Dormant Bud Development in *Phalaris aquatica* L.

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DORMANT BUD DEVELOPMENT IN *PHALARIS AQUATICA* L.

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Abstract

The formation of dormant buds is critical to the summer survival of phalaris (*Phalaris aquatica* L.) in pastures. Dormant buds are formed on the base of reproductive tillers as they develop in spring. This project aimed to determine the seasonal pattern of dormant bud development and the influence of grazing management on bud dynamics. Approximately three buds per reproductive tiller were formed in the spring and early summer period. These buds responded to summer rainfall, with one third of buds becoming active following a 15-mm rainfall event in mid summer. In the following growing season, on average, 1.5 buds per tiller produced new tillers and 1.25 buds remained dormant. A small, and decreasing, number of buds became active throughout the growing season. Less than two percent of buds died during the growing season. Grazing management had no effect on bud production and development.

Keywords: Dormant buds, phalaris, persistence, grazing management

Introduction

Phalaris is a perennial grass that is used extensively in summer dry regions of Australia (Hill, 1985). The production of dormant buds, and the maintenance of deep root systems that provide continual water supply, are the keys to its summer survival (McWilliam and Kramer, 1968a).

Dormant buds form at the internodes on the bases of reproductive tillers (McWilliam and Kramer, 1968a). The buds remain dormant over the summer, becoming active in favourable conditions to form new tillers. Relieving water stress and/or reducing temperature can stimulate active growth of buds (McWilliam and Kramer, 1968b).

Natural reseeding of phalaris in grazed pastures is not common (Hume and Barker, 1991; McCallum *et al*., 1991), so dormant bud development is a critical factor in determining phalaris persistence and production. However, little is known about the dynamics of bud production and development under grazing. The number of dormant buds produced per tiller can be reduced by defoliation (Hill, 1989). Different grazing management systems impose different defoliation patterns on the plant (Chapman and Clark, 1984). This study aimed to define the seasonal pattern of bud development in phalaris and the effect of grazing management on bud dynamics.

Material and Methods

The study was conducted at Vasey, near Hamilton, in south-western Victoria, Australia. Annual rainfall at the site averages about 650 mm, most of which falls in the months April to October. Summers are typically very dry, with little new pasture growth occurring in the period of January to mid April. Pasture at the site was sown to phalaris (cv. Australian) and *Trifolium subterraneum* L. (cv. Trikkala) in May 1995. The site was grazed by spring lambing merino ewes joined to prime lamb sires. The fertilizer and grazing management

treatments compared in this study are set out in Table 1. Three replicate paddocks (1.5 - 2.25 ha) of each treatment were monitored.

Randomly selected phalaris plants were removed from each paddock using an 80 mm diameter corer on 10 occasions from September 1998 to November 1999. Twelve cores per paddock were extracted on the first seven sampling times, and 8 cores on the final three sampling dates. Phalaris plant material was washed out, intact tiller bases collected and visually assessed. The number of buds on each tiller was recorded in the following categories:

- Dormant Buds - buds that had not commenced growth.
- Active Buds - buds that had recently commenced growth.
- New Tillers - buds that had developed to the point where they have their own leaf material. The new tiller category was introduced in the 1999 growing season.
- Dead Buds - buds that had commenced growth and died. Dead buds were only recorded during the 1999 growing season.

The number of buds per tiller in each category was averaged for each paddock. For each bud category, treatment differences in the number of buds per tiller were analysed at each sample date by ANOVA using the statistical package Genstat 5.

Results and Discussion

Grazing management and soil fertility treatments had no significant effect on bud development characteristics therefore the data presented are averages of the four treatments (Figure 1).

The number of dormant buds per tiller increased throughout the spring and early summer of 1998/99, from 0.13 buds per tiller in early September to 1.83 buds per tiller at the end of January. The low number of buds early in spring reflected the low proportion of

reproductive tillers at this time. As reproductive development progressed the number of dormant buds increased.

The proportion of total buds becoming active decreased through the spring and early summer. Two factors are likely to be involved in this: the apical dominance effect of the reproductive tiller inhibiting bud growth, and the environmental conditions of increasing temperatures and drying of the soil profile towards the end of the growing season (Hoen, 1968a).

A 15-mm rainfall event on 28 January 1999 stimulated bud activity. One third of the total buds became active indicating that the phalaris was in a phase of conditional dormancy (Hoen, 1968a). Hoen (1968b) noted that a response to summer rain is most likely to have a harmful effect if hot and dry conditions return, resulting in tiller death.

