Manipulating pasture composition - a matter of time, dollars and sense

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Summary. Low-cost management strategies are being explored which aim to slow or reverse the process of pasture decline. This will decrease the frequency of pasture re-establishment required, and lower production costs. Results indicate that such strategies can improve the proportion of legumes and perennial grasses to desirable levels. However, adoption of these procedures requires graziers to accept the fact that positive changes to pasture composition accrue slowly, especially with perennial species, and that higher managerial capability is required for their implementation. For pasture-based livestock industries to survive, we see a need to place more emphasis on managerial skills and time rather than capital investment.

Introduction

More efficient production is the key to maintaining viable and sustainable, food and fibre production systems. However, balancing viability and sustainability under conditions of escalating costs and static or falling commodity prices is proving difficult. Ideally, we should be able to maintain the productivity of pastures. but often pastures deteriorate prematurely, with loss of legumes and perennial grasses leading to botanical instability. The reliance on pasture re-sowing to rectify the problem has in hindsight, been a less satisfactory approach (2), and has delayed development of alternative ways to address pasture degradation.

Pasture replacement costs in the high rainfall zone (HRZ) of temperate Australia average $150-200 per hectare (4). Based on current returns from livestock, newly sown pastures must remain productive for 810 years just to break even on the investment, yet pastures often need to be resown before this time. Regrettably, the productivity of many pastures in the HRZ is well below potential, largely because of undesirable changes in botanical composition (3). In this paper we use data from grazing management studies done in central NSW, to show that the botanical composition of pastures can be improved by varying grazing pressure at critical stages in the development of a pasture.

Methods

Four pastures on farms within central NSW were selected to examine the effects of grazing or rests from grazing (= deferred grazing), at different times of the year on botanical composition. The pastures varied in productivity, but all had a low proportion of subterranean clover (Trifolium subterraneum) and other desirable species, and poor overall production compared to site potential. All pastures were being considered for resowing by the owners. Results from sites at Grenfell (600 mm AAR) and Newbridge (700 min AAR) are presented here.

Other species present were barley grass, *Hordeum leporinum,* and soft brome, *Bromus molliformis.* (Grenfell); and *Vulpia* spp. plus low density cocksfoot, *Dactylis glomerata.* (Newbridge). Experiments commenced in autumn 1990. Treatments compared three periods of grazing rest (autumn. winter, summer - each of three months duration) with continuous grazing and annual-grass free controls at two fertility levels. Grass control was achieved with a selective grass herbicide (Carbetamex; carbetamide 2.1 kg a.i./ha - applied three-four weeks after the seasonal break). 'Rest' treatments were imposed seasonally to include the main phases of plant and pasture development at those times of the year.

The lower fertility level was the current strategy used by the producer. The higher level was applying recommended rates of lime and superphosphate (9.1% P. 11.5% S), based on soil tests. Initial P status (Bray ppm) and pH ($CaCl_2$) were 14.4 and 4.8 for Grenfell, and 6.3 and 4.5 for Newbridge. Application of superphosphate and lime in 1990 and 1991 either maintained or elevated the P status and pH on the high fertility plots: Grenfell - 13.0 and 5.2 (9.3 and 4.4 on the low fertility plots); Newbridge - 9.5 and 5.0 (4.0 and 3.9).

An open communal grazing design was used to screen possible grazing tactics. Each experiment was located within a larger, continuously grazed, set-stocked paddock. Plots were then open or closed to grazing as required by the treatments. This design is an extension of a closed communal grazing design (5). Plot size was 10x15 m. There were 30 plots at each site (5 treatments x 2 fertility levels x 3 replicates), ie. a total experimental area of 0.45 ha, within 15 and 50 ha paddocks. Treatments were laid out in a nearest neighbour design. Sheep stocking rates were 7.5 to 10.0 (DSE/ha) at Grenfell and 13 to 16 at Newbridge, as set by the cooperating producers. Pasture yield and botanical composition using BOTANAL (6) were assessed every 12 weeks along fixed transects within each plot. Data reported in this paper were collected in early spring. Additional data were collected on plant and seedling regeneration.

Results

Grenfell

Resting the pasture in winter produced the greatest effect, resulting in increased subterranean clover, especially in 1991 and 1992 (Fig. Ia), and reduced barley grass, the dominant annual grass (Fig. Ib). Soft brome was marginally increased by this treatment. In 1992 the lower proportion of barley grass from the winter rest treatment, followed fewer seedheads being produced in 1991 and substantially fewer barley grass seedlings regenerating in 1992. The reduction in barley grass may result from both increased competition by subterranean clover during the winter rest plus grazing removing barley grass plants when plots were opened after the winter rest. *Vulpia,* though a minor component of the pasture, also had a lower number of seedlings regenerating in the winter rest treatment whereas subterranean clover numbers were increased. Soft brome seedling numbers were unaffected by the winter rest. The recommended fertiliser treatment had little influence on botanical composition, except for more thistles. but increased pasture yield by over 90%. This increase varied from season to season. reflecting the rainfall received.

