg ai/ha at 300 and 997 L/ha, or at 0.04 kg ai/ha in combination with dithiopyr at 0.56 kg ai/ha.

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CRABGRASS CONTROL IN BLUEGRASS WITH DITHIOPYR

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ABSTRACT

The objectives of this research were 1) to evaluate dithiopyr for pre- and postemergence large crabgrass [Digitaria sanguinalis (L.) Scop.] and smooth crabgrass [Digitaria ischaemum (Schreb. ex Schweig.) Schreb. ex Muhl] control and 2) to evaluate different formulations of dithiopyr for crabgrass control and effects on Kentucky bluegrass [Poa pratensis (L.) cv. Plush] growth and quality. The preemergence tests were applied in early April and postemergence test were applied in June or July.

The test sites were located at VPI&SU Turfgrass Research Center on Kentucky bluegrass which was established in the Fall of 1987. This excellent turfgrass was mowed at 3.2 cm, vertical mowed, aerified and overseeded with crabgrass seed at 375 g/1000 m^2 to promote crabgrass emergence and growth. The mowing height was raised to 3.8 cm in July. The growth stage for one postemergence test was 3-true leaf to 1-tiller with a few at 3-tiller stage. The second postemergence experiment was treated at 1- to 3-tiller stage with a few 5-tiller plants.

The emulsifiable concentrate formulations (EC) of dithiopyr at 0.28 kg/ha or above gave excellent early preemergence control of crabgrass. Using dithiopyr (EC) rates below 0.42 kg/ha, sequential applications were required to maintain residual crabgrass control into October. However, sequential dithiopyr (EC) treatments at 0.14 kg/ha provided excellent crabgrass control into October. The three granular formulations (G) of dithiopyr evaluated were MON 15178 (0.05%), MON 15181 (0.10%), and MON 15152 (0.25%). The rates of these formulations of dithiopyr (G) for excellent crabgrass control through October was 0.14 kg/ha for MON 15178, 0.21 kg/ha for MON 15181 and 0.28 kg/ha for MON 15152. Below these rates, sequential applications of the granular formulations were necessary for crabgrass control at the above rates. In these studies, three times as much dithiopyr in an EC formulation was needed for excellent crabgrass control as compared to a 0.05% granular formulation.

In the early postemergence test dithiopyr (EC) was slow to give adequate control; however, late in the season, crabgrass control was good. In the mid-postmergence test, dithiopyr (EC) was very slow to provide excellent crabgrass control. Consistent postemergence crabgrass control required a 0.84 kg/ha rate of dithiopyr EC. The quality of the Kentucky bluegrass was excellent and there was no apparent injury to the bluegrass.

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NEW TOOLS FOR SELECTIVE CONTROL OF CRABGRASS IN COOL-SEASON TURFGRASS

P. C. Bhowmik and B. M. O'Toole[1]

ABSTRACT

Field experiments were conducted on an established perennial ryegrass (Lolium perenne L.) to evaluate postemergence activity of dithiopyr and quinclorac in smooth crabgrass [Digitaria ischaemum (Schreb. ex Schweig.)Schreb. ex Muhl.] and large crabgrass [D. sanguinalis (L.) Scop.] control. All 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.

Treatments were applied on June 13, 1990 when the large crabgrass was at the three- to four-leaf stage. At 60 DAT, quinclorac applied at 0.84 kg/ha controlled large crabgrass effectively, irrespective of the herbicide combinations, including benefin, pendimethalin, dithiopyr, MSMA, fenoxaprop, dicamba, bentazon, 2,4-D plus triclopyr, 2,4-D, 2,4-DP, and MCPP. Quinclorac applied alone or in above combinations also controlled white clover (Trifolium repens L.), slender or creeping speedwell (Veronica filiformis Sm.) 95% or better. Yellow woodsorrel (Oxalis stricta L.) control was not adequate with quinclorac (0.84 lb/A) whether applied alone or in combination with 2,4-D, dicamba, benefin, dithiopyr, or fenoxaprop. Late-post (three- to four-tiller stage, July 3, 1990) applications of quinclorac at 0.28 and 0.5 kg/ha in combination with dithiopyr at 0.28 kg/ha controlled large crabgrass 98% or better 42 DAT. At 60 DAT, crabgrass control was only 65 and 82%, respectively with the 0.28 and 0.56 kg/ha of quinclorac.

Quinclorac (0.56 to 0.84 kg/ha) was very safe to 'Penncross' creeping bentgrass (Agrostis palustris Huds.) on a nursery green (September 6, 1990 application). Bentgrass injury was slight and was rarely noticeable 7, 14, and 21 DAT. Bentgrass color was slightly lower (8.0) at the 0.75 lb/A rate of quinclorac on a rating scale of 1 to 9.0, where 6.5 will be minimal acceptable level. The addition of Ferromac-AC did not improve bentgrass discoloration/chlorosis. Quinclorac did not injure bentgrass when combined with either BAS-9002S or dithiopyr at 0.28 kg/ha. Quinclorac also controlled common chickweed [Stellaria media (L.) Vill.].

In a putting green trial, 'Penncross' bentgrass was tolerant to dithiopyr up to 1.1 kg/ha. A slight injury (13%) was noted with dithiopyr at 1.68 k/ha. Bentgrass color or quality was not affected with postemergence treatments of dithiopyr. Also, the creeping bentgrass on the same putting green treated consecutively for three years did not show any detrimental effects on the recovery or overall quality of the bentgrass.

In the perennial ryegrass trial, dithiopyr applied preemergence at 0.28 to 0.43 kg/ha controlled large crabgrass effectively. However, the 0.43 kg/ha rate was not effective when applied at the tiller-stage of crabgrass.

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SELECTED CRABGRASS CONTROL EVALUATIONS FOR MARYLAND IN 1990

P. H. Dernoeden and J. M. Krouse[1/]

ABSTRACT

Three preemergence and two postemergence plus preemergence herbicide tank-mix studies conducted in 1990 are summarized below. Herbicides were applied at the rates and dates shown in Tables 1 and 2 or as noted in 50 gpa at 36 psi. Test sites treated with preemergence herbicides were irrigated or rain occurred within 48 hr of application. Plots were 5 by 5 ft in size and were arranged in a randomized complete block with four replications. Percent of plot area covered by smooth crabgrass [Digitaria ischaemum (Screb.) Muhl.] was determined visually on a 0 to 100% scale. Data were subjected to analysis of variance and significantly different means were separated at P = 0.05 by Duncan's multiple range test.

Preemergence Studies

In Study I, most herbicides provided excellent (>90%) smooth crabgrass control (Table 1). However, pendimethalin (3.0 lb/A) and DCPA provided good control (85-90%); bensulide (12 lb/A) and ethofumesate provided fair control (70-80%); and bensulide (10 lb/A) provided poor control (<60%).

Study II was conducted in a mature stand of Flyer creeping red fescue (Festuca rubra L. ssp. rubra). Herbicides were applied initially on 2 Apr and sequentials on 15 May 1990. Smooth crabgrass cover in untreated plots averaged 61% on 1 Sept and all treatments (oxadiazon 2G at 3.0 and 4.0 lb/A; pendimethalin 60DG at 1.5 + 1.5 and 3.0 lb/A; prodiamine 65DG at 0.50 and 0.65 lb/A; dithiopyr 1EC at 0.38 and 0.50 lb/A; DCPA at 10.5 + 5.2 lb/A; and benefin + trifluralin 2G at 2.0 + 1.0 lb/A) provided >97% control (data not shown). Oxadiazon, DCPA, and benefin + trifluralin reduced Flyer cover (bareground ranging 13-18% of plot area) significantly when compared to untreated plots (bareground = 4%).

Study III compared granular formulations of oxadiazon and dithiopyr. All treatments were applied on 26 Mar 1990, and smooth crabgrass cover in untreated plots averaged 35% on 31 Aug 1990 (data not shown). Treatments providing >91% control were as follows: oxadiazon 2G at 3.0 and 4.0 lb/A; RP EXP 03621B 2G at 3.0 and 4.0 lb/A; MON 15178 0.05G at 0.125 lb/A; MON 15181 0.10G at 0.187 and 0.250 lb/A; and MON 15152 0.25G at 0.38 and 0.50 lb/A. RP EXP 03621C 2G at 3.0 and 4.0 lb/A and MON 15178 0.05G at 0.092 lb/A provided 83 to 86% control.

Postemergence Studies

In Study IV (Table 2), herbicides were applied 21 June 1990 when smooth crabgrass was in the 4-leaf to 4-tiller stage. Excellent postemergence and subsequent preemergence control (>90%) was provided by dithiopyr 1EC + MSMA 6L (0.25 + 0.5, 0.38 + 0.5, and 0.38 + 1.0 lb/A), and dithiopyr 1EC + fenoxaprop 1EC (0.25 + 0.09 and 0.25 + 0.18 lb/A). Dithiopyr + fenoxaprop, especially 0.25 + 0.18 lb/A rate, discolored Kenblue Kentucky bluegrass significantly, and the discoloration persisted for about 30 days. Good control (87%) was provided by dithiopyr alone at 0.5 lb/A and dithiopyr + MSMA (0.25 + 1.0 lb/A). All other treatments gave commercially unacceptable control.

In Study V, herbicides were applied 11 May 1990 when smooth crabgrass was in the 1 to 3 leaf stage (mostly 2 leaf and growing below the perennial ryegrass canopy). Untreated plots had an average of 81% crabgrass cover on 31 Aug (data not shown). Excellent postemergence and subsequent preemergence control (91-99%) was provided by DCPA 6F + MSMA 6L (7.5 + 2.0 lb/A and 7.5 + 1.5 + [1.5 lb/A MSMA applied sequentially on 24 May]); prodiamine 65DG + quinclorac 50W (0.5 + 0.75 lb/A); prodiamine 65DG + fenoxaprop 1EC (0.5 + 0.12 lb/A); and dithiopyr (0.5 lb/A). Good control (85%) was provided by dithiopyr at 0.38 lb/A and fair control (78%) was provided by pendimethalin 60DG + fenoxaprop 1EC (1.5 + 0.12 lb/A).

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Table 1. Preemergence smooth crabgrass control in Palmer perennial ryegrass (Lolium perenne L.), Silver Spring MD, 1990.