There was also an increase in total buds following the rainfall event. There are two possible reasons for this. Firstly, the rain could have stimulated further bud development, however, this is unlikely to account for all of the increase given that the measurements were only 18 days apart. The second factor is that the storm caused rapid loss of old vegetative tillers from the pasture. The vegetative tillers have no dormant buds, so when they are removed to leave the reproductive tillers only, the average number of buds per tiller increased.

A peak of three buds per tiller was reached by the start of the 1999 growing season. Soon after this, an equilibrium was reached where, of the three total buds, about 1.5 had produced a new tiller and 1.25 remained dormant. A decreasing number of dormant buds became active after the opening rains. Less than two percent of buds died in the period of May to September.

The phalaris plants retained a reserve of dormant buds throughout the growing season. Each reproductive tiller supported approximately two growing points with one bud remaining

dormant. This dormant bud may become active if one of the growing buds dies. This is the subject of further investigation.

This paper explored the dynamics of dormant bud development in phalaris over a 15 month period. The key period for dormant bud formation is the spring and early summer. On average, three buds were produced per reproductive tiller. A summer rainfall event stimulated growth because the plants were in a state of conditional dormancy. During the growing season approximately two of the buds commenced growth and one remained dormant. Very few buds died during the growing season.

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Table 1 - Description of the treatments compared in the study.

Treatment	Soil Olsen P (mg/kg)	Grazing management	Stocking rate (ewes/ha)
A Control	4-6	Set stocked	8
B Set stocked adequate P	12-14	Set stocked	12
C Simple rotation	12-14	4 paddock rotation	14
D Intensive rotation	12-14	Rotations of variable length	14

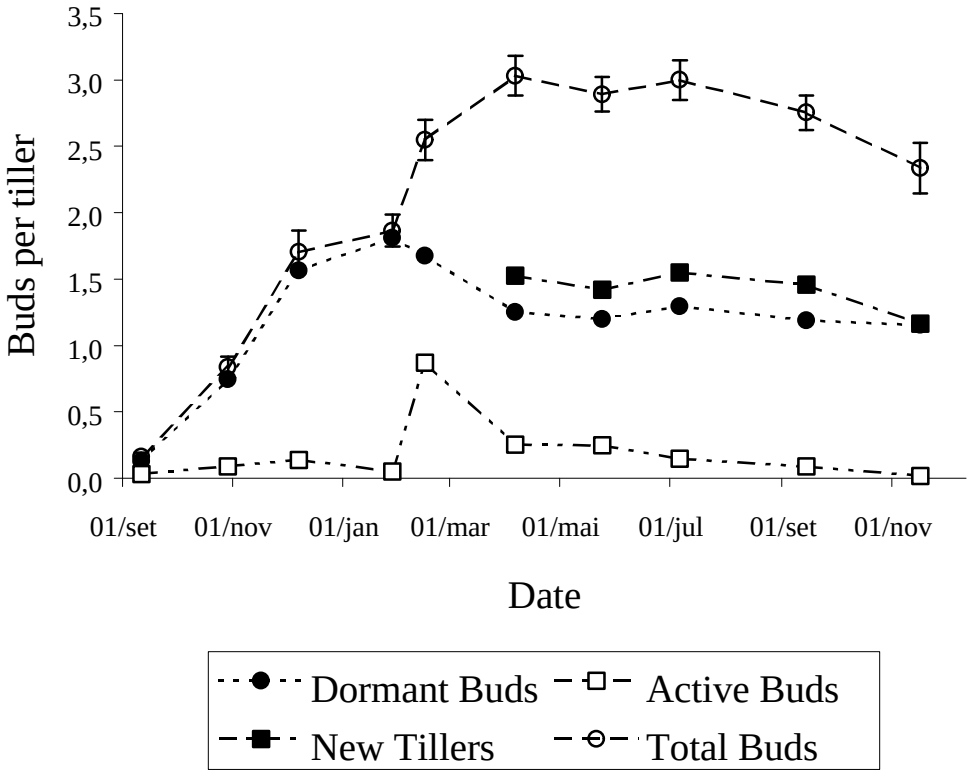

Figure 1 - The seasonal pattern of bud development in phalaris in south-western Victoria measured from September 1998 to November 1999. Vertical bars represent standard error of total buds.