THE EFFECT OF PASTURE TOPPING ON WEED CONTROL AND HERBAGE PRODUCTION AND SEED SET OF SUBTERRANEAN CLOVER

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Summary. The effect of glyphosate and paraquat applied at low rates in early and late spring (pasture topping) on weed control and the productivity and seed set of recently sown subterranean clover was examined. Both herbicides significantly reduced the productivity and seed set of the clover compared to a control plot treated with fluazifop. Clover regeneration in the following year was related to seed set. It was concluded that pasture topping would be a worthwhile practice when there is a large bank of residual seed, or when the paddock will be cropped the next season. Other options such as earlier application of higher rates of paraquat may be preferable where it is desirable to increase the clover vigour and seed set in the year of treatment.

INTRODUCTION

The cereal crop-clover ley system relies on a vigorous legume component to increase soil nitrogen levels and the quality of feed available to livestock. It is also desirable to keep the proportion of grass relatively low to minimise the carryover of fungal diseases such as "take-all" and to reduce grass weeds in the following crop (3). The annual grass weeds which are most likely to occur in southern Australia include annual ryegrass, *Lolium rigidum*, barley grass, *Hordeum* spp., brome grass, *Bromus* spp. and silver grass, *Vulpia* spp. (4). A number of herbicides are being used to reduce the weed content of pastures and in some cases to increase the proportion of legume. The terms used to describe the various techniques include spray topping, pasture topping and winter cleaning, depending on the time of application and the herbicide used (1). The experiment reported here was intended to evaluate the effect of two herbicides commonly used for pasture topping, applied in early and late spring, on clover growth and seed set and subsequent clover regeneration. The effect of the herbicides on productivity and regeneration of the annual grasses was also measured.

METHODS

A grass dominated paddock was cultivated to produce a fine seedbed. Seed of two varieties of subterranean clover, Woogenellup and Nungarin, was sown by hand into plots 1x5 m at a rate of 20 kg/ha on 1 May 1984 and harrowed lightly. Molybdenum superphosphate was applied at 250 kg/ha to the surface at sowing. A randomised split plot design was used with four replications; herbicides were the main plots and clover cultivars were the sub plots.

Two herbicide treatments were applied, paraquat (110 g/ha) and glyphosate (126 g/ha) in early (29.8.84) and late (7.10.84) spring. For comparison purposes, one plot was left unsprayed while another sprayed with fluazifop (212 g/ha) 12.7.84 to remove most grass competition.

Herbage production of the clover and grasses was measured on 20 October 1984, 13 days after the last spray application and 3 months after the fluazifop was applied. The various grass species present were measured on 26 October 1984, and presented as a percentage of total grass biomass.

Clover seed yield was determined by excavating strips of soil 2x0.1 m to a depth of 2 cm. In the following autumn, the number of clover plants

regenerating was also measured for each treatment. Herbage measurements were taken in the following year (20.8.85) to determine the yield of capeweed, ryegrass, barley grass and clover.

RESULTS AND DISCUSSION

The clover density measured in July prior to herbicide application was similar on all plots of the same variety, although plots of Nungarin were denser (303 plants/m^2) than those containing Woogenellup (173 plants/m^2). This difference is most likely due to the smaller seed size of Nungarin. There was no difference in the density of grass in the various treatments prior to herbicide application. Herbage present on the plots on 20 October, 13 days after the last herbicide application, was significantly affected by the treatments applied as shown in Table 1.

Table 1. The effect of herbicides on herbage production (kg DM/ha) measured on 20 October 1984

Treatment	Clover	Medic	Grass	Other	Total
Fluazifop	2880	514	1300	400	5096
Paraquat (early)	693	137	2950	690	4471
Paraquat (late)	989	25	480	2590	4053
Glyphosate (early)	385	70	1950	480	2880
Glyphosate (late)	665	58	2440	2740	5901
Unsprayed	145	73	4290	1270	7092
l.s.d. (P=0.05)	582	ns	429	852	1784

Clover yield was significantly greater in the fluazifop treated plots compared to the other herbicide treatments and the unsprayed plots. The yield of the grasses was suppressed by all the herbicide treatments and in the case of the "late" herbicide treatments, a large amount of dead grass was present and is shown under the "other" category in Table 1.

Table 2. The proportion of the various grass species (%) present 19 days after herbicide application.

