Changes in Pasture Management Needed for Improved Control of Weeds in Pastures

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Abstract

Early and current work by the Pasture Development Group at Orange seeks to develop guidelines which maintain or restore the positive balance between desirable and less desirable species in pastures by imposing treatments that interfere with the seed production and regeneration phases of the annual grasses. An additional aim is to increase the vigor of the more desirable species (eg. perennial grasses, legumes). This work indicates that with our current systems of pasture management, lower than optimum levels of forage dry matter is closely associated with presence of weedy species. To reduce the proportion of less desirable species in our pastures, there needs to be changes in the way pastures are managed. Tactical grazing rests which target the key functional pasture groups have emerged as being an important part of new management strategy. In this paper we demonstrate that resting a perennial grass based pasture is a useful way to increase the perennial grass: annual grass ratio, and propose the likely upper boundaries required to restrict the annual grass component in the sward. The implications of these conclusions are discussed using phalaris and vulpia data from a current experiment as examples.

Key words: Vulpia, phalaris, grazing management, deferred grazing, pasture weeds.

Acommon expectation for grazed pastures based on introduced species in temperate Australia, is that desirable species composition and productivity will inevitably decline over time. This decline is associated with ingress of less desirable species such as the annual grasses, especially Bromus and Vulpia spp. Herbicides have been used as the primary method for reducing vulpia densities (7, 6), but the long-term management of vulpia in pastures still remains a problem (2). While combined strategies have been suggested, no reliable integrated management programs are currently available. In an environment where perennial species (especially grasses) can persist and thrive, the perennials should limit opportunities for the annual species to dominate the pasture. In ungrazed situations, this appears to be the case (8). However, under typical grazed conditions in temperate Australia, perennial grasses typically decline prematurely. Both processes appear to be linked, but cause and effect is uncertain. Productivity of these pastures is also heavily dependent on the success of subterranean clover (Trifolium subterraneum), which is influenced in turn by many factors including adequate trace and major nutrients, appropriate rhizobia, space for regeneration. However, ensuring regenerative space for the legume also provides space for the other annual species to recruit.

In perennial pastures, the space between the perennial species may also simply be a function of the density that the grazed environment can support. Irrespective of the cause, many ecologists consider that these spaces will ensure that our grazed pastures will always contain some annuals as 'gap' fillers. These present no real problem providing only a small proportion of these species is weedy (eg. annual grasses), and they are in balance with the other pasture components. In reality, this situation becomes progressively less common as the pasture ages. Managing annual grass populations and maintaining positive balance between the functional groups is viewed as an important step in extending the productive life of a pasture. This paper reports results of an experiment that explores the interaction between vulpia and phalaris.

Materials and methods

Dry matter (DM) and botanical composition data were collected from a field experiment at Gumble, 75 km NW of Orange in central western NSW over the period 1994-96. Annual average rainfall for the site was 650 mm, though over this period, each year received below average rainfall, and in all years the seasonal break did not occur until late autumn – early winter. Phalaris (Phalaris aquatica) was sown in 1988 but productivity had deteriorated to such an extent that the landowner was planning to resow the pasture on expiration of the field experiment. Pasture composition in autumn 1994 consisted of 35% phalaris, 40% vulpia and 20% subterranean clover. Soil textural type was a fine sandy loam, with pH ($CaCl_2$) averaging 4.2 and soil P 8 mg/kg (Bray No. 1) when the experiment started. For the purposes of this paper, information used was restricted to data collected from plots where DM and botanical composition (rising plate and BOTANAL) were measured on at least two occasions in each year: early in the growing season, and spring. This enabled the change in vulpia over the growing period to be examined in relation to total DM and phalaris composition measured early in the growing season. Plots were subjected to varied management treatments which included a range of grazing deferments, herbicide and superphosphate applications, and cultural treatments (hay and silage cuts).

Results and discussion

Ideally, the management of vulpia in pastures should target both the reproductive phase in spring (seed production) and the regenerative phase in autumn since the continued presence of vulpia in pastures will also depend on its ability to re-establish in the following year. Various procedures (eg. spraytopping) have been developed for addressing the former but management for curtailing the establishment of vulpia in autumn is less clear. However, it might be expected that the extent of bare ground and degree of ground cover would impact significantly on annual grass recruitment. Plotting the change in vulpia DM over the growing period against total DM early in the growing season indicates that an increase in vulpia during this time is minimal when total DM >1000 kg/ha (Fig. 1). However, vulpia DM is unlikely to decline substantially until total DM early in the growing season approaches 1700 kg/ha.

This suppression was similar to findings from a study on the northern tablelands of NSW that showed recruitment was significantly reduced by increasing levels of DM in autumn (4). In that environment, greater summer rainfall incidence would provide opportunities for reasonable levels of DM to be present in autumn. These DM levels are of the same order as those levels of green DM considered to be the minimum DM required for well managed pastures in the pasture management envelope (5) and the Prograze manual (1).

