THE CONTROL OF GRASS WEEDS IN MAIZE

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Summary

The paper is a summary of 20 trials conducted during the last 3 years for the control of grass weeds in maize and sweet corn. Evaluations were made of both pre- and post-emergent applications of atrazine, alone and in mixture with a number of chemicals of the anilide, triazine and urea groups. Some evaluation of the addition of non phytotoxic crop oil to atrazine was also made. Barnyard grass (*Echinochloa crus-galli*) is well controlled by atrazine, thus most of the experimental work was directed against smooth witchgrass (*Panicum dichotomiflorum*) and also summer grass (*Digitaria sanguinalis*) sometimes present in association. The control of *Setaria*, *Eleusine* and *Agropyron* grass species is mentioned briefly.

INTRODUCTION

McPhail (1968) outlined the effectiveness of atrazine for the control of weeds in maize and sweet corn, including the control of barnyard grass (*Echinochloa crus-galli*) the main grass weed prevalent in maize crops at that time. However, with the advent of extensive maize cropping in areas other than Hawke's Bay and Poverty Bay, a different association of grassy weeds has emerged, which include mainly smooth witchgrass (*Panicum dichotomiflorum*) with lesser amounts of summer grass (*Digitaria sanguinalis*), crowfoot grass (*Eleusine indica*) and bristle grass (*Setaria* spp.) present. As field applications of atrazine give unsatisfactory control of these lesser known but important grasses, most of the experimental work reported here has been directed to their control.

EXPERIMENTAL

Results are given from 20 trials in most of which the treatments were randomized, replicated 4 times and subsequent crop yields statistically analysed. Treatments were applied as an overall (non-directed) spray in 30 gal water/acre, except in trial 20 where applications were made as directed sprays in 125 gal water/acre. Except in trial 6 and where oil was used, all post-weed-emergence applications included the addition of a non-ionic wetting agent at 0.5% v/v of spray mix. Trials 1, 2, 5-7 were situated on sandy loam soils, 10-11, silt loam, 12, sandy silt loam, 16-17, loam complex, 3-4, 8-9, 13, 18-20, peaty loam, and 14-15, sandy/peaty loam. (All rates are expressed in terms of lb active ingredient per acre.) All assessment ratings shown in the tables are based on the 1 to 9 scale system of scoring as proposed by the European Weed Research Council (EWRC) and, according to this scale, favourable results are expressed in small rating figures.

RESULTS AND DISCUSSION

Unfortunately, supplies of certain materials were both late in arrival and limited in quantity and comparative tests with standard treatments were restricted. Atrazine has been included as a component of all mixtures because of its effectiveness against broadleaved weeds.

SMOOTH WITCHGRASS

Unsatisfactory control from post-emergent applications of atrazine is clearly shown in Table 1. Although some control was achieved of emerged 1-leaf seedlings, there was very poor control of subsequent germinations even with considerable rainfall. The addition of oil gave some improvement for post emergent control.

Anilides

The control from atrazine mixtures containing either alachlor, prynachlor, or propachlor was very satisfactory provided an appreciable amount of rain fell within 2 weeks of application. Results were progressively better the earlier applications were made and the greater amount of rain falling after spraying. Under some conditions propachlor was slightly inferior to the other anilides.

Triazines

Very good control was obtained under wet conditions with terbutryn but little under dry. The lack of adequate residual activity in a peaty soil as against a loam soil under similar rainfall is shown by comparing the results of the pre-emergent applications in trials 18 and 16. Although the chlorotriazine "G34698" either alone or in combination showed greater activity than atrazine alone, grass control was not as great as that obtained with cyanazine. For both materials, results were better with adequate rainfall subsequent to application.

Urea

Tested in only 2 trials chlortoluron gave very good results and was superior to all other treatments in each trial.

Directed sprays

As shown in Table 2, a late post-emergent directed spray of ametryn + oil gave excellent control of a dense grass infestation which also included some summer grass. 2,2-DPA + oil was very slow in action though satisfactory control was eventually obtained after 3 months. The effects from other treatments were fairly temporary.