Treatment	Grass species		
	Hordeum	Lolium	Vulpia and Bromus
Fluazifop	3.8	7.5	88.8
Paraquat (early)	47.5	40.0	12.5
Paraquat (late)	46.3	38.8	15.0
Glyphosate (early)	28.3	46.3	25.0
Glyphosate (late)	36.3	53.8	11.3
Unsprayed	37.5	50.0	12.5
l.s.d. (P=0.05)	11.0	10.2	12.4

Total herbage production was reduced by all the spray treatments except for glyphosate (late) compared to the unsprayed control plot. The proportion of the various grass species present was significantly affected by the spray

treatments as can be seen in Table 2. While fluazifop suppresed barley grass and ryegrass, the *Vulpia* and *Bromus* spp. were less affected and became the dominant grasses present.

The other herbicide treatments did not greatly affect the proportions of the various grass species present although the late applied herbicides had not sufficient time to be fully effective.

Table 3. The effect of herbicides on clover seed set (kg/ha) and subsequent regeneration (plants/m^2)

Treatment	Clover seed yield		Clover regeneration	
	Nungarin	Woogenellup	Nungarin	Woogenellup
Fluazifop	349	560	2015	1865
Paraquat (early)	177	190	1537	1443
Paraquat (late)	197	333	1981	1671
Glyphosate (early)	97	93	1376	1299
Glyphosate (late)	46	18	1576	427
Unsprayed	225	263	1426	1604
l.s.d. (P=0.05)	134		658	

Clover seed yield was suppressed by the glyphosate treatments, with all Pasture topping treatments setting significantly less seed than the fluazifop treated plots, (Table 3). Clover regeneration in the following year was good in all plots although greatest where fluazifop had been applied. In the year following spray application, total herbage production by late winter (20.8.85) was not affected by the previous years treatments (Table 2). However, the proportion of clover was highest in those plots where clover seed set and regeneration were greatest (Table 5).

Table 4. The effect of herbicides applied in the 1984 on the yield (kg DM/ha) of capeweed, ryegrass and clover in August 1985

Treatment	Herbage Production			
	Capeweed	Ryegrass	Sub Clover	Total
Fluazifop	179	256	2738	3173
Paraquat (early)	113	1047	1666	2821
Paraquat (late)	108	1008	2080	3196
Glyphosate (early)	221	682	1804	2707
Glyphosate (late)	971	1104	1417	3492
Unsprayed	22	622	1925	2569
l.s.d. (P=0.05)	291	547	468	-

The barley grass content of all treatments was low (5%) and this was not affected by herbicide treatment the previous year.

Table 5. The effect of herbicides applied in the previous year on the proportion (%) of clover, ryegrass and capeweed in the sward

Treatments	Pasture composition		
	Capeweed	Ryegrass	Clover
Fluazifop	1.25	13.8	85.0
Paraquat (early)	1.25	16.8	71.3
Paraquat (late)	3.75	17.5	67.5
Glyphosate (early)	6.25	18.5	71.3
Glyphosate (late)	21.25	30.0	46.3
Unsprayed	0.00	15.0	76.3
l.s.d. (P=0.05)	7.24	9.08	7.24

This experiment has shown that the use of selective herbicides such as fluazifop can significantly decrease competition from grasses and increase the growth and seed set of subterranean clover. It has also shown that suppression of grasses, by either selective herbicides or by pasture topping, will reduce the total amount of herbage available to livestock in the year of treatment.

In these experiments in which residual clover seed banks were low, the herbicides used for pasture topping to reduce grass seed production, did not increase clover seed set and in some cases reduced it. This was caused by spraying too close to flowering of the clover and the clover being unable to recover sufficiently to set seed. Reductions in burr production of medics have also been reported from pasture topping (5) as well as reductions in the vigour of subclover in the year of treatment (2). Where clover seed set is to be stimulated, winter cleaning with paraquat (spraying in winter well before flowering) may be a preferable option although reinvasion of weeds may be a problem and the cost is greater.

In other situations, such as in old pastures where there is a large bank of clover seed, the reduction in clover seed set in any one year as a result of pasture topping may be acceptable if it also significantlly reduces grass seed set and encourages a more vigorous clover stand to regenerate from residual seed. Where the paddock is to be cropped, the reduction in clover seed set is of less significance, providing the potential for grass weeds and disease carryover into the following crop is minimised by pasture topping.

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