CONTROL OF SUMMER GERMINATING ANNUAL GRASS WEEDS IN MAIZE WITH OIL SUSPENSIONS OF ATRAZINE

E. A. UPRITCHARD and R. W. NAISH

Ivon Watkins-Dow Ltd, New Plymouth.

Summary

A liquid formulation of atrazine as a suspension in a penetrant non-phytotoxic emulsifiable paraffinic oil increased the herbicidal activity of atrazine when used alone or in mixture with propachlor wettable powder for control of *Digitaria*, *Panicum*, *Setaria* and *Echinochloa* species in maize. Mixtures of atrazine and propachlor were more effective than atrazine alone for control of these grass weeds.

INTRODUCTION

Since its introduction in 1956, many authors both in New Zealand and overseas have reported on the efficacy of atrazine for weed control in maize. Generally adequate to excellent control of annual broadleaf weeds has been obtained with wettable powder formulations. However, where germinating grass weeds have been present, particularly *Setaria* and *Panicum* species in the U.S.A., and *Digitaria*, *Setaria* and *Panicum* species in New Zealand, control of these genera has not been acceptable unless applied at weed emergence, when useful control may be obtained.

Echinochloa crus-galli has been adequately controlled by atrazine alone provided application is made before seedlings reach the 5 to 6 true leaf stage (2.5 cm high) (Woon 1971).

The addition of a non-ionic surfactant (0.5%) has been widely recommended for post emergence use with atrazine. More recently the addition of a non-phytotoxic crop oil at 10 litres/ha. has gained acceptance in New Zealand. Cumberland *et al* (1970) concluded that the addition of spraying oil reduces the amount of atrazine necessary while Patterson (1971) found that the addition of oil gave some improvement for post emergent control of *Panicum dichotomiflorum*.

Commercially in New Zealand, atrazine is used alone only for broadleaf weed control. For grass weeds atrazine is normally used in mixture with a wide variety of herbicides for both pre and post emergent application. The most common recommendation for weed control in maize in New Zealand include post emergence applications of atrazine with either propachlor or alachlor applied within 14 days of planting. Prynachlor and butylate may also be recommended. Mitchel (1970) outlined the advantages of using mixtures primarily to improve the spectrum of weed control, and also to reduce soil residues.

This paper presents results from eight typical maize trials comparing the efficacy of atrazine as a wettable powder formulation and as an oil suspension formulation in combination with propachlor wettable powder for control of annual grass weeds.

RESULTS

Results of grass weed control for eight trials are presented in Table 1.

	Dsan		3-4		0-2		0-1	
	2-3		2	8	2	9	3	8
	3	9						
1.8								
4.0	82	65					56	13
1.4								
2.0	84	67					36	0
3.0								
1.4+4					96	63		
1.6+4					89	62		
1.8+4							80	51
2.0+4	92	64	81	57				
1.0+4								
1.2+4					91	68		
1.4+4					94	62		
1.5+4	98	84	84	70	95	62	90	61
3.0+4								
—	8	0			10	0	15	8

able 1:—

Plant — Interval between planting and treatment

Moisture — Moist = 15-20%; Wet = Field capacity

Days — Days elapsed to first significant rain after treatment

ant Weeds —

Deer — *Digitaria sanguinalis*

Crops — Herbicides

406		407	409	076	192
2 Dec	10 Dec	8 Dec	8 Dec	24 Nov	24 Nov
8	16	14	14	14	22
22%	—	21%	17%	10%	14%
Wet	Moist	Moist	Moist	Moist	Wet
55 mm	0	0	2 mm	15 mm	66 mm
1	10	11	11	2	4
Pspp	—	Pspp	Dsan	Dsan	Dsan
Dsan	—			Sgla	
0-1	2-3	0-3	1-2	1-2	1-5
3 8	2 7	4 7	4 7	2	9 12
		20 10			
		30 20			65 248
90 63	50 28	60+ 40	95 85	77	
	58 35	60+ 40	75 65		
90 75	73 45	65+ 60	98 85	82	60 259
		60+ 55			90 464
0 0		0 0	0 0	0	0 100

*LSD 5% = 48; 1% = 65; CV% = 16

+ Propachlor applied at 4.5 kg/ha.

**LSD 5% = 106 1% = 160 CV% = 20

METHODS

All trials except 076 (Hastings) and 192 (North Taranaki) were in the Waikato area, and were laid in November and December 1971 between 7 and 22 days after planting. Sites were selected on the basis of having heavy grass weed infestations.

Significant populations of broadleaf weeds did not occur.

Small plot trials were laid using a precision sprayer applying 250 litres/ha at 200 kPa on plots of 10 m². Trial 192 was replicated twice and the rest were replicated four times. Soil moisture at application was determined by oven drying samples. Soil organic matter was determined using a modified method of Walkley and Blake (Metson, 1971).

Weed control was assessed visually by two or more independent observers using a 0-10 rating scale where 0 = 100% ground cover of grass weeds and 10 = bare ground. Results are expressed as % removal of grass weeds.

