HERBICIDE TOLERANCE OF ESTABLISHED TALL FESCUE AND PHALARIS SEED CROPS

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SUMMARY

The tolerance of established tall fescue (*Festuca arundinacea*) and phalaris (*Phalaris aquatica*) seed crops to a range of herbicides for the control of grass weeds including ryegrass (*Lolium perenne*) and volunteer seedlings was studied over 3 years. In four trials in the Manawatu tall fescue showed good tolerance to atrazine (2.0-4.5 kg/ha), simazine (2.0-4.0 kg/ha), diuron (2.0-6.0 kg/ha) and metribuzin (1.0-1.5 kg/ha). Terbacil at 0.75 kg/ha was safe, but 1.5 kg/ha caused severe injury. At Lincoln 1.5 kg/ha atrazine applied at different times, occasionally caused severe damage which was associated with little or no rain after application. Phalaris in two trials was tolerant to ethofumesate (1.0-2.0 kg/ha), atrazine (1.5-3.6 kg/ha) and diuron (3.0-4.5 kg/ha).

INTRODUCTION

Tall fescue (*Festuca arundinacea*) and phalaris (*Phalaris aquatica*) are now accepted as important forage species for drought prone regions in New Zealand. In addition turf tall fescues have become important in the USA and there is now considerable re-multiplication for export in Canterbury. In 1989/90 seed production areas included 447 ha of forage tall fescue; 1370 ha turf tall fescue and 106 ha of phalaris (Ministry of Agriculture and Fisheries (MAF), 1990).

Both tall fescue and phalaris seed crops can be harvested for six consecutive seasons in the New Zealand Seed Certification Scheme. The control of volunteer seedlings in these established crops is important, but no herbicides are registered for use in these species. However, diuron (1.75-3.5 kg/ha) and simazine (2.2 kg/ha) have been registered for use in established seed crops of these species in Oregon, USA (Lee 1979; Youngberg and Wheaton 1979).

This paper reports on herbicide tolerance trials to screen for herbicides suitable for use in established tall fescue and phalaris seed crops to control volunteer seedlings and grass weeds, including ryegrass which is a major cause of rejection from certification in tall fescue (Alan Johnson, pers. comm.).

METHOD

Tall fescue — Manawatu Trials

Three trials conducted in 1980, 1982 and 1983 examined the tolerance of established 'Grasslands Roa' tall fescue to a range of herbicides (Table 1). Herbicides were applied in 250 litres water/ha to plots 6 m² using a gas knapsack sprayer. Treatments were replicated four times.

These trials were conducted at the DSIR Aorangi Research Station on a Kairanga silt loam soil with herbicides applied from late April to late June in different years. In 1980, tall fescue stand injury and volunteer seedling control were visually evaluated and seed head numbers at harvest were recorded, while in the other two trials only seed yield was determined by hand harvesting 3.6 m², threshing, and cleaning the seed to a minimum 98% purity.

Another trial in 1982 (Table 3) examined ryegrass control in an 'S170' tall fescue sward using two herbicides applied on 5 May, to plots 4.5 m² at the DSIR Tiritea Research Area, on a Tokomaru silt loam soil. The treatments were replicated four times. A strip 8 cm wide x 2 m long was cut from each plot before application and 5

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TABLE 1: Effect of herbicides on 'Grasslands Roa' tall fescue seed crops in the Manawatu.

Herbicide	Rate (kg ai/ha)	Trial 1 Applied 24.4.80			Trial 2 Applied 28.5.82	Trial 3 Applied 27.6.83	
		Stand injury (%)	Seedling control (%)	Seed (heads/ m ²)	Seed yield (kg/ha)	Stand injury (%)	Seed yield (kg/ha)
		8 WAT	8 WAT			4 WAT	
untreated		0	0	155	665	0	505
diuron	2.0	0	0	315	875	—	—
(Karmex)	4.0	20	73	265	575	—	—
	6.0	42	67	260	—	—	—
atrazine	1.5	30	57	335	—	—	—
(Actazine 4A)	2.0	—	—	—	745	1	505
	3.0	35	100	260	—	—	—
	4.0	—	—	—	700	6	435
	4.5	48	100	80	—	—	—
simazine	2.0	—	—	—	725	0	480
(Simazole 5A)	4.0	—	—	—	780	0	550
terbacil	0.75	26	80	235	—	—	—
(Sinbar)	1.50	92	100	25	—	—	—
metribuzin	1.0	2	47	285	850	—	—
(Sencor)	2.0	20	85	230	790	—	—
	3.0	46	100	95	—	—	—
sethoxydim	0.05	—	—	—	—	3	520
(Alloxal-S)	0.10	—	—	—	—	10	593
	0.20	—	—	—	—	15	230
LSD 5%					NS		