In general, the proportion of vulpia in the sward is expected to be at a maximum during spring, but the potential for the perennial component to influence vulpia in spring is likely to be determined by the proportion of the perennial grass present early in the growing season. The ability of the perennial to control the development of vulpia during the course of the growing season should be reflected by the size of the increase in % vulpia over this period.

Plotting change in % vulpia against % phalaris early in the growing season exhibited considerable variation which was reduced by plotting vulpia change against phalaris meaned over 5% increments (Fig. 2). The trend was for the vulpia increase to decrease as % phalaris increased. The data suggest that when the proportion of green phalaris in the sward in autumn reaches 80%, the increase in the proportion of vulpia during the growing season is likely to be minimal, or even decline. Actually achieving such a high proportion of perennial grass over the long-term is not a realistic goal, but a pasture that limits the vulpia increase over its growing season to about 10% might be acceptable to producers. Such an increase over that period coincides with a phalaris content of 50-60% in the previous autumn, a level that has been recommended as the upper limit for the perennial component in a tableland environment, as proposed in the pasture management envelope concept (5). This level of perennial grass corresponds to 20-25 % vulpia (DM basis) in the pasture in spring for this data set (data not presented).

The common cause for ingress of annual grasses and decline of perennial grasses appears to be overgrazing, since weedy species (annual grasses in particular) are usually only a problem when perennial pastures are stocked too heavily. This suggestion is supported by other data that show rapid decline in vulpia populations when the pasture was left ungrazed. These results were assessed over a period of three years but the vulpia decline began to be apparent in the first autumn after closure to livestock. The implication here is that for most temperate Australian pastures, the grazing pressure is too high, or the grazing management imposed is inappropriate for the prevailing seasonal conditions and pasture systems being grazed. For desirable perennial species to be maintained or increased within a pasture, some period of grazing deferment is essential, and that a specific targeted deferment based on phenological considerations and the potential for growth, is even more beneficial (3). It can be argued that competitive pressure from the perennial component (phalaris) might be enhanced by deferment, and restrict the growth of the vulpia, and in turn, its potential for seed production. However, the data here suggest that phalaris was only able to limit the increase of vulpia over the growing season, and not decrease it.

These findings suggest that to minimise the presence of annual species such as vulpia in perennial grass pastures, a minimum proportion of perennial grass and DM needs to be present in the pasture at the start of the growing season. For these minimum DM levels to be achieved in environments where a broad range of seasonal conditions are expected, deferred grazing during the spring-summer period provides the best opportunity. This is a reasonable option given that deferred management would only be imposed on a paddock basis, selected on potential productivity and pasture composit- ion. In addition, forage on offer in spring is usually in excess of demand, enabling deferment to be a feasible practice. Other paddocks could be managed this way in later years, according to priority. Spring deferment also allows the opportunity for seeding, and potential recruitment of the perennial under favorable conditions in autumn. However, an important negative aspect of this approach is that establishment of subterranean clover would also be affected. In practice it is probably easier and more cost effective to oversow the legume rather than tolerate lower pasture and animal productivity from vulpia dominated pastures.

Conclusions

The old adage 'that if it wasn't for the livestock, we would have weed-free pastures' is perhaps truer now than when first stated. Because of a large number of constraints, greater grazing pressure is now placed on temperate pastures than they can reasonably tolerate over the long-term. This invariably leads to a decline of the perennial component and replacement by less desirable species including annual grasses. The cost of this deterioration is the income forgone in lost productivity, the eventual replacement of the pasture ($250/ha), and the various sustainability and environmental issues that are becoming increasingly important for landholders. If maintenance of the perennial base is regarded as a priority in pastures, then an alternative approach might be to recognise that overgrazing is a key factor in the decline of the perennial. Changes in management are necessary to ensure that minimum levels of ground cover are present, especially over summer-autumn if recruitment of annual grasses (specifically vulpia) is to be reduced.

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References

1. Allan, C.A. 1994. Prograze Manual. NSW Agriculture.

2. Dowling, P.M., Leys, A.R. and Plater, B. 1997. Aust. J. Exp. Agric. 37, 431-438.

3. Dowling, P.M., Kemp, D.R., Michalk, D.L., Klein, T.A. and Millar, G.D. 1996. Rangel. J. 18, 309-326.

4. Jones, C.E., Whalley, R.D.B., Lovett, J.V. and McIntyre, S. 1992. Proc. 6th Aust. Agron. Conf., Armidale. pp. 532.

5. Kemp, D.R., Michalk, D.L., Dowling, P.M. and Klein, T.R. 1996. Proc. 8th Aust. Agron. Conf.,Toowoomba. pp. 345-348.

6. Leys, A.R., Cullis, B.R. and Plater, B. 1991. ?Aust. J. ?Agric. Res. 42, 1405-1415.

7. Leys, A.R. and Plater, B. 1993. Aust. J. Exp. Agric. 33, 319-326.

8. Peart, D.R. 1989. ?J. Ecol. 77, 236-251.