Herbicides*	Rate	Smooth crabgrass** Cover	Control
	(lb ai/A)	---------(%)---------	
Oxadiazon 2G	3.0	1e***	99
Oxadiazon 2G	4.0	<1e	99
Pendimethalin 60DG	1.5 + 1.5	2e	98
Pendimethalin 60DG	3.0	12cde	85
Prodiamine 65DG	0.50	6cde	92
Prodiamine 65DG	0.65	4de	95
Dithiopyr 1EC	0.38	6cde	92
Dithiopyr 1EC	0.50	8cde	90
Dithiopyr 0.25G	0.25	2e	98
Dithiopyr 0.25G	0.38	<1e	99
Benefin 2.5G	2.0 + 2.0	3de	96
Benefin + trifluralin 2.5G	2.0 + 1.0	4de	95
Bensulide 4EC	10.0	33b	58
Bensulide 4EC	12.0	16cd	80
Ethofumesate 1.5EC	1.5 + 1.0	18c	77
DCPA 6F	10.5 + 5.2	11cde	86
Untreated	---	79a	--

*Herbicides were initially applied 26 March 1990 and sequentials were applied 11 May 1990.
**Smooth crabgrass cover was visually estimated 31 August 1990.
***Means in a column followed by the same letter are not significantly different at P = 0.05 according to Duncan's MRT.

Table 2. Postemergence and subsequent preemergence control of smooth crabgrass in Kenblue Kentucky bluegrass (Poa pratensis L.), Silver Spring MD, 1990.

Herbicide*	Rate	Crabgrass* Cover	Control	Turf color*** 2 Jul	6 Jul
	(lb ai/A)	------(%)------		(0-10 scale)	
Dithiopyr 1EC	0.25	14de+	79	8.1ab	7.8a
Dithiopyr 1EC	0.38	16de	76	7.9ab	7.6ab
Dithiopyr 1EC	0.50	9de	87	8.1ab	7.8a
Dithiopyr 1EC + MSMA 6L	0.25 + 0.5	7de	90	7.9ab	8.0a
Dithiopyr 1EC + MSMA 6L	0.25 + 1.0	9de	87	8.1ab	8.0a
Dithiopyr 1EC + MSMA 6L	0.38 + 0.5	3de	96	8.4a	8.0a
Dithiopyr 1EC + MSMA 6L	0.38 + 1.0	2e	97	7.8ab	7.8a
Dithiopyr 1EC + Fenoxaprop 1EC	0.25 + 0.09	2e	97	6.8c	7.1b
Dithiopyr 1EC + Fenoxaprop 1EC	0.25 + 0.18	<1e	99	6.2c	5.9c
Dithiopyr 1EC + Quinclorac 75DF	0.25 + 0.25	41b	39	7.8b	7.4ab
Dithiopyr 1EC + Quinclorac 75DF	0.25 + 0.50	38bc	43	7.8b	7.5ab
Quinclorac 75DF**	0.75	22cd	67	7.8ab	7.6ab
Quinclorac 75DF**	1.0	19de	72	7.8ab	7.5ab
Untreated		67a	--	7.9ab	7.8a

*Herbicides were applied 21 June 1990 when crabgrass was in the 4-leaf to 4-tiller (mostly 4-leaf to 2-tiller) stage, and plots were visually rated for crabgrass cover on 31 August 1990.
**Quinclorac treatments were tank mixed with BAS 090 surfactant at 2 pts/A.
***Turf color was rated on a 0 to 10 scale where 0 = turf brown and 10 = optimum greenness.
+Means in a column followed by the same letter are not significantly different at P = 0.05 according to Duncan's MRT.

DITHIOPYR FORMULATIONS AND TANK-MIX COMBINATIONS FOR POSTEMERGENCE CONTROL OF CRABGRASS IN COOL-SEASON TURF

K. E. Kackley, D. C. Riego and J. M. Higgins[1]

ABSTRACT

The postemergence activity of MON 15100 (dithiopyr) formulations for crabgrass (Digitaria spp.) control was evaluated over the last three years in small replicated plots. MON 15100 1 EC formulations provided excellent postemergence control of crabgrass prior to tiller formation. Performance after the tiller stage of crabgrass was not as effective. However, tank-mix combinations of MON 15100 1 EC formulations with MSMA or fenoxaprop have provided excellent control of crabgrass in the one to three tiller stage. Granular formulations of MON 15100 on clay or fertilizer have also provided postemergence crabgrass control. The various dithiopyr formulations have exhibited safety to major cool-season turf species such as Kentucky bluegrass (Poa pratensis L.), perennial ryegrass (Lolium perenne L.), tall fescue (Festuca arundinacea Schreb.) and bentgrass (Agrostis palustris L.).

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GROUND IVY AND HEALALL CONTROL IN TURF

J. C. Neal and A. F. Senesac[1]

Ground ivy (Glechoma hederacea L.) and healall (Prunella vulgaris L.) are creeping perennial weeds which commonly infest cool-season turf and are difficult to control with currently available herbicides. Greenhouse and field tests were conducted to evaluate two herbicide strategies for controlling these species. Isoxaben at 0.6, 1.1, and 2.2 kg/ha, and quinclorac (BAS 514) at 0.4, 0.6, and 0.8 kg/ha were evaluated alone and in combination with other synthetic auxin herbicides. In general, isoxaben was more effective in field tests than in greenhouse tests; whereas, synthetic auxins such as 2,4-D and triclopyr, were more effective at lower rates in the greenhouse than in the field. In the greenhouse, isoxaben at 2.2 kg/ha provided only 35% and 50% control of ground ivy and healall, respectively. However, in the field, up to 99% ground ivy and 85% healall control was obtained. The local use-rates of 2,4-D + triclopyr amine **or** clopyralid + triclopyr amine, provided only 10 to 20% healall control, but when mixed with 1.1 kg/ha of isoxaben, 80% to 85% control was obtained. Quinclorac efficacy in field and greenhouse tests were similar for ground ivy; but, for healall, greenhouse results were superior. In field tests, quinclorac applied alone at 0.8 kg/ha controlled healall; but, the speed of control was improved by tank mixing with 2,4-D. Ground ivy was not controlled by quinclorac applied alone, but was controlled by the tank mix with 2,4-D. From these tests, two viable strategies for improved control of ground ivy and healall in cool-season turf are: quinclorac + 2,4-D at 0.8 + 1 kg/ha, **or** isoxaben + synthetic auxin herbicides such as 2,4-D + triclopyr or clopyralid + triclopyr. Further research is needed to optimize the tank mix ratios.

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RESIDUAL PHYTOTOXICITY OF HEXAZINONE, IMAZAPYR, TEBUTHIURON, AND TRICLOPYR ON SELECTED CROPS

C. Benjamin Coffman and J. Ray Frank [1]

ABSTRACT

Hexazinone, imazapyr, tebuthiuron, and triclopyr are generally used for pre and postemergence control of perennial weeds on non-cropland, range, and pasture. Field experiments were established in 1988 at Beltsville, Maryland, to evaluate the residual activity of these herbicides on selected crops over a two year period. The experimental area was clean cultivated and treated with methyl bromide prior to the establishment of the research plots. Plots were 3 by 4 m in a randomized block design. Herbicide treatments were replicated three times. Hexazinone and tebuthiuron were applied at 2.2, 4.5, and 6.7 kg ha^{-1}. Imazapyr was applied at 2.2, 4.5, and 9.0 kg ha^{-1}. Triclopyr was applied at 3.4, 6.7, and 10.1 kg ha^{-1}. Crops were sown or planted in 30 cm rows one day after treatment (DAT), and one, three, six, and 12 weeks after treatment (WAT) in 1988. All plots were irrigated to supplement rainfall and provide at least 2 cm water per week. Visual estimates of plant responses (0 to 100) were made at selected intervals throughout the growing season. Test species included wheat (Triticum aestivum L.), kidney bean (Phaseolus vulgaris L.), corn (Zea mays L.), squash (Cucurbita pepo L.), okra [Abelmoschus esculentus (L.) Moench.], banana (Musa acuminata Colla), and potato (Solanum tuberosum L.). Bananas were transplants and potatoes were sown as tubers; all other species were seeded. In 1989 the experimental plots were replanted in June and August. Irrigation and data collection were as in 1988. Banana was excluded in 1989.

In 1988, corn sown one DAT tolerated tebuthiuron at 2.2 kg ha^{-1} through the end of the growing season, but did not tolerate the higher doses. Squash and okra tolerated imazapyr at all rates when sown one DAT, and one and three WAT. There was no tolerance to hexazinone by any species. Corn tolerated triclopyr at 3.4 kg ha^{-1} when sown three, six and 12 WAT.

In 1989, potato tolerated imazapyr at 2.2 kg ha^{-1} whereas kidney bean and squash tolerated triclopyr at 3.4 kg ha^{-1} in the June planting. In the August planting, corn and potato tolerated imazapyr whereas squash and potato were tolerant of residual triclopyr. There were no other herbicide tolerances observed in either year.

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OAT AND SOYBEAN YIELDS IN CROWNVETCH AND OTHER COVER CROPS

N. L. Hartwig[1]

ABSTRACT

Crownvetch (Coronilla varia L.) for this study was seeded on April 20, 1976. A number of research studies related to the use of cover crops for agronomic crop production have been done in this area since. In 1985 a study was set up to look at a number of different cover crops for a four year crop rotation of corn-corn-oats-winter wheat/soybeans with three levels of nitrogen applied to corn when it appeared in the rotation. The trial was large enough so all crops in the rotation were represented each year. Flatpea, another perennial legume, was introduced into the trial from 1985 to 1987. Other cover crops included hairy vetch and winter rye which were seeded yearly in those plots to be planted to corn or winter wheat but not to oats or soybeans. Oat yields are presented for the period of 1987 to '90 and soybean yields for the period 1987 to '89. In each case the year of extreme drought in 1988 is included. Yields in 1988 are a chance observation of the influence of crownvetch and other cover crops on oat or soybean yields in a very dry year.