(WAT = weeks after treatment)

months later samples taken from the regrowth were dissected into ryegrass, tall fescue, and other species, and botanical composition by dry weight was determined.

Tall fescue — Lincoln Trials

This trial examined the effect of three different times of application of atrazine and two combinations (Table 2) applied to a 15 month old stand at DSIR Lincoln on a light Templeton silt loam soil. Plots were 30 m², and treatments were replicated four times. Contaminant seed heads (mostly soft brome (*Bromus hordeaceus*) and some ryegrass) were counted and seed heads and seed yield determined. The carry over responses into the following year were also measured.

Phalaris

Two trials were conducted to examine the tolerance to herbicides (Table 4) of established 'Grasslands Maru' phalaris. These trials were at the DSIR Aorangi Research Farm, near Palmerston North on a Kairanga silt loam soil. In 1982 treatments were applied on 27 May to a 15 month old stand that had been grazed to 10-15 cm. In 1984 treatments were applied to the same stand on 14 June when phalaris was 20 cm tall (1 week after grazing) and volunteer seedlings were 5 cm tall at the four leaf stage. Plots were 6 m² (1982) and 11 m² (1984) and treatments were replicated four times. In 1982 plots were visually scored for vigour on 19 August and plant height measured on 1 October. In 1984 plots were defoliated and closed for seed production on 20 September and herbage dry matter yield determined.

In late September of both years urea was applied at 50 kg N/ha. Plots were harvested for seed in late January by cutting 3.6 m², belt threshing and cleaning to a 99% purity. Purity and germination of samples were determined by the MAF Official Seed Testing Station.

RESULTS AND DISCUSSION

Tall fescue

Over 3 years established tall fescue in the Manawatu had good tolerance to medium to high rates of diuron (2.0-6.0 kg/ha); atrazine (1.5-4.0 kg/ha); simazine (2.0-4.0 kg/ha); metribuzin (1.0-2.0 kg/ha); terbacil (1.50 kg/ha) and sethoxydim (0.05-0.10 kg/ha) (Table 1). Unacceptable stand injury occurred at higher rates of atrazine 4.5 kg/ha, terbacil 1.5 kg/ha; metribuzin 3.0 kg/ha, and sethoxydim 0.2 kg/ha. Low rates of sethoxydim (0.05-0.2 kg/ha) reduced grass seed head formation (Rolston *et al* 1985). Tall fescue does not have tolerance to sethoxydim, unlike *Festuca rubra* which is tolerant to rates of 15-30 kg/ha (Butler and Appleby 1986).

At Lincoln the tolerance of tall fescue was influenced by the time of application (Table 2). While applications in June and late August were safe, an early August application and all double applications produced no seed although damaged plants recovered fully the following year. Contaminants were reduced by at least 87%. The cause of atrazine damage in early August appeared to be associated with a lack of rain to wash the herbicide off the leaves into the soil. Atrazine on leaves is slowly absorbed resulting in crop damage. Growers have reported similar damage when atrazine was applied and no follow up rain occurred (L.G. Jones, Ashburton, pers. comm. 1982). Rainfall recorded in the 2 weeks following atrazine application was Manawatu 15.6 mm (1980), 64.5 mm (1982), 27.5 mm (1983); Lincoln 17.9 mm June 1987, 0.5 mm early August 1987, 7.5 mm late August 1987.

