ANNUAL GRASS AND BROADLEAF CONTROL IN PASTURES

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Abstract A number of herbicide combinations at different rates were applied in winter and evaluated for their effectiveness in controlling annual grass and broadleaf weeds in one annual and two perennial pastures in central western NSW during 1998. The most effective combinations that increased ($P<0.05$) subterranean clover and phalaris, were those based on MCPA, simazine and paraquat. Increases in application rate rarely resulted in a significant improvement. However, herbicides reduced DM production as assessed in mid-spring by 10-50% compared to the unsprayed control. Proposals to reduce this yield penalty are discussed. Chemical renovation of pastures is probably more cost-effective than pasture resowing, but it should always be considered only as the first step of an integrated pasture management program. Such a program seeks to maintain the improved status of the renovated pasture for as long as possible.

INTRODUCTION

The practice of replanting pasture in temperate Australia to replace degraded pastures is becoming increasingly uneconomic except in more favourable locations. Maintenance of a productive pasture base needs to explore other approaches for improving botanical composition and dry matter production. This process is essentially aimed at replacing the annual grass and broadleaf weed components of the pasture with legume and perennial grasses. Providing that the pasture has not degraded too far, and there are still sufficient plants of the replacement species still present, then these alternative approaches can be considered.

Herbicide application is a quick way of achieving change, and when combined in various mixtures, are extremely effective in reducing the incidence of the target species. However, care needs to be taken with this option, especially if ground cover of the replacement species is too low. The result can be bare ground for extended periods, ingress of unwanted species, and importantly for the landholder, a decline in forage supply over winter when feed is scarce.

Here we present data on the effectiveness of a range of herbicide mixtures for controlling annual grasses and broadleaf weeds in degraded subterranean clover/ phalaris pastures in central western NSW. We also emphasise the importance of the timing of herbicide application, and the need to integrate herbicide application with other management options for maintaining longer-term pastures.

MATERIALS AND METHODS

Three experiments comparing a number of herbicide combinations at different application rates for control of broadleaf and annual grass species were conducted in 1998 on degraded annual and perennial pastures in central western NSW. The annual pasture type comprised subterranean clover (*Trifolium subterraneum* L.), saffron thistle (*Carthamus lanatus* L.), vulpia (*Vulpia* spp.) and barley grass (*Hordeum leporinum* Link). The perennial pastures also included phalaris (*Phalaris aquatica* L.), variegated thistle (*Silybum marianum* L. Gaertn.), Paterson's curse (*Echium plantagineum* L.), capeweed (*Arctotheca calendula* (L.) Levyns) and annual ryegrass (*Lolium rigidum* Gaud.).

Herbicide combinations compared were based on MCPA amine (500 g L^{-1}), paraquat (200 g L^{-1}) and simazine (500 g L^{-1}). Combinations and rates of application of the commercial product (L ha^{-1}) for the perennial pasture sites were: MCPA + paraquat (1.0 + 1.0), simazine + paraquat (1.0 + 0.5, 1.0 + 0.75, 1.0 + 1.0), MCPA + simazine + paraquat (0.5 + 1.0 + 0.5, 0.75 + 1.0 + 0.75, 1.0 + 1.0 + 1.0).

At the annual site, additional herbicide combinations and rates were compared: MCPA (1.0), paraquat (0.75, 1.0), MCPA + paraquat (0.5 + 0.5, 0.5 + 0.75, 0.75 + 0.75), but the two highest rates of simazine + paraquat were not included. The same herbicide combinations had been applied at this site previously in 1996 and 1997 (primarily to reduce saffron thistle populations – Milne 1996, 1997, 1998), so results represent the cumulative effects of three annual applications.

Thus there was a total of 8 treatments at each perennial site, and 12 treatments at the annual site - including an unsprayed control at each site. Herbicides were applied to the annual site in late May 1998 and to the perennial sites in June 1998 with a hand held boom in 100 L water ha^{-1}. All species were well established and actively growing at the time of herbicide application. Pasture at the perennial sites was grazed down to 5-15 cm, while at the annual site, pasture was 5 cm high.

Botanical composition of the pasture was assessed on a dry matter (DM) basis from one quadrat per plot (1.0 m × 0.25 m). Plot size was 3 m × 10.5 m and treatments were replicated three times.

RESULTS

Annual pasture site The herbicide combinations at this site provided total control of saffron thistle (0.86 t ha^{-1} DM – 215 plants m^{-2} on the unsprayed control), and had a variable effect on the proportion of annual grasses in the pasture. The herbicide combinations that excluded simazine increased subterranean clover and decreased annual grass (Fig. 1) by controlling barley grass, but these proportions were mostly not different ($P<0.05$) from the unsprayed control (exception - paraquat at 1.0 L ha^{-1}). However, all simazine combinations increased the clover and decreased annual grass relative to the control ($P<0.05$), largely as a consequence of vulpia reduction. Importantly, while total DM was reduced on some of these treatments by up to 27% relative to the control, subterranean clover appeared to replace annual grass on an approximate 1:1 basis (Fig. 1).

