

Simulated time of break and emergence of annual species in a degraded perennial grass pasture

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Abstract

An experiment was conducted to examine the effect of time of break on the emergence of annual species in a degraded cocksfoot/phalaris pasture. Seasonal breaks were simulated under permanently fixed rain-out shelters by watering the plots with 100-110 mm on 7 April, 7 May, 4 June and 7 July in 1998. Seedling counts and Frequency score (%) of the perennial grasses were taken 2-3 weeks after each watering treatment. The seedling emergence of the C₄ annual summer grass, hairy panic, declined with time. In contrast, seedling emergence of subterranean clover and mouse-eared chickweed increased significantly over the period of measurement. The seedling numbers of the prevalent annual grasses (vulpia, annual ryegrass, soft brome and great brome) were unaffected by date of break. Overall, total seedling emergence increased with time but this largely reflected the influence of mouse-eared chickweed, without which the trend was not significant. Frequency of the perennial grasses was low (under 20%). Frequency decreased with later breaks for both species but this was significant for cocksfoot only.

Key Words

Pasture, Emergence, Break of Season, Cocksfoot, Phalaris

Introduction

In terms of botanical composition, improved pastures in medium to high rainfall areas of southern Australia are dominated by annual species (1). Timing and extent of germination is an important initial step in determining composition. Another key factor in determining composition is the timing of the 'break of season'. A break in south-eastern Australia can be loosely defined as the rainfall event that enables seed germination of the dominant cohort of cool season species that will eventually flower and set seed. Typically the break occurs between late March and late June in this region. Timing of the break is known to affect botanical composition (2, 3), early breaks favouring legume components and later ones favouring annual grasses. However, much of the data that these generalisations are based on is derived from comparisons of composition across years. By simulating the time of break, using watering under rain-out shelters in a single year (see also 4), it is possible to reduce some of the confounding of time of break with year. The experiment reported here was designed to investigate the effect of varying the time of break on emergence of annual species and regeneration of perennial species in a degraded perennial pasture.

Methods

The site chosen for the experiment was a pasture originally sown to cocksfoot (*Dactylic glomerata* L. cv. Currie), phalaris, (*Phalaris aquatica* L. cv. Sirolan) and subterranean clover (*Trifolium subterraneum* L. cv. Junee) in 1995. In spring 1997 it contained perennial grasses (cocksfoot and phalaris, 18%), *Vulpia* spp (16%), broad-leaved weeds (6%) annual ryegrass (*Lolium rigidum* L., 29%) and subterranean clover (25%). The experiment consisted of three blocks, each containing four (1.75 x 1.75 m) plots in a 2 x 2 arrangement separated by 0.5 m buffers. Each block was covered by a permanently fixed rain-out shelter (6 x 6 m), constructed of Laserlight² sheeting attached to a metal gable frame 1.2-1.5 m above ground level. This allowed a 1 m buffer between the plots and the uncovered pasture. Plots were watered with 100-110 mm over a 24 hour period through leaky pipe on 7 April, 7 May, 4 June and 7 July in 1998 to simulate time of break. There was no movement of water between plots and very little into the buffer areas. Frequency (%) of the perennial grasses and seedling counts were taken 2-3 weeks after watering treatment was imposed. A quadrat (1 x 1 m) divided into 100 even sized cells was used for frequency and

seedling counts. Seedling counts were made in 10 of the cells (0.1 m²) arranged diagonally across the quadrat. A frequency score of one was given for the presence of a phalaris or cocksfoot base within any one of the 100 cells (5). Data was analysed as a randomised complete block using Genstat 4.1.

Results

The results show that for most species time of break did not affect the density of germinated individuals (Table 1). Data for some species, represented by very low numbers, are not presented. The C₄ grass, hairy panic, was the only species for which emergence significantly declined with later breaks. There were only two species, subterranean clover and mouse-eared chickweed, for which emergence significantly increased with later breaks. In the case of subterranean clover, there was reduced emergence at the earliest date, while there was no significant differences between the later dates.

Table 1: Effect of time of break on seedling germination or frequency of major pasture species. Presence of superscripted letters indicate a significant effect of time of break. Means followed by the same letter are not significantly different (P > 0.05).

	7 April	7 May	4 June	7 July
Germination (seedlings/m ²)				
Silver grass (<i>Vulpia spp.</i>)	2973	5133	3533	6923
Annual ryegrass	713	1103	1513	1300
Paterson's curse (<i>Echium plantagenium</i>)	23	47	13	13
Capeweed (<i>Arctotheca calendula</i>)	103	7	20	30
Naturalised clovers (<i>various</i>)	401	303	140	350
Hairy Panic (<i>Panicum effusum</i>)	167 ^a	87 ^a	7 ^b	0 ^c
Subterranean Clover	343 ^a	1450 ^{ab}	1863 ^b	2107 ^b
Mouse-eared chickweed (<i>Cerastium glomeratum</i>)	0 ^a	110 ^b	1383 ^c	5753 ^d
TOTAL (Seedlings/m ²)	4653 ^a	8440 ^a	8810 ^a	16580 ^b
Frequency (%)		Frequency (%)		
Phalaris	13.0	12.7	8.7	4.3

Cocksfoot

16.0^a

5.0^b

1.3^b

5.3^b

The total number of plants to emerge was greatest when the break was imposed on 7 July, but this was largely due to the increased emergence of mouse-eared chickweed. Ignoring this species, there was no effect of time of break on total number of all other seedlings that emerged.

Frequency of cocksfoot was affected by time of break; frequency counts being greatest at the earliest time. Although phalaris frequency was not significantly affected by time of break, there was a noticeable decline in phalaris frequency with time (only significant at $P < 0.1$).

Conclusion

- Emergence of the majority of the annual species found in this pasture was unaffected by time of break. Mouse-eared chickweed was a notable exception and appears to be adapted to germinate under the relatively cold conditions of winter.
- We know that early breaks favour clover and later ones favour grasses. This study demonstrates that there is little variation in seedling emergence irrespective of the timing of the break, and that sub clover germination increases with later breaks. This suggests that plant growth after the break is the main determinant of pasture botanical composition (i.e. grasses are able to grow at lower temperatures than clover).
- Bud and tiller death are the most likely explanations for the apparent decline in basal frequency of the perennial grasses with later time of break

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