In trial 405, yield was assessed by shelling 20 randomly picked cobs per plot and in trial 192 total fresh weight of 10 plants per plot was taken. Results are expressed as a % of control where control = 100.

DISCUSSION

The supplementary effect of mixing atrazine and propachlor for post emergence grass weed control is clearly demonstrated. Atrazine alone up to 4 kg/ha gives variable post emergence grass control, and propachlor alone up to 4 kg/ha is accepted as having little post emergence effect. Activity of atrazine can be increased by mixing or formulating with spraying oils but combination treatments are essential for reliable grass weed control.

These results agree with others who have found soil moisture at application (Fellowes and Scherp, 1971) and overhead moisture following application (Akhavain *et al.*, 1970) are the limiting factors in successful control of grass weeds. While dry soil was not experienced in this series, and interpretation is complicated by the variable age of the weeds, grass control is least effective when no rain has fallen soon after treatment of larger weeds (trials 405 late, 406 late and 407). Minimum rainfall required is about 6.5 mm for larger grasses (trial 403 early) but the requirement is less if weeds are smaller (trial 409).

Soil organic matter (even up to 37%) has not had a marked effect on weed control which supports the conclusion of Fellowes and Scherp (1971) that moisture is a more important factor. In the Waikato maize growing area, few soils are below 10% O.M., and probably average about 15%. On the lighter alluvial loams of Hawkes Bay and Gisborne, organic matter is more in the range of 6 to 10%.

These results support those of several authors in earlier Proceedings (Cumberland *et al.*, 1970, 1971; Mitchel, 1970; Patterson, 1971; Woon, 1971) and present some further considerations for future workers.

CONCLUSIONS

1. There is a highly significant ($n = 11$, $r = 0.77$) correlation between the degree of weed control and the final maize yield.
2. Treatment within 10 days of planting gives the most reliable weed control and highest yields, but treatment within 21 days of planting still gives significant yield increases compared with untreated maize.
3. Generally weed control is improved if moisture follows soon after treatment, particularly if application is delayed beyond the two true leaf stage of the grasses.

4. There appears to be no marked difference in susceptibility to atrazine/propachlor mixtures between *Panicum*, *Digitaria* and *Setaria* species. *Echinochloa crus-galli* is known to be more susceptible than these species.
5. Oil suspension formulations of atrazine are considerably more herbicidally active than wettable powder formulations, particularly when used in combination with propachlor.
6. Mixtures of 1.5 kg/ha atrazine in oil suspension plus 4 kg/ha propachlor will give excellent annual grass weed control when applied at early post emergence. Under ideal moisture conditions the rate of atrazine oil suspension may be decreased to 1 kg/ha, but this minimum rate is not consistently reliable for commercial recommendation. For the wettable powder formulation of atrazine at least 1.75 kg/ha is commercially recommended in mixture with propachlor.
7. Residual weed control is reduced on heavy peat soils (up to 37% O.M.) but there was little difference in the range from 10 to 25% O.M.
8. Soil moisture and following rainfall are suggested as being the main factors affecting grass weed control, best results being obtained if soil is moist at application, and moisture occurs or is applied within 7 to 10 days of application.

ACKNOWLEDGEMENTS

Thanks are extended to farmers and contractors who co-operated in the trial series and to the Research Staff of Ivon Watkins-Dow Ltd. who carried out the trials and soil analyses.

REFERENCES

- Akhavain, A. A., Pollack, T., Olsen, P. D. and Appleby, P. A., 1970. Effectiveness of herbicide combinations for weed control in corn. *Western Soc. of Weed Sci. Res. Prog. Report*: 84.
- Cumberland, G. B. L., Matthews, L. J. and Honore, E. N., 1970. Weed control in maize. *Proc. 23rd N.Z. Weed and Pest Control Conf.*: 31.
- Cumberland, G. B. L., Honore, E. N. and Farrell, C. A., 1971. The importance of weeds and the correct timing of weed control measures in maize crops. *Proc. 24th N.Z. Weed and Pest Control Conf.*: 115.
- Fellowes, R. W. and Scherp, L. A., 1971. Control of annual grass weeds in maize. *Proc. 24th N.Z. Weed and Pest Control Conf.*: 105.
- Metson, A. J., 1971. Methods of chemical analysis for soil survey samples. *N.Z. Govt. Printer, Wellington*.
- Mitchel, W. J. P., 1970. Pre and post emergence weed control in maize. *Proc. 23rd N.Z. Weed and Pest Control conf.*: 37.
- Patterson, T. M., 1971. Control of grass weeds in maize. *Proc. 24th N.Z. Weed and Pest Control Conf.*: 90.
- Woon, G. W., 1971. Herbicides for the control of grass weeds in maize. *Proc. 24th N.Z. Weed and Pest Control Conf.*: 109.

Proc. 27th N.Z. Weed and Pest Control Conf.