GRAZING STRATEGIES TO INCREASE PERSISTENCE OF PHALARIS AQUATICA L. IN SUMMER RAINFALL AREAS OF TEMPERATE AUSTRALIA

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ABSTRACT
A grazing strategy of resting *Phalaris aquatica L.* pastures in spring-early summer (to increase the presence of flowering tillers over summer) and autumn (to allow bud and tiller development) markedly increased its persistence, compared with continuously grazed plots in a summer rainfall environment.

KEYWORDS
Phalaris, sheep, production, persistence, seasonal grazing

INTRODUCTION
Perennial grasses are required in temperate Australian pastures for year-round production and to reduce the risks of soil erosion, acidification and salinisation through their higher ground cover and deeper root systems. Rainfall in southern Australia is winter dominant, with dry summers at latitudes higher than 32°. As latitude decreases, however, the incidence of summer rain increases. In predominantly mixed cropping, sheep-cattle areas of northern inland New South Wales (30-31°S°, 148-152½E) rainfall is summer dominant, with 60% of the annual total (450-850 mm) occuring between November and March.

Sirosa, the main cultivar of phalaris sown, is a winter- active type with moderate to low summer dormancy. Pastures are grazed by both sheep and cattle at 8-12 sheep equivalents ha^{-1} and despite adequate rainfall and fertiliser inputs, the average life of sown stands is only 4-5 years, well below the 8-10 years required to achieve an economic return.

Species persistence in perennial grass pastures may be enhanced by timing periods of grazing and rest to coincide with key aspects of plant phenology such as seeding, bud development or seedling recruitment (e.g. Lodge, 1995). Both autumn and spring may be important times for these phenological events. However, summer rainfall may also affect phalaris since it favours tiller development, particularly in winter-active types. In summer, phalaris bud activity and new tiller formation can be reduced by the presence of flowering tillers, while tiller defoliation may reduce autumn, early-winter forage production by 55%, compared with summer rest (Berry and Hoveland, 1969; Hoveland, 1970).

This paper reports preliminary results (1993 to 1995) on the effects of continuous grazing and extended spring and autumn closures on the dry matter yield and basal cover of Sirosa phalaris in two phalaris/ subterranean clover pastures grazed by sheep near Tamworth, northern New South Wales.

METHODS
These studies were part of a network of 22 sites across southern Australia (Mason et al., 1997), with treatments standardised to compare continuous grazing with at least seven different seasonal closures (i.e. 13 weeks rest from grazing). This paper reports data from the continuously grazed treatments and plots closed in spring-early summer and autumn (extended spring-autumn closure). The latter treatment was designed to increase the presence of flowering tillers over summer and allow bud and tiller development in autumn.

The pastures studied were two 5 ha areas. One was sown in 1979 and the other in 1990 to a mixture of phalaris (cv. Sirosa) and subterranean clover (cv. Seaton Park). Both had been adequately fertilised since sowing and initial phalaris densities (spring, 1993) were around 9 plants m^{-2} at both sites. Plots (11 by 16 m) were communally grazed by dry sheep (Michalk and McFarlane, 1978), since the main aim was to investigate effects on pasture rather than animal performance. Stocking rates declined from a high level in spring 1993 (Table 1) to around 2 sheep ha^{-1} in spring 1995.

A dry-weight-rank method (Jones and Hargreaves, 1979) was used to estimate dry matter yield (kg ha^{-1}) of phalaris every six weeks from 10 quadrats (0.16 m^2) along a fixed transect in each plot. Phalaris basal cover was estimated in autumn and spring each year, from two permanent quadrats (1 m^2) in each plot.

RESULTS AND DISCUSSION
In both pastures, phalaris dry matter and basal cover decreased over time in continuously grazed plots and increased in the extended spring- autumn closures (Table 2). Excellent conditions in winter and spring, 1993 allowed a large accumulation of dry phalaris forage in the spring-autumn closures, compared with continuously grazed plots. These differences were apparent throughout the experimental period, despite extremely dry conditions and declining stocking rates. With dry conditions there was also little opportunity for seedling recruitment, despite seed production of around 100 kg ha^{-1} in the spring-autumn closures in 1993-94.

These data show the potential benefits of an extended spring and autumn closure for phalaris persistence in a summer rainfall environment. A strategy of resting pasture from grazing in spring, encouraged stem elongation and production of seed heads and resulted in the accumulation of dry matter over summer. Resting from grazing in autumn encouraged bud regeneration and development of new tillers. Further studies are required to examine the mechanisms by which these benefits occur and to reduce the closure times from whole seasons to those that more closely coincide with critical stages of phalaris phenology.

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Table 1

Monthly and long-term average rainfall and stocking rates at the 3 and 14-year-old phalaris grazing sites from spring 1993 to spring 1995

Month	Rainfall (mm)			Stocking rate (sheep ha^{-1})			
	Average	1993-94	1994-95	1993-94		1994-95	
				3	14	3	14
September	48	43	16	25.7[z]	22.0[z]	1.5	2.2
October	60	107	17	25.7	22.0	1.5	2.2
November	67	42	102	25.7	8.0	1.5	2.2
December	71	88	23	12.5	8.0	1.5	2.2
January	85	21	119	12.5	5.6	1.5	2.2
February	66	104	22	7.5	5.6	1.5	2.2
March	49	79	2	7.5	5.6	3.0	4.4
April	41	20	3	7.5	5.6	3.0	4.4
May	43	4	78	7.5	5.6	3.0	4.4
June	50	20	31	7.5	5.6	3.0	2.2
July	45	6	24	2.2	5.6	3.0	2.2
August	46	18	0	2.2	2.0	3.0	2.2

[z] Stocking rates in spring 1993 were doubled to reflect the increase that occurs with lambing ewes.

Table 2

Dry matter yield and percent basal cover of Sirosa phalaris at the start of spring and autumn each year in continuously grazed and extended spring-autumn closures (S-A) for pastures that were 3 years-old and 14 years-old when the studies started

	Dry matter yield (kg ha^{-1})		Basal cover (%)	
	Continuous	S-A	Continuous	S-A
3-year-old				
Spring 1993	500	550	4.0	4.8
Autumn 1994	450	1300	3.0	7.8
Spring 1994	500	900	3.5	4.5
Autumn 1995	220	700	0.5	3.5
Spring 1995	380	1050	0.8	4.8
14-year-old				
Spring 1993	1000	850	8.3	18.5
Autumn 1994	600	1000	17.8	12.0
Spring 1994	450	1350	21.3	24.3
Autumn 1995	270	950	7.8	15.0
Spring 1995	400	950	1.3	12.8