TABLE 2: Effect of time of application of atrazine (1.5 kg/ha) on 'Grasslands Roa' tall fescue at Lincoln.

Time of application	Seed yield (kg/ha)		Seed heads (m ²)	Contaminants (heads/m ²)
	1987	1988		
Nil	280	560	399	565
June	230	380	426	55
early August	0	920	0	0
late August	385	455	452	76
June & early August	0	1100	0	0
June & late August	0	780	0	0
LSD 5%	197		208	206

Ryegrass is slightly more susceptible to soil active herbicides such as atrazine and metribuzin than tall fescue (Table 3), probably because tall fescue is deeper rooted than ryegrass. However, none of the treatments can be regarded as giving satisfactory control of ryegrass, although they may suppress ryegrass sufficiently to reduce ryegrass seed content in tall fescue to the allowable maximum of 2% for Second Generation Certified Seed. To limit ryegrass seed in higher grades of seed (e.g. in basic tall fescue the maximum ryegrass allowed is less than 0.1%) both a careful selection of paddock (based on previous cropping history) and spot spraying of ryegrass with glyphosate is necessary.

TABLE 3: Effect of herbicides on ryegrass in S170 tall fescue swards after 5 months (% by dry weight).

Herbicide	Rate (kg ai/ha)	Ryegrass	Fescue
control		24.9	73.0
metribuzin	1.0	4.4	91.6
metribuzin	1.5	6.2	93.0
atrazine	2.0	12.3	87.3
atrazine	3.0	1.7	97.2
LSD at 5%		22.0	21.3

Ryegrass composition on a dry matter basis at application 5 May 1982 was 12%; tall fescue 87%.

TABLE 4: Tolerance of phalaris to herbicides.

Treatments	Rate (kg ai/ha)	Seed yield (kg/ha)		Crop vigour	Plant height ² (cm)	Herbage yield ³ (kg DM/ha)
		1982	1984			
control		693 a ⁴	350 ab	10.0 a	39.0 a	6863 a
ethofumesate	1.0	308 c	377 ab	8.0 b	38.8 a	6962 a
(Nortron)	2.0	560 b	386 ab	8.8 ab	35.5 a	5827 ab
atrazine ¹	1.5	535 b	321 b	8.5 b	37.3 a	4162 c
(Actazine 5A)	3.0	596 ab	432 a	7.6 b	35.0 a	3884 c
diuron	3.0	645 ab	405 ab	8.5 b	38.0 a	5110 bc
(Karmex)	4.5	653 ab	400 ab	8.0 b	35.5 a	4488 bc

¹ The rates used were 1.8 and 3.6, respectively in the 1984 trial.

² Visual assessment, 0-10 scale, where 10=no crop damage; 0=no growth of the crop.

³ Measured at closing in 1984 trial. Other parameters were measured in 1982 trial.

⁴ Numbers with no letter in common are significantly different ($P < 0.05$).

Phalaris

Phalaris had excellent tolerance to medium to high rates of ethofumesate (1.0-2.0 kg/ha), atrazine (1.5-3.0 kg/ha) and diuron (3.0-4.5 kg/ha) (Table 4). In both trials no chlorosis was seen following treatments. Low seed yields occurred with lower rates of atrazine and ethofumesate. In 1982 the control was hand weeded and seed yield was equal to the best herbicide treatments, while in 1984 with no hand weeding the seed yield of the control was equal to that at lower herbicide rates. As no other species were present, these results suggest that volunteer phalaris seedlings were significantly lowering seed yield. Similar results have been reported with cocksfoot (Rolston and Hare 1990) where control of volunteer seedlings resulted in increased seed yields.

While the herbicides depressed stand vigour and herbage yield at closing in mid spring (Table 4), there was no detrimental effect on seed yield. Seed germinations ranged from 88-92% (1982) and 90-96% (1984) and were not affected by herbicide treatments.

CONCLUSION

Established tall fescue and phalaris seed crops both have good tolerances to medium to high rates of a range of soil active herbicides. Crop damage may occur occasionally when there is a lack of rain to wash herbicides off the leaves into the soil.

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