It was expected that the presence of a crownvetch living mulch would have a detrimental effect on oat and soybean growth and yield but oat yields were the same or better when planted into crownvetch regardless of the amount of sidedressed nitrogen on the corn prior to oats in the rotation. This would indicate that even in an extremely dry year, crownvetch producing up to about 500 lb/A of dry matter did not result in increased competition for moisture. In 1990, when no nitrogen was applied to the oats, oat yields were significantly greater than most of the other cover crops. Flatpea didn't have a detrimental effect on oat yields until the last year when it became so vigorous it overtopped the oats by harvest in most plots and significantly suppressed yields relative to the crownvetch.

Soybean yields were also not significantly affected by the cover crop in any of the years 1987 through '89. In 1988, soybean growth was suppressed due to drought and as a result the soybeans were not nearly as competitive as they would have been in a normal year, thus allowing a lot of recovery growth of crownvetch and flatpea. Soybeans yields appeared to be slightly reduced as a result.

It would appear that both no-till oats and soybeans can be grown in a living mulch of crownvetch without any loss in potential yield as long as the crownvetch is sufficiently suppressed. Flatpea could perhaps also be used if a more potent herbicide program or tillage were used to suppress it.

INTRODUCTION

Research on the use of crownvetch (Coronilla varia L. 'Penngift') as a living mulch for agronomic crop production was started at Penn State in 1975 (1). Initial research from 1975 to 1980 determined how to manipulate crownvetch in no-till corn (Zea mays L.). Starting in 1981, oats (Avena sativa L.) was introduced into the rotation and crownvetch was allowed to recover one year in four for hay to see if crownvetch could be maintained without losing it. From 1985 to 1987 a study was set up to look at a number of different cover crops with a four year crop rotation of corn-corn-oats-winter wheat (Triticum aestivum L.)/soybeans (Glycine max L.) with three levels of nitrogen applied to corn when it appeared in the rotation. The trial was large enough so all crops in the rotation were represented each year. Flatpea (Lathrus sylvestris L. 'Lathco'), another perennial legume, was introduced into the trial from 1985 to 1987. Other cover crops

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included hairy vetch (Vicia villosa L.) and winter rye (Secale cereale L.) which were seeded yearly in those plots to be planted to corn or winter wheat but not to oats or soybeans. It was determined and reported that corn grown in crownvetch out-yielded corn without crownvetch even in 1988 when Pennsylvania had its driest June and July in 100 years (2,3). The research data presented in this paper covers oat and soybean yields with or without the perennial crownvetch or flatpea cover crops and following corn which also had the winter annuals winter rye or hairy vetch cover crops.

MATERIALS AND METHODS

The crownvetch for this study was seeded on April 20, 1976 on a Murrill silt loam soil (Typic Hapludult) containing about 16% sand, 67% silt, 14% clay and 2.5% organic matter. The area was limed to a pH of 7.0 before seeding and it has been limed since to maintain a pH of about 7.0. A number of research studies related to the use of cover crops for agronomic crop production have been done in this area since.

Cover crops were planted in blocks 18.3 by 22.86 m. Each block was subdivided in twelve 4.6 by 6.7 m plots. Each year of the four year rotation was assigned a strip of three plots. The trial was replicated 3 times.

Corn in the rotation was sidedressed with 0, 77, and 154 kg ha^{-1} of nitrogen as UAN in a band between each corn row. No-till oats which followed corn in the rotation received a blanket topdressing of 36, 80, 73 and 0 kg ha^{-1} nitrogen in 1987, '88, '89 and '90 respectively. Winter wheat followed oats in the rotation and was harvested for silage in late May or early June. Soybeans were then no-tilled into the wheat stubble in early June and received no fertilizer.

Due to recurring problems with dandelion (Taraxacum officinale Weber in Wiggers) and quackgrass (Agropyron repens (L.) Beauv.), especially in the no cover treatments, glyphosate[1] [N-(phosphonomethyl)glycine] and 2,4-D [(2,4-dichlorophenoxy)acetic acid] low volatile ester (LVE) @ 1.1 + 0.55 kg ha^{-1} were applied May 7, 1987; glyphosate @ 1.5 kg ha^{-1} was applied alone April 21, 1989; and 2,4-D LVE @ 0.55 kg ha^{-1} was applied alone in October 16, 1989 before seeding oats no-till on 5/11/87; 3/29/88; 4/17/89 and 4/10/90. Dandelion is normally not a problem in a good living mulch ground cover but the above treatments were applied to all plots going to oats regardless of the sensitivity of the ground cover to avoid treatment variations that couldn't be accounted for statistically. Although crownvetch and flatpea are both very sensitive to glyphosate and especially 2,4-D, applications made before dandelion bloom in the spring or after several hard frosts in the fall will not result in the loss of these perennial living mulches.

Usually additional weed control and/or living mulch suppression is necessary after the oats has emerged since glyphosate and 2,4-D have little or no soil residual activity. No additional treatment was needed in 1987 but in 1988 a premix of bromoxynil (3,5-dibromo-4-hydroxybenzonitrile) + MCPA [(4-chloro-2-methylphenoxy)acetic acid] @ 0.55 kg ha^{-1} each was applied June 3 in 115 l/ha of liquid nitrogen to suppress dandelion. Due to the extremely dry weather following this treatment it did little good. MCPA @ 0.275 kg/ha^{-1} was applied 6/19/89 when oats was in the boot stage, crownvetch 25 to 35 cm and Canada thistle (Cirsium arvense (L.) Scop.) 45 to 60 cm. This treatment was too little too late to do an effective job of suppressing the crownvetch or Canada thistle. On May 25, 1990, MCPA @ 0.55 kg/ha^{-1} was applied to oats, crownvetch and flatpea 10 to 15 cm tall with excellent suppression of the crownvetch. The flatpea was temporarily suppressed but by harvest time the recovery growth had almost buried the oats in some plots.

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[1] Ranger, Monsanto Agricultural Products Co., St. Louis, MO

Soybeans were drilled in 25 cm rows with a no-till drill on 6/2/87, 6/6/88 and 6/12/89 at a seeding rate of 100 kg/ha. In 1987, metolachlor [2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide] + bentazon [3-(1-methylethyl)-(1H)-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide] at 0.55 + 1.1 kg/ha^{-1} + emulsifiable crop oil at 2.34 l/ha^{-1} was applied June 11 for redroot pigweed (Amaranthus retroflexus L.) and annual grass control followed by imazethapyr [(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid] at 0.1375 kg/ha^{-1} on June 24 to clean up the weeds missed by the first treatment. In 1988 and 1989, imazethapyr + metolachlor at 0.06875 + 1.65 kg/ha^{-1} was applied preemergence for annual weed control.

All treatments were applied with a tractor mounted small plot sprayer with 80015 extended range flat fan nozzles at 187 kPa and 187 l/ha of water.

Both the oats and soybeans were harvested with a small plot combine. The harvested area was 2.44 by 6.7 m out of the middle of each plot. Yields were analyzed using the SAS statistical package as a split-split-split plot design.

RESULTS AND DISCUSSION

Oat yields for the period 1987 to 1990 were good in all years except 1988 when it was extremely dry in July and August when the oats was filling. There were no nitrogen carryover effects from nitrogen applied to corn except in 1988 (Table 1). Due to the extreme drought, the high nitrogen level of 154 kg/ha did significantly increase yield over the 77 kg/ha rate.

Table 1: Influence of nitrogen rates applied to corn the previous two years on oat yields when averaged over cover crops. (n=21)

Cover Crop	Nitrogen Rate	Oat Yield 1987	1988[a]	1989	1990
	kg/ha	<----------bu/A @ 12% H_2O---------->			
- - -	0	72	19	69	57
- - -	77	68	18	69	65
- - -	154	70	23	70	63
Significance Level (P)		0.348	0.01	0.798	0.169
LSD (P=0.05)		6.8	3.6	4	8.8

[a] Driest June and July in 100 years.

Only in 1990 was there a significant cover crop effect on oat yields when averaged over nitrogen levels applied to the corn previously (Table 2). In the first three years of the study, 36 to 80 kg/ha of nitrogen was applied each year which was apparently enough to mask any nitrogen influenced yield differences among the cover crops. In 1990 no nitrogen was applied to the oats and as a result there was a significant yield reduction, very likely due to lack of nitrogen, for oats following corn overseeded with hairy vetch where there was apparently no nitrogen carryover and where no cover crop had been planted (Table 2). Oat yields were also significantly reduced where flatpea was present as a living mulch because flatpea was not sufficiently suppressed by the herbicide program in 1990. Flatpea was growing out the top of the oats at harvest time in many plots. Crownvetch was suppressed very nicely in all years (data not included) by the herbicide programs and oats yielded the most when planted into a crownvetch living mulch due to the contribution of some nitrogen and perhaps other factors as yet unidentified.

Table 2: Influence of the cover crop on oat yields when averaged over nitrogen rates. (n=9)

Cover Crop	Nitrogen Rate	Oat Yield 1987	1988[a]	1989	1990
	kg/ha	<----------bu/A @ 12% H_2O---------->			
None	- - -	62	16	74	47
Winter Rye[b]	- - -	59	---	70	69
Crownvetch	- - -	70	18	67	87
Hairy Vetch[b]	- - -	75	29	71	39
Flatpea	- - -	64	21	68	47
Crownvetch + Hairy Vetch[b]	- - -	67	18	71	81
Crownvetch + Flatpea	- - -	76	18	63	63
Significance Level (P)		0.458	0.136	0.062	.0004
LSD (P=0.05)		14	9.66	7	18

[a] Driest June and July in 100 years.

[b] Seeded only into corn the two years preceding oats in the rotation.

Soybean yields were not significantly affected by the cover crop in any of the years 1987 through 1989. It appeared that soybean yields were suppressed by crownvetch and flatpea in 1988, but not significantly due to variability in the data. In 1988, soybean growth was suppressed due to drought and as a result the soybeans were not nearly as competitive as they would have been in a normal year, thus allowing a lot of recovery growth of crownvetch and flatpea. Soybeans yields appeared to be slightly reduced as a result.