SUMMER GRASS

Details of control are shown in Table 3. Under similar weather and stage of growth conditions, summer grass was generally easier to control than smooth witchgrass. Atrazine was very poor except when 1.5 in. rain fell within a week of a pre-emergent application on to a silt loam soil. Whereas the anilides gave very acceptable control under adequate rainfall conditions, the triazine mixtures were generally inferior. Both terbutryn

TABLE 1: CONTROL OF SMOOTH WITCHGRASS
(EWRC 1 to 9 ratings at 4 to 6 wks)

Trial No.	18	16	19	14	13	19	4	15	18	16	17	8
Weed stage	...	...	...	(1 leaf)		(1-2 leaf)			2 leaf	(2-3 leaf)		tiller
Rainfall (in.) 2 wk	...	...	...	0.1 1.0 2.3		0.1 0.2 1.0			0.1	0.4 1.9		2.5
Rainfall (in.) 4 wk	...	...	...	1.1 1.7		1.3 2.5 1.7			1.1	1.7		
Treatment (lb)												
atrazine 4	...	pre-emergence		7.3 6.0		7.0 8.3 6.5			7.3	8.0 7.5		6.5
atrazine 2/alachlor 2	...	1.6 1.9		4.8 1.8 1.0					7.3	7.0 3.5		
atrazine 2/propachlor 4	...	...		4.5 2.5 1.0		5.7				6.0		
atrazine 2/prynachlor 4	...	...		3.8						4.5		
atrazine 2/terbutryn 2	...	2.0 2.8		2.0		6.0						
atrazine 2/prometryn 2	...	5.0 2.8				7.0						
atrazine 2/"G34698" 3	...	...		4.3		6.3			7.5	7.8 3.5		
atrazine 2/cyanazine 2	...	...		4.8 1.5 2.0								
atrazine 2/chlortoluron 1	...	...				3.0				1.0		
atrazine 4/crop oil 1 gal	...	...		4.8		5.5		5.5		6.5		5.8
"G34698" 4	...	...		4.0		7.0				3.5		

TABLE 2: CONTROL OF SMOOTH WITCHGRASS WITH
DIRECTED SPRAYS
(EWRC 1 to 9 ratings)

Trial No. 20							
Weed stage—4 to 9 in. high							
Rainfall (in.) 2 wk—1.0							
Treatment (lb)	Grass Control						
	2 wk	4 wk	8 wk	12 wk			
ametryn 2.5 + crop oil 1 gal			1	2	2	2	
2,2-DPA 3.7 + crop oil 1 gal			9	9	5	3	
chlortoluron 4 + crop oil 1 gal			7	7	8	8	
atrazine 8 + crop oil 3 gal			9	9	9	9	
paraquat 0.5			5	7	7	9	
Untreated			9	9	9	9	

TABLE 3: CONTROL OF SUMMER GRASS
(EWRC 1 to 9 ratings at 4 to 6 wk)

Trial No				3	11	18	19	4	19	18	
Weed stage (leaf)				(pre-emergence)				1	1-2	2	2-3
Rainfall (in.) 2 wk				....	0.2	1.5	1.6	0.1	0.2	0.1	0.1
Rainfall (in.) 4 wk				....	2.5	1.7	1.1	2.5	1.3	1.1	
Treatment (lb)											
atrazine 2				....	6.0	3.0		9.0			
atrazine 4				....		2.5		9.0	7.0	8.0	
atrazine 2/alachlor 2				....			3.5			5.3	
atrazine 2/propachlor 4				....	2.0	1.0	2.8	2.0			
atrazine 2/prynachlor 4				....			1.3	2.0			
atrazine 2/terbutryn 2				....	3.3	1.0	7.0	5.3			
atrazine 2/prometryn 2				....	4.7	1.0		5.7			
atrazine 2"‘G34698" 3				....					5.3	8.3	
atrazine 2/cyanazine 2				....			2.5				
atrazine 2/chlortoluron 1				....					5.5		
atrazine 4 + crop oil 1 gal				....					3.8		
"‘G34698" 4				....					7.3		

and "G34698" were inadequate, especially in soils of high organic matter such as the peaty loams. From the results of a single trial, chlortoluron did not appear as effective on summer grass as it was against smooth witchgrass.

BARNYARD GRASS

Pre-emergence

Table 4 shows a similar pattern of control to that obtained for the previous two grasses. Under dry conditions all treatments failed but where rain fell after treatment control was better. With the lack of sufficient rainfall within 2 weeks, results were not as good as those obtained from normal post-emergent sprays.

TABLE 4: CONTROL OF BARNYARD GRASS
(EWRC 1 to 9 ratings at 4 to 6 wk)

<i>Trial No.</i>	2	1	7	12
Weed stage (leaf)	(pre-emergence)			
Rainfall (in.) 2 wk	0.0	0.2	0.0	0.2
Rainfall (in.) 4 wk	0.6	1.3	2.5	0.5
<i>Treatment (lb)</i>				
atrazine 2	8.8		7.0	
atrazine 4	8.3	4.8	4.3	9.0
atrazine 2/propachlor 4	8.8	6.5	1.3	
atrazine 2/prynachlor 4				2.3
atrazine 2/terbutryn 2	8.5	4.8	4.3	5.0*
atrazine 2/prometryn 2	8.8	5.0	2.7	3.3*
atrazine 2/cyanazine 2				8.0*

*1 lb only of additional triazine.

