GRASS WEED CONTROL IN MAIZE WITH TRIDIPHANE HERBICIDE

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SUMMARY

Field trials conducted over 5 years evaluated the new oxirane herbicide tridiphane in mixture with atrazine for pre- and post-emergence grass and broadleaf weed control in maize and sweet corn. Application of tridiphane 1 kg ai/ha with atrazine 1.6 kg ai/ha either pre- or post-emergence provided comparable annual grass and broadleaf weed control to standard pre-emergence herbicides. Post-emergence activity was enhanced by addition of a crop oil. Best post-emergence annual grass control was obtained when tridiphane/atrazine was applied before grasses reached the first tiller stage.

INTRODUCTION

Tridiphane (Dowco 356) is a new oxirane herbicide providing pre- and post-emergence control of annual grasses in maize and sweet corn. It has a two-fold mode of action; primarily by inhibition of meristematic tissue development in grass weeds, but also by inhibition of the enzyme system glutathione-S-transferase which is involved in the detoxification of triazines in a broad range of grass weeds (Ryder *et al* 1983). Tridiphane is low in acute oral and dermal toxicity to mammals and birds but is moderately toxic to fish and aquatic invertebrates.

Tridiphane is formulated as an emulsifiable concentrate (XRM-4710) containing 480 g/litre active ingredient. Typically it is applied in tank mixture with atrazine to provide both broad spectrum control of grass and broadleaf weeds, and to utilise its effect of inhibition of atrazine detoxification.

This paper presents results from 23 small plot field trials and 18 large scale field assessments over five seasons between 1978 and 1984.

METHOD

Field trials were conducted on growers' properties over five seasons in typical soils of the Waikato, Hawkes Bay and Taranaki regions. Soil organic matter contents were mainly in the range 6 - 12% with a few trials in peat and peat loams of 20 - 30% D.M. Initial small scale trials were in randomised complete block designs of three replicates for weed control assessments and four to six replicates for yield measurements. Individual plot size was usually 3 x 10 m. Treatments were broadcast applied with a backpack precision sprayer and hand held boom fitted with TeeJet 730.154 fan tips operated at 200 kPa and delivering 200 litres/ha. Large scale trials were unreplicated, part paddock treatments where applications were made by the farmer or contractor using conventional boom spray equipment. Application was made alongside the farmer's choice of standard herbicide treatment for comparison.

Pre-emergence treatments were applied before either weed or crop emergence. Post-emergence applications were made at the stages of grass growth indicated in Table 2. A non-phytotoxic emulsifiable paraffinic oil (Shell Sunspray Oil) was included in all post-emergence treatments of tridiphane plus atrazine.

Evaluations of weed control were made at the times indicated in Tables 1 and 2. Data is recorded as the mean visual assessment of at least two individual observers expressed as percent control.

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TABLE 1: Mean percent annual grass control with pre-emergence treatments.

Herbicide Treatment	Rate kg ai/ha	Percent grass control —weeks after treatment	
		5	8 +
tridiphane/atrazine	0.5 + 1.6	66 (5)	42 (5)
	0.75 + 1.6	76 (5)	44 (5)
	1.0 + 1.6	84 (5)	81 (3)
	1.5 + 1.6	87 (4)	90 (2)
	2.0 + 1.6	89 (4)	91 (2)
alachlor/atrazine	2.0 + 1	86 (3)	72 (2)
	3.5 + 1.6	94 (2)	88 (2)

() Number of observations in mean.

RESULTS AND DISCUSSION

Table 1 summarises mean annual grass control of summer grass (*Digitaria sanguinalis*), barnyard grass (*Echinochloa crus-galli*), or smooth witchgrass (*Panicum dichotomiflorum*) in five small plot pre-emergence trials.

Tridiphane at 1 - 1.5 kg ai/ha with atrazine (Actazine 5A) 1.6 kg ai/ha provided equivalent grass control to the standard alachlor (Lasso) 3.5 kg ai/ha plus atrazine 1.6 kg ai/ha. Tridiphane 0.75 kg ai/ha with atrazine 1.6 kg ai/ha initially provided complete control of emerging grasses but further germinations occurred within 3 weeks of treatment contributing to the low percent control eight or more weeks after treatment. Grass control in six field assessments was similar; tridiphane 0.75 kg ai/ha plus atrazine 1.6 kg ai/ha provided 70% grass control 6 weeks after treatment compared to control with the standard pre-emergence herbicide treatments. Grain yield from three of these trials also showed no significant differences between tridiphane/atrazine and the standard herbicide treatments. Smooth witchgrass and summer grass appeared less susceptible than barnyard grass and were first to emerge as residual activity of the herbicide declined.

Weed control data from the 18 small plot post-emergence trials are summarised in Table 2.

TABLE 2: Percent grass control with tridiphane/atrazine mixtures 6 - 8 weeks after treatment and at two application times.

