Residual effects of Oxyfluorfen on the establishment of surface-sown pasture species

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Summary

The effects of four rates (18, 36, 54, 180 g ha^{-1} a.i.) of oxyfluorfen applied 2 and 14 days before surface sowing four pasture species were observed under glasshouse conditions. Establishment of *Trifolium subterraneum, Medicago sativa* and *Phalaris aquatica* was unaffected by rates up to 54 g ha^{-1} a.i. and establishment of *Dactylis glomerata* by rates up to 36 g ha^{-1} a.i., provided there was a 14 day interval between spraying and sowing. With a two day interval the only safe rate of oxyfluorfen for *T. subterraneum, M. sativa* and *P. aquatica* was 18 g ha^{-1} a.i; *D. glomerata* was unable to tolerate this rate.

Introduction

Oxyfluorfen (Goal® CT) was released in Australia in 1988 as an additive to glyphosate to improve rate of weed control and widen the spectrum of weeds controlled (Anon. 1989). Thus oxyfluorfen could increase the effect of glyphosate on weeds that are generally resistant, *Erodium* spp., *Geranium* spp., *Malva* spp., and *Urtica* spp. These weeds are widespread on non-arable land in New South Wales that is suitable for pasture improvement using aerial techniques (Campbell 1985). As high rates of oxyfluorfen provide long residual control of many weeds that germinate soon after spraying (Anon. 1989), it was necessary to examine the tolerance of commonly aerially-sown improved pasture species to oxyfluorfen.

Material and methods

Four pasture species (subterranean clover, *Trifolium subterraneum* cv. Karridale; lucerne, *Medicago sativa* cv. Pioneer 581; cocksfoot, *Dactylis glomerata* cv. Currie; phalaris, *Phalaris aquatica* cv. Sirosa) were surface sown in pots in a glasshouse at 25°C on fertile soil derived from basalt and the effects of four rates (Table 1) of oxyfluorfen noted on establishment. The recommended rate of oxyfluorfen for improving the effect of glyphosate on pasture weeds of 18 g ha^{-1} a.i. (Anon. 1989) was applied with 2×, 3× and 10× rates to measure the effect of possible overlapping when spraying. Ten seeds of each species were sown per pot and positions marked with coloured pins. Seeds of *T. subterraneum* were covered with sand because germination of such large seeds would not occur otherwise; the smaller seeds of the other species germinated uncovered. Two intervals between spraying and sowing were imposed to allow the herbicide a short, dry interval (two days with no simulated rain) and a longer wet interval (14 days with 89 mm of rain applied from a misting machine) in which to break down before germination of seeds and possible intake of herbicide. After sowing, 6 mm of simulated rain was applied per day for 14 days and then 3 mm per day for the remainder of the experiment to all treatments. Observations were made on symptoms of herbicide effect 18 days after sowing and on the percentage of seedlings to establish on day 43. There were four replications and the randomly distributed pots were moved at 3-day intervals to equalize rainfall.

Results

Fewer seedlings ($P < 0.05$) exhibited symptoms of herbicide effect and more seedlings ($P < 0.05$) established on treatments that had 14 days between spraying and sowing than on treatments that had a 2-day interval (Tables 1 and 2).

Establishment of *T. subterraneum, M. sativa* and *P. aquatica* on treatments with 14 days between spraying and sowing was unaffected by rates up to 54 g ha^{-1} a.i.; however *D. glomerata* could only tolerate 36 g ha^{-1} a.i. without depression (Table 2). On the 2-day interval treatments *T. subterraneum, M. sativa* and *P. aquatica* tolerated 36 g ha^{-1} a.i. but establishment of *D. glomerata* was depressed ($P < 0.05$) even at the lowest rate of 18 g ha^{-1} a.i.

Symptoms of oxyfluorfen effect were: for grasses, browning of the plumule tip and depression in growth rate; for leg-

Table 1. Percentage of seedlings that germinated and exhibited symptoms of herbicide effect 18 days after sowing.

Rate of oxyfluorfen (g ha^{-1} a.i.)	*T. subterraneum*	*M. sativa*	*D. glomerata*	*P. aquatica*
2 days between spraying and sowing				
18	7a	11a	47b	11a
36	48b	41b	86c	64b
54	47b	54c	100c	69bc
180	95d	100d	100c	86cd
14 days between spraying and sowing				
18	6a	0a	13a	0a
36	6a	0a	13a	5a
54	21a	6a	52b	17a
180	68c	67c	100c	95d
Control*	3a	0a	3a	8a

* Symptoms that resembled herbicide effect; due to overwatering, damping off or some factor pertinent to glasshouse conditions.
Values, within species, not followed by a common letter differ significantly $P < 0.05$.

Table 2. Plants established (percent of those that achieved radicle entry) 43 days after sowing.

Rate of oxyfluorfen (g ha^{-1} a.i.)	*T. subterraneum*	*M. sativa*	*D. glomerata*	*P. aquatica*
2 days between spraying and sowing				
18	100a	69a	74b	94a
36	85ab	59ab	59b	69b
54	76b	49ab	16c	63b
180	17c	12c	0c	0c
14 days between spraying and sowing				
18	100a	79a	100a	100a
36	100a	82a	100a	97a
54	91a	74a	74b	85a
180	85ab	31bc	13c	16c
Control	100a	72a	100a	100a

Values, within species, not followed by a common letter differ significantly $P < 0.05$.

umes, thickening and distorting of cotyledons and depression in growth rate.

Discussion

The results of this experiment indicate that oxyfluorfen is safe to use for the establishment of aerial sown pasture species provided there is an interval of 14 days between spraying and sowing. Under these conditions *T. subterraneum*, *M. sativa* and *P. aquatica* can withstand three times and *D. glomerata* twice the recommended rate which allows for overlaps in aerial application. As oxyfluorfen is virtually insoluble in water (0.1 ppm) and is strongly absorbed on soil it will not leach through the soil (Anon. 1983); the more water received the more active it is on plants (Anon. 1990). Thus the consistent application of water in this experiment maximized the effect of oxyfluorfen on establishing seedlings. On the other hand favourable conditions for plant growth may have allowed some plants to recover from symptoms of herbicide effect. Under the more stringent conditions in the field some or all these plants may not have recovered.

Oxyfluorfen is broken down by microbial action (Anon. 1990) but photodecomposition on soil is slow (Anon. 1983). Thus the warm moist conditions imposed in this experiment promoted fast breakdown. As aerial sowing of pastures is recommended for late autumn and winter (Campbell 1985) oxyfluorfen may break down more slowly in the field than in this experiment and thus a longer interval than 14 days between spraying and sowing may be necessary to overcome residual effects. In a field experiment near Mandurama, New South Wales that was sprayed with glyphosate and oxyfluorfen on May 10, 1990 and sown 34 days later, no residual effects ($P < 0.05$) of oxyfluorfen (18, 36, 72, g ha^{-1} a.i.) were recorded on the establishment of surface-sown *T. subterraneum*, *M. sativa*, *D. glomerata*, *P. aquatica* and *Festuca arundinacea* (M.H. Campbell, unpublished data).

References

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