Post-emergence

Table 5 shows excellent control obtained from 4 lb atrazine, with generally poorer results at lower rates. The addition of oil to lower rates may improve control, but is less effective than a higher rate of atrazine. Overall there was little difference between 0.5 and 1 gal rates of oil. An application of 1.6 gal/acre of a 12.5% w/v atrazine in oil emulsion (A3619) was no better than other treatments at an equivalent 2 lb rate of atrazine but slightly better at 3 lb.

TABLE 5: BARNYARD GRASS (POST-EMERGENT)

<i>Trial No.</i>	2	5	6	1
Weed stage (leaf)	2-3	2-3	2-3	2-4
Rainfall (in.) 4 wk	0.6	3.8	3.8	1.1
<i>Treatment (lb)</i>				
atrazine 2			8.5	
atrazine 2 + w.a.		6.0	7.0	
atrazine 2 + oil ½ gal		4.8	6.0	
atrazine 2 + oil 1 gal	5.0	4.5		3.5
atrazine 3 + w.a.	4.3	4.8		2.0
atrazine 3 + oil ½ gal	3.8	3.5		
atrazine 3 + oil 1 gal	3.8	5.0		2.0
atrazine 4 + w.a.	1.3			1.5

CROWFOOT GRASS AND BRISTLE GRASS

These were separately present in 2 trials and results are shown in Table 6. Although atrazine applied alone gave generally poor control of both grasses, mixtures with propachlor were very good. Other triazine mixtures gave very good control of bristle grass but not of crowfoot grass.

COUCH

In trial 10, applications were made to actively growing couch with leaves 4 to 6 in. long and covering 20% of the area. Table 7 shows the degree of couch control to be in direct relation to the rate of atrazine.

TABLE 6: CONTROL OF ANNUAL GRASSES
(EWRC 1 to 9 ratings at 6 wk)

					Crowfoot Grass	Bristle Grass
Trial No.	....	....	....	....	3	11
Weed stage	....	....	....	....	pre-emergence	1 leaf
Rainfall (in.)	2 wk	....	....	....	0.2	1.5
Rainfall (in.)	4 wk	....	....	....	2.5	
<i>Treatment (lb)</i>						
atrazine	2	....	....	....	9.0	6.0
atrazine	4	....	....	....		4.0
atrazine	1/propachlor	3	....	....	2.3	2.0
atrazine	2/propachlor	4	....	....	1.7	1.0
atrazine	2/terbutryn	2	....	....	7.0	2.0
atrazine	2/prometryn	2	....	....	8.0	2.0
atrazine	2/GS14254	2	....	....	7.5	3.0

TABLE 7: CONTROL OF COUCH

<i>Treatment (lb)</i>					<i>Couch Control</i>		<i>Grain yield</i>
					6 wk	5 mth	(bu/acre)
atrazine	4	+	w.a.	....	3.0	1.5	172
atrazine	3	+	oil 1 gal	....	4.0	2.0	166
atrazine	1	+	oil 1 gal	....	6.0	8.0	157
Hand-weeded control	..	....	....	....	1.0	1.0	161
Untreated control	..	....	....	....	9.0	9.0	150

CROP TOLERANCE

Anilides

No effect was observed from either pre- or post-emergence applications of all 3 materials including emulsifiable formulations of alachlor and prynachlor.

Triazines

Methylthio triazines such as terbutryn are too phytotoxic as post-emergent applications and consequently are restricted in their time of application. Pre-emergent applications have sometimes given rise to slight chlorosis, especially under wetter conditions, but the crop recovered and showed no yield depression. However, considerable damage occurred in trial 11 on sweet corn. Generally, prometryn appears more selective. There were only slight symptoms of effect with no yield suppression from post-emergent applications of "G34698" but cyanazine caused considerable yellowing and stunting with consequent lower yields.

Urea

Although considerable yellowing of the crop occurred from early post-emergent applications of chlortoluron, grain yields were not different from standard treatments.

Oil

The addition of 1 gal oil to atrazine at times gave a slight scorch or yellowing but the crop quickly recovered and yielded well. In trial 9, 2 gal/acre of various proprietary orchard and crop oils was well tolerated by maize and most effects had disappeared by four weeks.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the assistance of M. R. Crooks and D. D. McPhail in carrying out the trial work, G. R. Cassels for statistical analyses of grain yields and the co-operation and interest of many growers including R. D. Wallace (Cambridge), B. Holmes (Pokeno), A. Cameron (Gisborne Mills Ltd.) and M. Dods (Gisborne) on whose properties most of the trials were situated.

REFERENCE

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