Table 3: Influence of the cover crop on soybean yields when averaged over nitrogen rates applied to corn two and three years previously. (n=9)

Cover Crop	Nitrogen Rate	Cover Crop (lb) and Soybean Yield (bu) 1987		1988[a]		1989	
	kg/ha	lb/A	bu/A	lb/A	bu/A	lb/A	bu/A
None	- - -	---	40	230	22	---	36
Winter Rye[b]	- - -	---	39	138	21	---	39
Crownvetch	- - -	---	35	922	10	---	40
Hairy Vetch[b]	- - -	---	34	4	24	---	38
Flatpea	- - -	---	35	79	19	---	44
Crownvetch + Hairy Vetch[b]	- - -	---	29	506	14	---	37
Crownvetch + Flatpea	- - -	---	35	1012	15	---	40
Significance Level (P)			0.5389	0.0068	0.4211		0.073
LSD (P=0.05)			13.5	549	14.6		5.2

[a] Driest June and July in 100 years.

[b] Seeded only into corn preceding oats in the rotation.

It would appear that both no-till oats and soybeans can be grown in a living mulch of crownvetch without any loss in potential yield as long as the crownvetch is sufficiently suppressed. Flatpea could perhaps also be used if a more potent herbicide program or tillage were used to suppress it.

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ICIA5676: WEED CONTROL FOR FIELD CORN IN THE NORTHEAST

S. W. Cosky, S. Dennis and M. P. Whalen[1]

ABSTRACT

Field experiments were conducted in 1988, 1989 and 1990 to evaluate the effectiveness of ICIA5676[2] in controlling weeds in field corn (Zea mays L.) in the Northeast. ICIA5676 was applied alone and in tankmix combinations with atrazine in conventional field corn. All studies were conducted utilizing randomized complete block designs and with three or four replications.

Application rates of ICIA5676 were soil type dependent. Generally, ICIA5676 was applied at rates from 0.75 lb ai/A for course soils with <3% organic matter to 2.50 lb ai/A for fine soils having >3% organic matter. Tankmix applications were applied with atrazine at 1.0 to 1.5 lb ai/A.

Season long control (>90%) of important grass weed species including giant foxtail (Setaria faberi Hermm.), large crabgrass [Digitaria sanguinalis (L.)Scop.] and fall panicum (Panicum dichotomiflorum Michx.) have been observed from applications of ICIA5676 alone. Common lambsquarters (Chenopodium album L.) control is generally observed at >85% in early ratings (<35 days after treatment (DAT)), but may be less at later observation dates (>35 DAT).

Crop tolerance to ICIA5676 has been excellent. Visual injury ratings (<35 DAT) estimating reduction in vegetative growth of corn are generally <10% and are comparable to other acetanilide herbicides. Such symptomology is not apparent at later observation dates.

These studies indicate that ICIA5676 may be used successfully in weed control programs for the control of important grass and broadleaved weed species with excellent crop tolerance.

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[1]ICI Americas Inc., Agricultural Products Group, Wilmington, DE 19897.

[2]ICIA5676 is a formulated combination of acetochlor and the corn safener dichlormid (R25788) containing 6.4 lb ai/gal and 1.08 lb ai/gal, respectively.

ICIA 5676 IN CORN

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

ABSTRACT

Corn (Zea mays L.) herbicides fall into six chemical classes with chloroacetamides being the most commonly used for preemergence grass control. Acetochlor is a chloroacetamide that has been evaluated as a corn herbicide. These studies were conducted with acetochlor under the codes SC-5676 and ICIA-5676 between the years 1985 and 1990. The two coded products generally included dichlormid as a herbicide antidote. Initially, emphasis was placed on studies in conventional corn ['Pioneer 3378' (R)] with only a limited number of treatments included in no-till corn. In 1989 and 1990, separate adjacent studies compared acetochlor with alachlor in conventional and no-till corn. On the Coastal Plain soils which served as the sites for these studies, annual grass control was frequently sufficient from 1.0 lb/A acetochlor and consistently high from 1.25 lb/A in conventional corn. Control of smooth pigweed (Amaranthus hybridus L.), common lambsquarters (Chenopodium album L), and common ragweed (Ambrosia artemisifolia L.) was higher from acetochlor than alachlor and metolachlor. Acetochlor rates required for control of annual grasses in no-till corn were a minimum of 1.5 lb/A or 20% more than in conventional corn. Combinations of acetochlor with atrazine have potential for control of numerous broadleaf weeds and grasses in conventional and no-till corn. In the limited comparisons of acetochlor with acetochlor + dichlormid, dichlormid protected corn from acetochlor injury. In 1990, some reductions in corn growth (5 to 12%) from 1 to 2 lb/A acetochlor + dichlormid were evident 7 weeks after planting conventional corn but yields were not affected; no-till corn has not responded to acetochlor.

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PREEMERGENCE ACTIVITY OF ICIA-5676 IN CONTROLLING ANNUAL GRASSES IN FIELD CORN

P. C. Bhowmik, B. M. O'Toole[1], and S. Dennis[2]

ABSTRACT

Field experiments were conducted to evaluate the preemergence activity of ICIA-5676 in controlling annual grasses in field corn. All treatments were applied preemergence on May 12 and 25, 1989 and on May 11 and 15, 1990, respectively, in minimum-till (one disking) and in conventional-till (moldboard plow followed by disking) system. Treatments were applied with a CO_2-backpack sprayer at 150 kPa to deliver 187 L/ha. The experimental design was a randomized complete block with three replications. Plots were 2.3 by 3.0 m. Major weed species were large crabgrass [Digitaria sanguinalis (L.) Scop.], yellow foxtail (Setaria lutescens (Weigel) F.T. Hubb.), common lambsquarters (Chenopodium album L.), and redroot pigweed (Amaranthus retroflexus L.) in both years. Corn injury, percent weed control, and corn yields were used for the evaluation.

In 1989 conventional-till corn, ICIA-5676 at 0.84 to 1.68 kg/ha gave excellent control of large crabgrass, yellow foxtail, fall panicum (Panicum dichotomiflorum Michx.), common lambsquarters and common ragweed five weeks after treatment (WAT). At 9 WAT, the same treatments gave significantly less control (78-88%) of large crabgrass than did metolachlor at 1.68 and 2.2 kg/ha and alachlor at 2.2 kg/ha (93-98% control). Irrespective of the rate, ICIA-5676 gave excellent control of yellow foxtail. In 1990, all treatments of ICIA-5675 in combination with atrazine at 1.35 kg/ha gave excellent season-long control of yellow foxtail, common lambsquarters, and redroot pigweed 14 WAT except large crabgrass control (less than 80%).

In 1989 minimum-till corn, ICIA-5676 (0.84 to 1.84 kg/ha) controlled large crabgrass and yellow foxtail 7 WAT as effectively as treatments of alachlor (2.2 kg/ha) and metolachlor (1.84 to 2.2 kg/ha). Alachlor applied preemergence at 1.56 kg/ha controlled yellow foxtail but gave only 86% control of large crabgrass at the same rate. Only metolachlor treatments at 1.84 and 2.2 kg/ha provided 79 to 84% large crabgrass control 12 WAT. All ICIA-5676 treatments gave only 50% control of large crabgrass 12 WAT. Similar results were obtained in 1990.

In summary, ICIA-5676 applied preemergence at 0.84 to 1.1 kg/ha effectively controlled large crabgrass, yellow foxtail, fall panicum, common lambsquarters, and redroot pigweed in both years under both conventional- and minimum-till systems. In general, the ICIA-5676 appeared to be less effective in annual grass control under minimum-till system compared to conventional-till system.

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Canada Thistle Control in Corn

S. Glenn, L. Heimer, and N. Anderson[1/]

ABSTRACT

Canada thistle (Circium arvensis L.) (CIRSA) control in corn (Zea mays L. 'Pioneer 3352') was studied in Washington County, Maryland. The study area was planted on May 2, 1990. All plots, except untreated control plots, were treated with 2.2 kg/ha atrazine and 2.2 kg/ha metolachlor at planting. Paraquat at 0.6 kg/ha + 0.5 (v/v) X-77 was also applied preemergence to all plots that were to be treated with postemergence herbicides. Preemergence applications (6-cm high CIRSA) of 1.7 and 2.2 kg/ha glyphosate produced 78 and 87% CIRSA control 4 weeks after treatment (WAT); however, by 13 WAT CIRSA control was 52 and 62%. Tank mixtures of 0.6 kg/ha 2,4-D with glyphosate did not improve CIRSA control compared to applications of glyphosate applied alone. Preemergence applications of triclopyr + 2,4-D (0.1 + 0.3, 0.3 + 0.6, and 0.4 + 0.8 kg/ha) and atrazine + Dicamba (1.1 + 0.5 kg/ha) were not effective in controlling CIRSA. Early postemergence applications (10-cm CIRSA) of 2.2 kg/ha atrazine + 1% crop oil were also not effective in controlling CIRSA. Late postemergence (LP) applications (20-cm CIRSA) of 0.6 kg/ha 2,4-D, 0.3 kg/ha Dicamba, and 0.6 + 0.3 kg/ha 2,4-D + Dicamba produced 47, 53, and 80% control of CIRSA, respectively, 8 WAT. CIRSA control with LP applications of 0.03 and 0.05 kg/ha nicosulfuron + 1% crop oil was 53 and 63%, 8 WAT. Tank mixtures of 0.6 kg/ha 2,4-D with 0.03 and 0.05 kg/ha nicosulfuron produced 75 and 85% CIRSA control. Chlopyrolid applied LP at 0.2 and 0.3 kg/ha + 0.25% X-77 produced 83 and 92% CIRSA control. Corn yields increased 40 to 60% when CIRSA was effectively controlled compared to untreated controls.