Perennial pasture sites The general effect of the herbicide combinations at both sites was for the legume component to increase 7-11 fold and the annual grasses to decrease by 94-100% relative to the unsprayed controls (Table 1). These effects were significant at all reported rates and combinations. The proportion of phalaris in the pasture was also increased by herbicide application at both sites. But these increases were only significant at all rates of the MCPA + simazine + paraquat combination at both sites, and the two higher rates of the simazine + paraquat combination at the Gumble site.

Herbicide application reduced total DM by as much as 60% (mean = 52%) and 40% (mean = 31%) compared with the unsprayed control at Gumble and Cumnock, respectively. However, phalaris as a proportion of total DM where herbicide had been applied was 40-60% at Gumble compared with 20-40% at Cumnock. These percentages were considerably greater than the comparative values for phalaris on the unsprayed controls (10% and 1%).

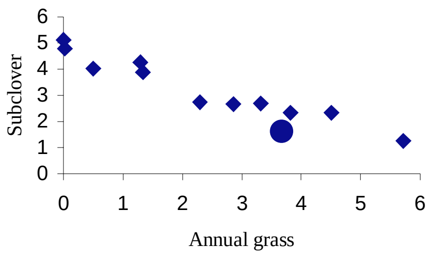

Figure 1. Effect of different herbicide combinations and application rates (see Materials and Methods) on DM production (t ha^{-1}) of subterranean clover and annual grasses measured 20 weeks after application. Each data point is the mean of 3 replicates. The unsprayed control is the larger data point

DISCUSSION

Data from the annual pasture site demonstrate clearly that once the broadleaf species are controlled, annual grasses can be replaced by subterranean clover. Providing that herbicide application occurs early enough in the season, and there is an adequate seed source, then substitution might be expected to approximate a 1:1 ratio as shown in Figure 1. Those treatments that resulted in almost 100% subterranean clover (MCPA + simazine + paraquat at the two highest rates) would be a useful preparation for a cropping program (increased fertility, reduced weed and disease incidence).

For the purposes of pasture renovation, an incomplete substitution would be more acceptable (MCPA + simazine + paraquat at the lowest rate, simazine + paraquat, paraquat at the high rate) leaving 0.5-1.3 t ha^{-1} annual grass and 4 t ha^{-1} legume. However, the net loss in DM over winter and early spring following herbicide application is of concern to landholders, even when the quality of available DM is expected to be substantially higher (greater % legume). This is because a DM loss of 20-30% in mid spring probably represents > 50% loss in late winter.

The dramatic response by the annual grass, legume

Table 1. Effect of herbicide combination and application rate on dry matter (DM) production (t ha^{-1}) of legume, phalaris and annual grass components at two perennial pasture sites in central western NSW.

Herbicide combination	Rate (L ha^{-1})	Gumble Legume	Gumble Phalaris	Gumble Annual grass	Cumnock Legume	Cumnock Phalaris	Cumnock Annual grass
Unsprayed control		0.43	1.54	14.04	0.51	0.13	10.15
MCPA (M) + paraquat (P)	1+1	3.62	3.23	0.48	4.46	3.78	0.37
Simazine (S) + paraquat	1.0 + 0.5	2.75	3.03	0.26	4.30	1.81	0.16
	1.0 + 0.75	3.73	4.77	0.03	5.35	1.70	0
	1.0 + 1.0	3.38	3.81	0.13	4.97	1.23	0.03
M + S + P	0.5 + 1.0 + 0.5	3.27	4.69	0.09	5.05	2.15	0.60
	0.75 + 1.0 + 0.75	3.13	5.03	0.07	5.01	2.78	0.22
	1.0 + 1.0 + 1.0	3.07	4.84	0.14	5.14	3.15	0.10
LSD (P=0.05)		1.17	2.22	1.84	2.03	1.62	1.41

(mostly subterranean clover) and perennial grass (phalaris) components to herbicide application is a clear indication of the important role that customised herbicide combinations can play in renovating degraded pastures. Increasing emphasis on sustainability issues (e.g. erosion, soil salinity and acidity) is highlighting the need to retain perennials in our pasture systems and if this can be achieved without resorting to resowing pastures, this is a positive step forward. Comparative per ha costs for resowing a perennial pasture and application of an MCPA/ simazine/ paraquat combination are approximately $200 vs. $25.

As with the annual pasture system, however, there is a large DM penalty, especially over winter. When considered on a paddock-by-paddock basis, where 1-2 paddocks on e.g. a 30-40 paddock farm might be managed this way, then the consequences of a DM penalty are less important. Alternatively, commencing herbicide management earlier in the pasture degradative process before the desirable species have declined to such low proportions, might be a useful approach to consider.

The application of appropriate herbicide combinations has resulted in rapid and significant changes in botanical composition from less desirable to more desirable species. This achievement however should be regarded only as the first step. It needs to be followed up by strategies that maintain the improved botanical composition for as long as possible. This will mean a change in the way the pasture is managed, since inappropriate grazing and pasture management probably were the main reasons leading to the pasture's degraded state in the first place. Simple practices such as allowing the perennials to reseed and providing opportunities for recruitment, ensuring nutrition is not limiting, and restricting seed production of annual grasses, may prove useful. Such practices are currently being evaluated.

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