Growth stage at treatment	tridiphane* kg ai/ha	Percent grass control					Standard**
		0	0.5	0.75	1.0	1.25	
1 - 4 leaves	Grass species:						
	barnyard grass	60 (15)	93 (15)	94 (1)	96 (1)	-	91 (4)
	bristle grasses (<i>Setaria</i> sp)	38 (1)	64 (5)	71 (4)	-	-	84 (3)
	summer grass	32 (3)	81 (15)	59 (1)	84 (1)	-	78 (4)
	smooth witchgrass	-	-	74 (3)	88 (2)	92 (1)	45 (1)
1 - 3 tillers	barnyard grass	61 (9)	81 (9)	77 (1)	76 (1)	-	48 (3)
	bristle grasses	57 (1)	67 (4)	72 (6)	-	-	-
	summer grass	28 (3)	39 (9)	37 (1)	55 (1)	-	33 (3)

() Number of observations in mean

** Alachlor 3.5 kg ai/ha + atrazine 1.6 kg ai/ha except for smooth witchgrass where metolachlor 2.5 kg ai/ha plus atrazine 1.75 kg ai/ha used.

* All tridiphane treatments included atrazine 1.6 kg ai/ha and crop oil 3 - 8 litres/ha.

For simplicity only data showing residual grass control (6 - 8 weeks post treatment) are shown. With applications made after grass weeds had reached 1 - 4 leaves, addition of tridiphane at 0.5 - 0.75 kg ai/ha to atrazine 1.6 kg ai/ha plus crop oil provided marked enhancement of control, especially of barnyard grass and summer grass, though 1.0 kg ai tridiphane with atrazine and crop oil appeared necessary for control of all important annual grasses. With later applications, at the onset of tillering of grasses, tridiphane 0.5 - 1 kg ai/ha with atrazine 1.6 kg ai/ha plus oil did not provide acceptable grass control, though it was more effective than the standard treatments. The latter were applied post-emergence contrary to label direction as a reference treatment only.

Tridiphane 0.75 kg ai/ha and atrazine 1.6 kg ai/ha with crop oil were applied post-emergence in 12 field assessments. In nine of these, grasses were at 1 - 4 leaf stage at treatment; the remainder were salvage treatments over crops previously treated with pre- or PPI herbicide mixtures, and regenerated grasses had 1 - 3 tillers when sprayed. The tridiphane/atrazine mixture in the nine assessments with small weeds, provided a mean of 68% grass control 6 weeks post treatment compared with 76% obtained with the standard pre-emergence treatments. Smooth witchgrass was the least well controlled. Three of the field assessments were harvested and no significant difference in grain yield was apparent between herbicide treatments. Salvage treatments were unsuccessful — tridiphane/atrazine provided tillered grass control ranging from only 10 - 60%.

Overall, the post-emergence trial results show that there is a relatively narrow "window of application" for acceptable grass control with tridiphane/atrazine mixtures; viz. from grass emergence to development of first tiller.

Crop oil was added in all post-emergence treatments (Table 2) because initial trials showed up to 40% enhancement of grass control (A. Zorner unpublished). Radioactive labelled uptake studies, also demonstrated greater uptake of tridiphane when applied to giant foxtail (*Setaria faberi*) foliage in combination with 3 - 4 litres/ha crop oil. In local trials crop oil was usually added at a rate of 3 litres/ha and occasionally at 6 or 8 litres/ha. Enhancement was least evident on barnyard grass, but pronounced on summer grass when 3 litres/ha crop oil was optimal and on smooth witchgrass for which 6 - 8 litres/ha crop oil was required. The data for individual grass species (Table 2) also suggest that response to the tridiphane/atrazine mixture was species dependant with barnyard grass being most susceptible and smooth witchgrass most resistant; other species were intermediate. This may be due to the greater ability of smooth witchgrass and summer grass to metabolise atrazine than barnyard grass (Jensen *et al* 1977) thus requiring a higher dosage of tridiphane for control. It may also be due to differing ease of uptake of tridiphane by individual grass species as indicated by crop oil requirements outlined above.

Although tridiphane applied alone will provide only limited broadleaf control the mixture with atrazine provided near complete broadleaf weed control in all trials. Several field assessment sites had established atrazine resistant fathen (*Chenopodium album*) populations. The tridiphane/atrazine mixture provided partial control and surviving plants were severely stunted and did not become competitive in the crop.

Apart from minor initial chlorosis and leaf tip burn in some trials the tridiphane/atrazine mixture was well tolerated by both maize and sweet corn. In seven maize and three sweet corn trials harvested at maturity there was no significant differences between the yield obtained with the tridiphane/atrazine mixture and standard herbicide treatments or hand weeded control (one trial) even with a tridiphane rate of 1.92 kg ai/ha.

CONCLUSIONS

Tridiphane 0.75 kg ai/ha plus atrazine 1.6 kg ai/ha, provided adequate grass weed control in pre- and early post-emergence applications but lacked residual activity. In post-emergence use best weed control was obtained when application was made before grasses developed the first tiller. Later applications resulted in insufficient grass control. Addition of a crop oil enhanced tridiphane activity on all annual grasses. Three litres crop oil/ha appeared optimum for summer grass whereas eight litres/ha was required

for smooth witchgrass. Although atrazine-resistant fathen was not completely controlled the long term suppression obtained warrants further evaluation.

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