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Perennial Weed Control with Nicosulfuron Combinations

N. Anderson and S. Glenn[1/]

ABSTRACT

Experiments were conducted in Washington County, Maryland to study the control of hemp dogbane (Apocynum cannabinum L.) (APOCA) and wild blackberry (Rubus allegheniensis L.) (RUBAL) in no-tillage corn (Zea mays L. 'Pioneer 3352'). All plots were treated with 0.6 kg/ha paraquat, 2.2 kg/ha metolachlor, 2.2 kg/ha atrazine, and 0.5% (v/v) X-77. Postemergence applications were made when corn was at the 4- to 5- leaf stage and APOCA and RUBAL were 25- to 30-cm high. APOCA and RUBAL control with applications of 0.6 kg/ha 2,4-D was 63 and 45% and with 0.3 kg/ha Dicamba was 55 and 60% 6 weeks after treatment (WAT). Nicosulfuron applied at 0.03, 0.05, and 0.07 kg/ha plus 1% crop oil produced 85, 85, and 73% control of APOCA and 72, 70, and 80% control of RUBAL, respectively, 6 WAT. Tank mixtures of 0.6 kg/ha 2,4-D + 0.03 and 0.07 nicosulfuron increased APOCA control (100%) compared to the control obtained with either herbicide applied alone. Tank mixtures of 0.6 kg/ha 2,4-D + 0.03 and 0.05 kg/ha nicosulfuron also increased RUBAL control (85 and 82%) compared to that obtained with either herbicide applied alone. Combining 0.3 kg/ha Dicamba with nicosulfuron was not as effective in controlling APOCA and RUBAL as the 2,4-D nicosulfuron tank mixtures. Studies were conducted to evaluate johnsongrass [Sorghum halepense (L.) Pers.] (SORH) control with nicosulfuron applied alone and in tank mixtures with 2,4-D and Dicamba. Combinations of 2,4-D and Dicamba reduced SORHA control compared to that obtained with nicosulfuron applied alone 4 WAT. However, by 9 WAT, 2,4-D had no effect on SORHA control with nicosulfuron. Tank mixtures of 0.3 kg/ha Dicamba + 0.03 and 0.05 kg/ha nicosulfuron continued to antagonize SORHA control 9 WAT compared to that obtained with nicosulfuron applied alone.

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THE EFFECTS OF ROW WIDTH, NITROGEN AND HERBICIDES ON WHEAT YIELD

R. L. RITTER1/

ABSTRACT

Field studies conducted in Maryland since 1985 examined the effects of row width, nitrogen application, and herbicides on wheat (Triticum aestivum L.) yield.

Studies conducted from 1985 to 1987 examined a variety of herbicide programs on wheat planted in either 20 cm or 10 cm row spacings. Weed control ratings made late in the growing season prior to wheat harvest averaged 70% for the 20 cm row spacing, while the 10 cm row spacing averaged 82%. These visual ratings were for winter annual broadleaf weeds, primarily common chickweed (Stellaria media L.). Wheat yields, also averaged for the 3-year time period, were 5,443 kg/ha for the 20 cm row spacing and 5,914 kg/ha for the 10 cm row spacing. Thus, better weed control and higher yields were obtained with the wheat planted in narrower rows.

Studies were then initiated in 1988 to examine wheat planted in 10 cm rows compared to wheat planted in 15 cm rows. Coupled with these studies were five different herbicide programs and two different nitrogen application regimes. Here, a single nitrogen application of 90 kg/ha applied early April was compared to a split application of 67 kg/ha applied early March plus an additional 67 kg/ha applied early April. Wheat yield data averaged over the 2 years found no differences between the row spacings. Here, wheat yields were 4,583 kg/ha for the 15 cm row spacing and 4,650 kg/ha for the 10 cm row spacing. Wheat yields for the nitrogen treatments varied considerably. The single nitrogen treatment averaged 4,328 kg/ha for the 2-year study, while the split application yielded 4,850 kg/ha.

From 1989 to 1990, another series of field studies compared nitrogen rates (67, 90 and 112 kg/ha) applied alone, with thifensulfuron, or with thifensulfuron plus surfactant. These applications were made early March and compared to late March applications. Wheat yield data averaged over the 2-year study found a positive effect from the herbicide treatments when applied early March. On the other hand, wheat yields decreased, particularly with the thifensulfuron plus surfactant plus nitrogen treatment, when applied late March.

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TERBACIL FOR CONTROL OF HENBIT AND COMMON CHICKWEED IN ESTABLISHED AND SEEDLING ALFALFA

D.D. Ganske[1] and E.S. Hagood[2]

ABSTRACT

Field trials were established in 1988-90 in West Virginia, Virginia, and Maryland to evaluate terbacil at reduced rates for the control of common chickweed (Stellaria media L.) and henbit (Lamium amplexicaule L.) in seedling and established alfalfa.

Herbicide treatments were applied in water to 6 X 12 or 6 X 25 foot plots using flat fan spray tips mounted on a compressed air plot sprayer calibrated to deliver a set volume of water.

Four rates; 0.20, 0.27, 0.40, and 0.60 lbs ai/a, of terbacil herbicide were applied at two timings, late fall and late winter.

All treatments of terbacil applied at both timings controlled henbit. A rate of 0.27 lbs ai/a was necessary to control common chickweed in the fall and a rate of 0.40 lbs ai/a was needed to obtain control in late winter. In general, as the rate of terbacil increased the control of henbit and common chickweed increased irrespective of timing. Seedling alfalfa injury increased as the rate of terbacil increased; however, all rates had acceptable crop injury ratings of less than 18%. There were similar crop injury ratings from fall applications versus late winter applications when comparing equal rates of terbacil.

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Control of Canada Thistle [Cirsium arvense (L.) Scop.] on Highway Rights-of-Way - Or - Why I'll never be out of a job in weed control.

W.J. Chism, S. W. Bingham, and R.L. Shaver[1]

ABSTRACT

Canada thistle is an herbaceous, perennial weed increasingly being found on highway rights-of-way in Virginia. It's prolific seed production and extensive rhizomes make it an excellent invading species in disturbed sites. Spring herbicide treatments were chosen to selectively control Canada thistle (Cirsium arvense L.) Scop.) in tall fescue (Poa pratensis L.) and trailing crownvetch (Coronillia varia L.).

TALL FESCUE

Test plots at Staunton, VA compared April versus May treatments for Canada thistle control. The best control of Canada thistle and turf quality were provided by triclopyr + clopyralid (0.63 + 0.21 & 0.94 + 0.32) and clopyralid (0.28 & 0.42 kg/ha). Anilizene produced very rapid growth reduction in Canada thistle initially (90%) but did not provide adequate control after 2 months at this site. Treatment time did not influence Canada thistle control.

Test plots at Wytheville, VA compared April versus May treatments for Canada thistle control. The best control of Canada thistle and turf quality at this site were provided by 2,4-D (2.8 kg/ha), triclopyr (2.24 kg/ha), triclopyr + clopyralid (0.63 + 0.21 & 0.94 + 0.32) and clopyralid (0.28 & 0.42 kg/ha). Anilizene provided moderate, but not adequate growth reduction over the course of the experiment. April versus May application timings did not appear to influence weed control.

CROWNVETCH

An experiment was conducted at Bland, VA to test the ability of anilizene to control Canada thistle in trailing crown vetch. Anilizene has provided inconsistent control of Canada thistle over the past three years. Control of Canada thistle was not adequate at this site.

CANADA THISTLE BIOTYPES

Several authors have described four distinct biotypes of Canada thistle found in the U.S. and Canada. Upon examination we determined that our test sites over the past three years have different biotypes present in them. Anilizene is thought to act as an inhibitor of photosystem II. Our work with an SF-10 fluorometer indicates that our biotypes have a differential response to atrazine. However, the same work indicates that anilizene does not influence whole leaf fluorescence and did not inhibit PS II. Therefore, the inconsistencies we are experiencing in controlling Canada thistle may be due to biotype differences in herbicide sensitivity.

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GIANT FOXTAIL CONTROL WITH HERBICIDES APPLIED TO SOIL WITH AND WITHOUT SURFACE RESIDUE

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ABSTRACT

As part of a cooperative project with the Pennsylvania Department of Transportation, 13 herbicide combinations were applied to an area known to have high giant foxtail (Setaria faberi Herrm.) pressure as well as an accumulation of surface plant residue. The herbicides included broad spectrum, root absorbed herbicides, as well as low-solubility herbicides that work primarily at the soil surface on germinating seeds and seedlings. These herbicides were applied to plots with and without surface residue to determine if the residue would reduce the activity of the herbicides. Combinations of these two types of herbicides are often used under guiderails for total vegetation control with the assumption that the low-solubility materials provide longer activity near the soil surface than the more soil-mobile broad spectrum herbicides.

The herbicides applied were imazapyr, sulfometuron methyl, bromacil, tebuthiuron, two rates of diuron, oryzalin, pendimethalin, simazine, isoxaben, metolachlor, oxyfluorfen, and glyphosate. Glyphosate was added with each herbicide and applied alone to the check plots to eliminate winter annual weeds present at application. The application rates are listed in Table 1. The treatments were applied April 6, 1990 to an area that had been in a no-till rotation of corn-oats-fallow for almost 20 years. The application equipment was a CO_2 powered hand-held sprayer, applying 174 l/ha at 207 kPa with Spraying Systems 8004 flat fan nozzles. The experimental design was a randomized complete block with a split-block treatment arrangement and three replications, with 1.5 by 9.1 m herbicide treatment plots, 4.6 by 19.8 m residue plots, and 1.5 by 4.6 m herbicide by residue sub-plots. Surface residue was removed from the no-residue plots with a tractor mounted York rake. Visual ratings of percent giant foxtail cover were taken June 29 and October 9, 12 and 26 weeks after treatment (WAT), respectively. An application of 0.56 kg ai/ha of 2,4-D was made July 6 to remove broadleaf weeds from the experimental area.

When the data was subjected to analysis of variance, the effect of residue was found to be nonsignificant for the June 29 rating ($p=0.42$), and nearly significant for the October 9 rating ($p=0.09$). The interaction between herbicide and residue treatment effects was not significant June 29 ($p=0.18$), but was highly significant October 9 ($p=0.0007$). Giant foxtail cover ratings were lower for all herbicides when applied to bare soil (Table 1). Imazapyr, isoxaben, and oxyfluorfen showed the greatest difference in giant foxtail cover between the two surface conditions, with a 32, 50, and 33 percent difference, respectively, between bare soil and residue plots. Giant foxtail cover in plots treated with sulfometuron methyl, the high rate of diuron, and pendimethalin were very similar between the two surface conditions. Herbicide treatment effects, averaged over soil surface conditions, were highly significant, and all treatments had significantly less giant foxtail cover than the glyphosate-only check, which was rated at 62 and 87 percent 12 and 26 WAT, respectively. Sulfometuron methyl, the high rate of diuron, pendimethalin, bromacil, tebuthiuron, and oryzalin provided excellent giant foxtail control. The 26 WAT cover ratings for these treatments ranged between 2 and 13 percent. The low rate of diuron, simazine, metolachlor, and imazapyr plots had less than 10 percent giant foxtail cover when rated 12 WAT, but at 26 WAT these treatments ranged between 22 and 41 percent giant foxtail cover. Isoxaben and oxyfluorfen did not provide acceptable control of giant foxtail, as both were rated at 31 percent cover 12 WAT; and 47 and 58 percent, respectively, 26 WAT.

Under the conditions of this study, the broad spectrum herbicides bromacil, diuron, sulfometuron methyl, and tebuthiuron provided season long control of giant foxtail and would not need to be combined with low solubility herbicides such as oryzalin and pendimethalin. Oryzalin and pendimethalin could be combined with broad spectrum herbicides that have little or no residual activity to control existing vegetation as well as weeds such as giant foxtail, and reduce the possibility of off-site movement which can occur with the broad spectrum residual herbicides used in this study. Their use would be limited though, by their reduced spectrum of control.

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TABLE 1: Percent giant foxtail cover present in treatments applied April 6, 1990, and rated June 29 and October 9, 12 and 26 weeks after treatment. Values for 12 WAT and the mean for 26 WAT are the mean of six observations, and the bare soil and residue value for 26 WAT are the mean of three observations.

		Giant Foxtail Cover			
			26 WAT		
Treatment	Application Rate	12 WAT	mean	bare soil	residue
	(kg ai/ha)	(%)	(%)	(%)	(%)
1. imazapyr + glyphosate	0.84 + 0.56	8	41	25	57
2. sulfometuron methyl + glyphosate	0.21 + 0.56	0	2	1	2
3. bromacil + glyphosate	4.48 + 0.56	1	9	2	16
4. tebuthiuron + glyphosate	3.58 + 0.56	1	9	3	15
5. diuron + glyphosate	5.60 + 0.56	2	22	12	32
6. diuron + glyphosate	11.2 + 0.56	0	4	3	6
7. oryzalin + glyphosate	3.36 + 0.56	2	13	7	19
8. pendimethalin + glyphosate	4.48 + 0.56	0	4	2	7
9. simazine + glyphosate	4.48 + 0.56	3	32	25	38
10. isoxaben + glyphosate	1.12 + 0.56	31	47	22	72
11. metolachlor + glyphosate	4.48 + 0.56	5	32	23	40
12. oxyfluorfen + glyphosate	0.90 + 0.56	31	58	42	75
13. glyphosate	0.56	62	87	85	88
Significance Level (P)		0.0001	0.0001	0.0007[1/]	
Coefficient of Variation (%)		97	47	29	
l.s.d. (P=0.05)		12	16	14	

[1/] The significance level of the interaction between residue and herbicide treatment effects.

MEYER ZOYSIAGRASS REGROWTH AS INFLUENCED BY HERBICIDES

P. H. Dernoeden[1/]

ABSTRACT

Establishment of Meyer zoysiagrass (Zoysia japonica Steud.) from vegetative plugs generally requires a minimum of three growing seasons; whereas, establishment from sprigs requires about two growing seasons. The objective of this study was to determine if establishment from regrowth of harvested sod could be hastened by herbicides that reduce weed competition.

Meyer zoysiagrass was established from plugs at Silver Spring, MD in 1983, and the mature stand was harvested in Aug 1988. On 10 Apr 1989, the area was lightly rototilled and the site was separated into two areas. Area I was hand raked to remove all loosened plant debris; whereas, Area II was not raked and sod ribbons and debris were allowed to remain in place. Both areas were rolled, and herbicides were applied over primarily bareground in Area I and bareground plus plant debris in Area II. Plots were 5 by 10 ft and arranged in a randomized complete block with either four (Area II) or five (Area I) replications per treatment. The herbicides (dithiopyr at 0.5 lb/A; pendimethalin at 3.0 lb/A; prodiamine at 0.65 lb/A; DCPA at 10.5 lb/A; oxadiazon at 3.0 lb/A; fenoxaprop at 0.35 lb/A and quinclorac at 1.5 lb/A) were applied at recommended times in 50 gpa at 36 psi. Quinclorac was tank-mixed with 2 pts/A of BAS 090 surfactant. Nitrogen from urea was applied at 1.0 lb N/1000 ft^2 on 20 July 1989, and 15 May, 13 June, and 10 July 1990. Plot area covered by weeds or zoysiagrass was determined visually on a 0 to 100% scale. All data were subjected to analysis of variance and significantly different means were separated at P = 0.05 by Duncan's multiple range test.

1989 Results

Carpetweed (Mollugo verticillata L.), and smooth crabgrass (Digitaria ischaemum [Schreb.] Muhl.) were the primary weed competitors. In Area I, carpetweed was effectively controlled by all preemergence herbicides, but not by fenoxaprop or quinclorac. Crabgrass was reduced significantly by all treatments. Except for pendimethalin and prodiamine (22-23% zoysia cover), most herbicides (24-34% zoysia cover) enhanced the competitiveness of Meyer significantly, when compared to untreated plots (13% zoysia cover).

In Area II, only pendimethalin, prodiamine and oxadiazon had provided effective preemergence carpetweed control; whereas, all herbicides had provided excellent crabgrass control. By 13 Sept it was evident that all herbicides (58-69% zoysia cover), except quinclorac (48% zoysia cover), were associated with a significant increase in Meyer cover when compared to untreated plots (31% zoysia cover). This increase in zoysiagrass cover was attributed to the reduction of crabgrass competition accorded by the herbicides.

1990 Results

Herbicide rates were reduced in 1990 and all preemergence herbicides provided excellent crabgrass control in Area I. Fenoxaprop and quinclorac had reduced crabgrass, but the level of control was only 73%. Herbicide use in Area I was associated with significantly greater zoysiagrass cover ratings (92-97%) when compared to untreated plots (88% cover) on 9 Oct 1990.

In Area II, all herbicides provided excellent crabgrass control because zoysiagrass cover was very high in spring 1990 and weed competition was therefore not as severe as it was in Area I. Zoysiagrass cover was significantly higher (98-100% cover) in herbicide-treated plots than untreated plots (95% cover) on 9 Oct 1990.

Results of this study showed that herbicide use significantly reduced weed competition and assisted in speeding zoysiagrass growth. None of the herbicides was phytotoxic, and none was associated with a reduction in the growth or

THE EFFECT OF APPLICATION TIMING ON THE ACTIVITY OF PLANT GROWTH REGULATORS APPLIED TO TALL FESCUE

Arthur E. Gover, Thomas L.Watschke, and Gregory T. Lyman[1/]

ABSTRACT

Previous research at Penn State[2/] has suggested that different plant growth regulators (PGR's) have different periods of peak activity between the breaking of dormancy and seedhead emergence on unmown tall fescue (Festuca arundinacea Schreb.). This study was initiated as part of a cooperative research project with the Pennsylvania Department of Transportation to determine if different plant growth regulator combinations demonstrated different activity peaks within the pre-mow application window.

MATERIALS AND METHODS

The study site was seeded in the spring of 1987 to a blend of 'Cimmaron', 'Bonanza', and 'Olympic' turf type tall fescues. Prior to 1990, the area received 60 kg of fertilizer nitrogen/ha annually, and was maintained at a height of 9 cm. The experimental design was randomized complete block with a split-plot treatment arrangement with three replications. Each 5.5 by 4.6 m application timing whole plot was divided into six 0.9 by 4.6 PGR treatment sub-plots. The application times were April 23, April 27, May 2, May 8, and May 14, 1990. The PGR treatments were mefluidide (*N* 2,4-dimethyl-5-[[trifluoromethyl) sulfonyl] amino] phenyl] acetamide) at 420 g ai/ha; chlorsulfuron (2-chloro-*N* -[[4-methoxy-6-methyl-1,3,5-triazin-2-yl) amino] carbonyl] benzenesulfonamide) at 26.2 g ai/ha; mefluidide plus chlorsulfuron at 210 plus 13.1 g ai/ha; a commercial premix of imazethapyr and imazapyr[3/] ((±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H* -imidazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid and (±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H* -imidazol-2-yl]-3-pyridinecarboxylic acid), at 98.4 and 3.8 g ai/ha; mefluidide plus the premix of imazethapyr and imazapyr at 140 plus 49.1 plus 1.9 g ai/ha, respectively; and an untreated check. The treatments were applied with a CO_2 powered hand held sprayer delivering 161 l/ha at 207 kPa using Spraying Systems 8002 flat fan nozzles. All PGR treatments included dicamba (3,6-dichloro-2-methoxybenzoic acid) at 0.56 kg ai/ha and a spray adjuvant[4/] at 0.25% v/v. Initial visual ratings of turf color and turf quality were taken May 15 for the April 23 applications; May 29 for the April 27, May 2, and May 8 applications; and June 5 for the May 14 application. All plots were visually rated for percent seedhead suppression, turf color, and turf quality July 2 Seedhead suppression ratings were based on the untreated check within each application time whole plot. Turf color and quality were rated on a 0 to 9 scale, with 9 being ideal, 0 dead turf, and 5 acceptable. When the data was subjected to analysis of variance, the interaction between application time and PGR treatments was highly significant for all dependent variables.

RESULTS AND DISCUSSION

Initial color ratings for mefluidide at 420 g ai/ha were acceptable and consistent for all applications. Turf quality ratings decreased for later applications as the turf grew taller with a more uneven canopy compared to other treatments. Seedhead suppression ratings taken July 2 were good to excellent for applications made April 23 and 27, then decreased significantly for the May 2

1/ Sr. Research Technologist, Professor of Turfgrass Science, and Project Assistant, The Pennsylvania State University.

2/ Gover, A.E., T.L. Watschke, G.T. Lyman. 1990. Effect of Application Timing on Embark and Escort Combinations. Roadside Vegetation Management Research Report - Fourth Year Report, Report #PA 90-4620 + 85-08. Available from National Technical Information Service, Springfield, VA.

3/ Event, American Cyanimid Company, Wayne, NJ.

4/ Cidekick II, JLB Inc., Vero Beach, FL

application . Turf color and quality ratings taken July 2 followed the same trend as the seedhead suppression ratings. The color decline appeared to be due to the beginning of leaf senescence, and the quality decline was due to increasing presence of seedheads and an uneven canopy, and less favorable color ratings.

Chlorsulfuron at 26.2 g ai/ha showed an improved initial color rating between the April 23 and 27 application dates, then no change with subsequent applications. The initial quality ratings were more varied, though acceptable, and did not show any overall trend. Seedhead suppression was not acceptable for the April 23 and 27, and May 2 applications, but improved to acceptable levels for the May 8 and 14 applications. When rated July 2, turf color and quality were consistent and acceptable for all application dates. The combination of mefluidide and chlorsulfuron, produced barely acceptable initial color ratings for the April 23 and 27 applications. Turf color ratings improved with the later applications, but this combination consistently received the lowest initial turf color ratings. Initial turf quality relative to the other treatments changed from worst rated for April 23 to best rated for May 14, despite a change of only 6.3 to 7.0. July 2 ratings of seedhead suppression, turf color, and turf quality were good to excellent for all application dates.

The commercial premix of imazethapyr and imazapyr showed initial turf color and turf quality ratings between 6.3 and 7.0 for all application dates. Seedhead suppression was good to excellent for all application dates, as was turf color and turf quality when rated July 2. Adding mefluidide to the premix of imazethapyr and imazapyr produced initial turf color ratings that were consistently lower, though acceptable, than the premix alone. Initial turf quality differences between the two treatments were not apparent. Mefluidide plus the premix consistently provided excellent seedhead suppression, and was among the highest for July 2 color and quality ratings.

The untreated check received the highest initial turf color ratings for each application date. The initial turf quality rating fell dramatically to unacceptable levels after the April 23 application due to the uneven appearance resulting from unchecked growth. Seedhead pressure was different between the check plots, but was always rated 0 percent suppression. July 2 ratings of turf color were barely acceptable as leaf senescence was occurring, and turf quality was unacceptable due to the presence of seedheads and uneven canopy growth.

Under the conditions of this study, mefluidide showed greater activity on tall fescue in earlier applications. When combined with a reduced rate of chlorsulfuron, early applications caused more discoloration, but seedhead suppression was improved. Similar results were found when mefluidide was combined with a commercial premix of imazethapyr and imazapyr, though improvements in seedhead suppression were not as pronounced as with chlorsulfuron.

TABLE 1: Visual ratings of turf color, turf quality, and percent seedhead suppression for PGR treatments applied at five different dates to tall fescue. Turf color and turf quality ratings were on a 0 to 9 scale, with 0 indicating dead turf, and 9 being ideal.Seedhead suppression was rated based on the untreated check for each application date. Each value is the mean of three observations.

			3-4 WAT		July 2, 1990		
Date	Products	Application Rate	Turf Color (0-9)	Turf Quality (0-9)	Sdhd. Supp. (%)	Turf Color (0-9)	Turf Quality (0-9)
4/23	mefluidide	420	7.0	7.3	90	7.0	7.3
4/23	chlorsulfuron	26.2	5.7	6.7	67	7.0	6.7
4/23	mefluidide + chlorsulfuron	210 + 13.1	5.0	6.3	93	7.0	7.7
4/23	imazethapyr + imazapyr[1/]	98 + 3.8	6.3	7.0	83	7.0	7.0
4/23	mefluidide + imazethapyr + imazpyr	140 + 49 + 1.9	5.3	6.7	93	7.0	7.0
4/23	untreated check	- - -	8.0	7.3	0	5.0	4.3
4/27	mefluidide	420	6.7	5.7	85	6.3	7.0
4/27	chlorsulfuron	26.2	6.3	6.3	48	7.0	7.0
4/27	mefluidide + chlorsulfuron	210 + 13.1	5.3	6.3	92	7.0	7.7
4/27	imazethapyr + imazapyr	98 + 3.8	6.3	6.7	92	6.7	7.3
4/27	mefluidide + imazethapyr + imazpyr	140 + 49 + 1.9	5.7	6.7	92	6.7	7.3
4/27	untreated check	- - -	8.0	4.7	0	5.0	4.0
5/2	mefluidide	420	7.0	5.3	8	5.0	4.0
5/2	chlorsulfuron	26.2	6.3	6.7	65	7.0	6.3
5/2	mefluidide + chlorsulfuron	210 + 13.1	6.0	6.7	83	7.0	7.0
5/2	imazethapyr + imazapyr	98 + 3.8	6.3	6.7	87	6.7	6.7
5/2	mefluidide + imazethapyr + imazpyr	140 + 49 + 1.9	6.0	7.0	95	7.3	7.7
5/2	untreated check	- - -	8.0	4.7	0	5.0	4.0
5/8	mefluidide	420	7.3	5.3	13	5.0	4.7
5/8	chlorsulfuron	26.2	6.3	5.7	80	7.0	6.7
5/8	mefluidide + chlorsulfuron	210 + 13.1	6.3	6.3	90	7.7	7.3
5/8	imazethapyr + imazapyr	98 + 3.8	7.0	6.3	83	6.3	6.3
5/8	mefluidide + imazethapyr + imazpyr	140 + 49 + 1.9	6.7	6.7	90	7.0	7.3
5/8	untreated check	- - -	8.0	4.3	0	5.0	4.0
5/14	mefluidide	420	6.7	4.7	55	5.7	5.3
5/14	chlorsulfuron	26.2	6.3	6.3	83	7.0	6.7
5/14	mefluidide + chlorsulfuron	210 + 13.1	6.0	7.0	95	7.3	7.0
5/14	imazethapyr + imazapyr	98 + 3.8	6.3	6.7	97	7.0	7.7
5/14	mefluidide + imazethapyr + imazpyr	140 + 49 + 1.9	6.0	6.3	93	7.0	7.0
5/14	untreated check	- - -	7.7	4.0	0	5.0	4.0
Significance Level (P)			0.042	0.001	0.001	0.001	0.001
C.V. (%)			5	10	13	6	8
LSD (P=0.05)			0.6	1.0	14	0.6	0.8

[1/] A commercial premix, Event, American Cyanimid Company, Wayne, NJ

CGA 163935 ALONE AND IN COMBINATION WITH OTHER GROWTH REGULATORS IN TALL FESCUE[1]

ADRIAN J. ENACHE and RICHARD D. ILNICKI[2]

ABSTRACT

The experimental turf growth regulator, CGA 163935, was evaluated in two studies at the Adelphia Research Center, Freehold, N.J. The objectives of this research were to determine if there were differences in turf growth regulation and turf response (i) when CGA 163935 was applied alone and in combination with three other growth regulators, and (ii) when sequential applications of CGA 163935 were used.

All treatments were applied to tall fescue (Festuca arundinacea Schreb.). For the first study, treatments were applied at turf green-up (April 12, 1990) and included CGA 163935 at two rates (0.6 and 0.8 kg ai ha^{-1}), mefluidide, maleic hydrazide, and primisulforon alone and in combinations with CGA 163935. Treatments for the second study were applied April 12 and May 23, 1990 and included CGA 163935 at four rates (0.2, 0.4, 0.6, and 0.8 kg ai ha^{-1}) applied alone at turf green-up and followed by a second application of various CGA 163935 rates. Each study consisted of three replicates in a randomized block design. Turf color and injury were rated and number of seedheads counted periodicaly in each study. In the second study turf height and fresh weight of clippings were recorded also.

No injury to the turf was observed at two weeks after treatment (WAT) with CGA 163935 applied alone. Combinations with high rates of mefluidide and primisulfuron caused temporary turf injury. All CGA 163935 applications, either single or split, significantly reduced turf height compared to unmowed check; however, no differences between the mowed check and all treatments resulted. Sequential application of CGA 163935 at 0.4 and 0.8 kg ai ha^{-1} seemed to be the most effective in reducing the turf height. CGA 163935 applied alone reduced the number of seedheads compared to unmowed check; no reductions were observed compared to mowed check. Higher rates of CGA 163935 with mefluidide and primisulfuron were more effective than lower rates while the combinations with maleic hydrazide were more effective at lower rates. Single application of CGA 163935 did not reduce fresh weight of clippings. Sequential application reduced fresh weight at 10 WAT. At 14 WAT, fresh weights of all, single or sequential, applications of CGA 163935 were lower than the unmowed check and similar to that of the 12 times mowed check.

This indicated that either single or sequential applications of CGA 163935 were capable to replace 10 to 12 turf mowings during a season.

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[1] New Jersey Agric. Exp. Stn. Publication No. J-15173-1-90.
[2] Res. Assoc. and Res. Prof. Weed Sci., respectively, Crop Sci.

RESPONSE OF SEVERAL TURF GRASSES TO CGA-163935.

D. B. Vitolo, R. Brooks, S. W. Pruss and P. J. Porpiglia 1

ABSTRACT

CGA-163935 is a growth regulator being developed by Ciba-Geigy for vegetative inhibition of turfgrass and lodging prevention in cereals and oilseed rape.

Effective use rates of CGA-163935 vary from 200 to 1000 g ai/ha. Factors which influence rate include turf species, application timing, environmental conditions, and duration of desired inhibition. Use rates have been selected which provide approximately 50% growth inhibition for four weeks.

CGA-163935 was evaluated in 1990 for cool-season turfgrass inhibition in field trials conducted in New York, Illinois, and California. Turfgrass species evaluated included tall fescue (Festuca arundinacea Schreb.), red fescue (Festuca rubra L.), perennial ryegrass (Lolium perenne L.), and Kentucky bluegrass (Poa pratensis L.).

CGA-163935 at 1000 g ai/ha applied to tall fescue reduced clipping fresh weights by 50% over a six week period. An 800 g ai/ha rate reduced the number of mowings by 50% over a seven week period. This single 800 g ai/ha application provided mowing reductions comparable to two applications of either 400, 600, or 800 g ai/ha applied 30 days apart. Clipping weights of perennial ryegrass were reduced by 68% over a four week period with 600 g ai/ha of CGA-163935. Fresh weight of perennial ryegrass was reduced 57% over an eight week period following two applications of 800 g ai/ha applied at 30 day intervals.

In addition to cool-season turf, CGA-163935 has been tested extensively on St. Augustinegrass (Stenotaphrum secundatum [Walt.] Kuntz), bahiagrass (Paspalum notatum Fluegge), and Bermudagrass (Cynodon dactylon [L.] Pers.) for general turfgrass inhibition and as an edging compound.

Single applications of CGA-163935 at 800 g ai/ha reduced the number of mowings of St. Augustinegrass, bahiagrass, and bermudagrass 66%, 57%, and 33%, respectively, for a period of seven weeks.

Turfgrass tolerance to CGA-163935 has been excellent. Three successive years of 3000 g ai/ha per year, applied in 1000 g ai/ha increments during the growing season, have shown no adverse effects on tall fescue. Three successive years of 4000 g ai/ha applied in 1000 g ai/ha increments have shown no adverse effects on St. Augustinegrass or bahiagrass, while 1200 g ai/ha, applied in 400 g ai/ha increments, have shown no adverse effects on Kentucky bluegrass or common Bermudagrass for one and two years, respectively.

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SUMMARY OF THE BAS 514 00 H EUP PROGRAM RESULTS ON NORTHEASTERN TURF

Richard R. Evans[1], Greg Roman, William Sciarappa

ABSTRACT

BASF Corporation conducted an EUP program in 1990 with BAS 514 00 H for the control of grass and broadleaf weeds in turf. The national program allowed the usage on 107 hectares of turf in all areas of the United States. In the Northeast, applications were made in Maryland, Delaware, Virginia, Pennsylvania, New York, New Jersey and Ohio. Over 40 trials were conducted on golf courses, commercial turf, and sports turf at 0.2 to 1.6 hectares per site. Application rates ranged from 1.7 to 2.25 kg/hectare applied postemergence in 24 to 220 liters of water per hectare. The turf species present at each site were usually 2- and 3-way mixtures of perennial ryegrass (Lolium perenne L.), Kentucky bluegrass (Poa pratensis L.), tall fescue (Festuca arundinacea Schreb.) and fine fescue (Festuca species) or bermudagrass (Cynodon dactylon Pers.) or bentgrass (Agrostis palustris Huds.). Application dates ranged from June 5 to August 15 for the initial application with subsequent applications, if needed, made approximately 30 days later. Users indicated their evaluation of the control of each weed by checking the appropriate box labelled excellent, good, fair or poor.

Injury to turf was very low to none. Good to excellent control of smooth crabgrass (Digitaria ischaemum Schreb. ex Schweig.), large crabgrass (Digitaria sanguinalis L.), yellow foxtail (Setaria glauca L.), dandelion (Taraxacum officinale Weber), Veronica species, buckhorn plantain (Plantago lanceolata L.) and white clover (Trifolium repens L.) was obtained at the rates used. Some weeds not controlled were broadleaf plantain (Plantago major L.), prostrate knotweed (Polygonum aviculare L.), mouseear chickweed (Cerastium vulgatum L.), goosegrass (Eleusine indica L.) and nimblewill (Muhlenbergia schreberi J. F. Gmel.).

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NUMBER OF LOCATIONS THAT RANKED THE CONTROL OF TURF WEEDS WITH BAS 514 OO H

NUMBER OF LOCATIONS

RATE Kg/ha	DIGSP#				SETSP#				TRFRE**				VERSP#				TAROF**				PLALA**				OXAST**				PLAMA**			
	E*	G*	F*	P*	E	G	F	P	E	G	F	P	E	G	F	P	E	G	F	P	E	G	F	P	E	G	F	P	E	G	F	P
0.84	15	1	2	1	4	1	1	1	12	2	1	1	3	1	-	-	3	5	3	3	3	2	1	1	-	-	-	3	-	-	-	5
1.12	13	3	1	-	-	-	1	-	14	2	1	-	2	3	1	-	2	3	2	-	3	1	-	1	-	-	-	4	3	-	2	2
TOTAL LOCATIONS	28	4	3	1	4	1	2	1	26	4	2	1	5	4	1	-	5	8	5	3	6	3	1	2	-	-	-	7	3	-	2	7

INFORMATION IS GROUPED FOR DIGITARIA SPECIES (DIGSP), SETARIA SPECIES (SETSP) AND VERONICA SPECIES (VERSP)

* E = EXCELLENT CONTROL
G = GOOD CONTROL
F = FAIR CONTROL
P = POOR CONTROL

** WSSA CODES

BAS 514 H - APPROACHES TO SELECTIVITY AND EFFICACY IN BENTGRASS AND BLUEGRASS

William J. Sciarappa[1]

ABSTRACT

Field studies were conducted in 1990 with BAS 514 H [BASF - quinchlorac/proposed] in order to improve efficacy against buckhorn/narrowleaf plantain [Plantago lanceolata L.] in Kentucky bluegrass [Poa pratensis L.] turf and to improve selectivity in Penncross creeping bentgrass [Agrostis palustris Huds.] turf while controlling hairy crabgrass [Digitaria sanguinalis L.].

Control of buckhorn plantain in bluegrass with a single postemergence application of BAS 514 H at .38,.5,.75 or 1.0 lbs ai/a plus surfactant [BAS 090 02 S at 1 qt/a] during early June, mid July or late September ranged from ca. 30 to 60 %. Sequential applications at low rates 30 days after the first spray significantly improved control at the mid-summer period. Sequential applications of BAS 514 H [0.75 +.25 lbs ai/a , .5 +.5 lbs ai/a or .375 +.375 lbs ai/a] achieved over 90% control. No injury occurred at any treatment rate to Kentucky bluegrass.

Control of tillered hairy crabgrass in bentgrass was related to rate of BAS 514 H and the mowing height. Lower cut crabgrass was controlled more easily and higher rates provided better efficacy. At .38 lbs ai/a, control ranged from 70% [3/16 inch cut] to 52% [1 to 2 inch cut]. At .5 and .75 lbs ai/a, control ranged from 59% to 78% and from 83% to 93%, respectively. Sequential applications of .5 lbs ai/a increased control at all rates and mowing heights to over 90%.

Bentgrass tolerance to BAS 514 H showed an integrated relationship of rate, mowing height, and the use of a chelated iron source coupled with a low burn, timed release, liquid nitrogen fertilizer. Shorter mowing heights and higher rates decreased turf quality. At 7 days after treatment, the untreated bentgrass turf was rated as 8 on a color/quality scale of 1 to 10. Quality of bentgrass treated with BAS 514 H at .75 lbs ai/a averaged 5.83 in the 3/16 inch putting green cut, 6.50 in the 5/16 inch collar cut, 7.17 in the .5 inch fairway cut and 7.33 in the 1 to 2 inch rough cut. At .5 and .38 lbs ai/a, quality improved and was rated respectively at 6.33 and 6.33 in the green, 7.33 and 8.0 in the collar, 7.83 and 8.0 in the fairway and 7.33 and 7.5 in the rough. The inclusion of the iron chelate/low burn fertilizer into the .75 lb ai/a rate of BAS 514 H improved turf quality dramatically to 7.17, 7.50, 7.67 and 7.67 at the increasing mowing heights. Similar trends were recorded 20 and 42 days after initial treatments. Single or sequential applications of BAS 514 H late in the season at .5 lbs ai/a + BAS 090 02 S surfactant, iron chelate and liquid N fertilizer showed exceptional safety at all heights.

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Abstract

TURFGRASS ROOT LENGTH, STRENGTH, AND MASS RESPONSE TO QUINCLORAC.
R. D. Sterling, D. R. Carlson, D. E. Dougherty.

Quinclorac (BAS 514) is an experimental herbicide being developed by BASF for early postemergence crabgrass and broadleaf weed control in turf. Many dinitroanilines used for preemergence crabgrass control in turf have deleterious effects on root growth. Three separate approaches were used to determine whether quinclorac inhibited root length, strength, and mass as compared to the commercial standard pendimethalin.

A petri dish assay with pregerminated corn was used to determine if quinclorac inhibited root growth. Silica sand was treated with 30 mls of dilute herbicide solution. The solution concentrations of quinclorac were applied at 2.0, 1.0, and 0.5 ppm. Pendimethalin was applied at 3.0 and 1.5 ppm. Treatments were replicated three times. After twenty four hours, quinclorac inhibited root growth 14%, 3%, and 0% at 2.0, 1.0, and 0.5 ppm, respectively. The pendimethalin treated seedlings exhibited 81% inhibition at 3.0 ppm and 58% at 1.5 ppm. Corn seedlings treated with pendimethalin had swollen meristems, while the quinclorac roots appeared normal.

To determine herbicide affects on root mass, forty-two 0.45 liter pots were filled with a sandy loam soil and watered to field capacity. The bare soil was sprayed with quinclorac at 2.0, 1.0, and 0.5 kg/ha, and with pendimethalin at 3.0 and 1.5 kg/ha. Each treatment contained seven replications. After the soil was treated, a mixed sod of 'Kenblue' bluegrass/'Rebel' tall fescue was placed on the soil surface and allowed to grow for four months. After four months, the root mass was cut below the sod. The roots were then washed, dried and weighed. Both compounds affected turfgrass root mass. Treatments with quinclorac resulted in a 19, 17, and 15% decrease in root mass at 2.0, 1.0, and 0.5 kg/ha, respectively, while pendimethalin resulted in a 36% decrease in root mass at 3.0 kg/ha and a 32% decrease at 1.5 kg/ha.

To determine turfgrass root strength, a field study was conducted using a dynameter which measures the force required to pull a 929 cm^2 sod piece from the ground. The soil surface was treated with quinclorac at 2.0, 1.0, and 0.5 kg/ha and pendimethalin at 3.0 and 1.5 kg/ha. Metal grates were then placed over the treated area. A mixed sod of 'Kenblue' bluegrass / 'Rebel' tall fescue was placed over the grates and allowed to grow from October to December. When the sod was pulled, quinclorac treatment resulted in a 4, 3, and 0% decrease at 2.0, 1.0, and 0.5 kg/ha respectively, while pendimethalin reduced root strength by 36% at 3.0 kg/ha and 18% at 1.0 kg/ha.

Quinclorac caused little or no inhibition of root length, strength, or mass in the mixed turf compared to pendimethalin. Further studies will be conducted to determine the effect of quinclorac on other turf species.