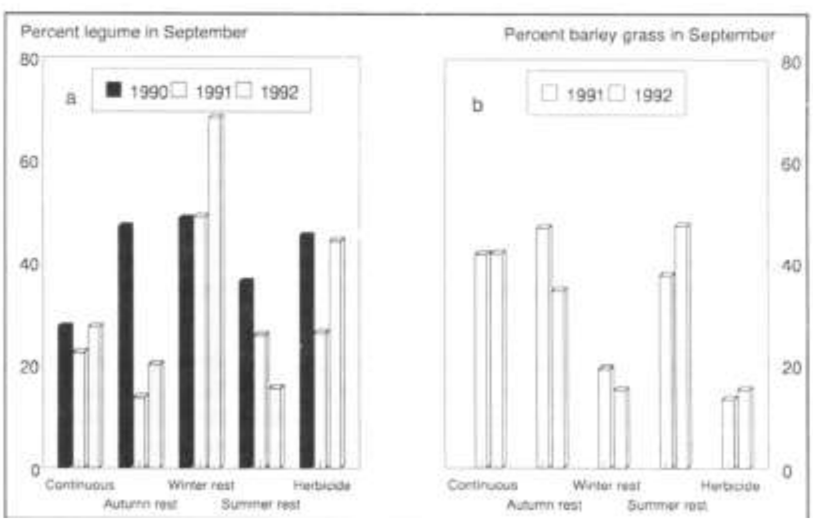

Figure 1. Effect of grazing rests and application of herbicide (carbetamex) on proportion o' a) annual legume (mostly subterranean clover) and b) barley grass in the pasture in early spring at the Grenfell site. Mean of two fertility levels.

Newbridge

The winter rest and herbicide treatments had similar effects on the legume content to those found at Grenfell. The legume content increased in those treatments by an average 36% and 15% respectively. compared with the continuously grazed control over the three years. The autumn and summer rests resulted in an average 36% reduction in legume content. Resting the pasture over summer, and herbicide application had the largest Effect on grass content. In 1992, cocksfoot increased to I I% on the summer rest compared with a decline to 2% under continuous grazing (Fig. 2a). The summer of 1991/92 had more rain than previous years. The proportion of annual grass (mainly *Vu/pia)* in the pasture had by 1992 decreased from 43% where continuously grazed to 23% on the summer rest (Fig. 2b). However, the summer rest also resulted in an increase in the proportion of bare ground in September (39%) compared with the control (18%). Fewer annual legume seedlings regenerated on the high fertiliser treatment, but pasture yield was increased by 30%.

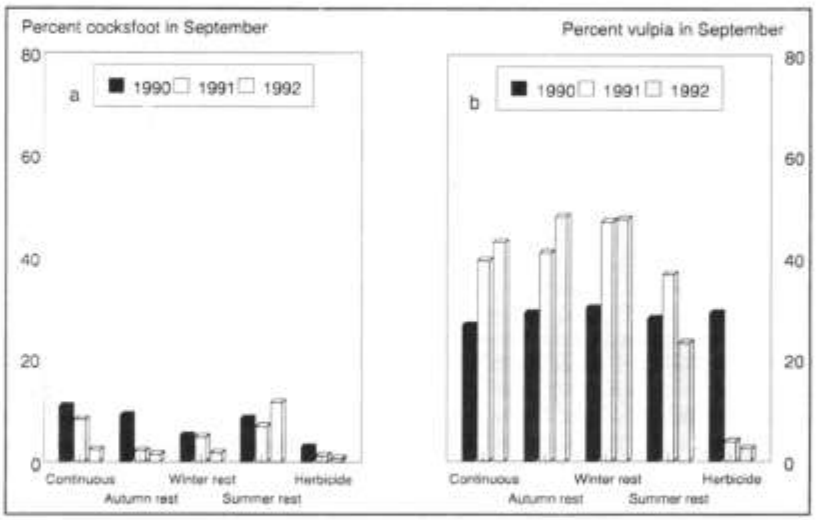

Figure 2. Effect of grazing rests and application of herbicide (carbetamex) on proportion of a) cocksfoot and b) vulpia in the pasture in early spring at the Newbridge site. Mean of two fertility levels.

Discussion

The results suggest that the favourable manipulation of botanical composition by grazing tactics at key times, is feasible. This was demonstrated at both sites where the legume content of the pasture was increased by deferred grazing over winter, while at Grenfell, the barley grass content was also decreased by this treatment. At Newbridge, cocksfoot content was increased at the expense of *Vulpia,* by resting the pasture from grazing over a summer when conditions for growth favoured cocksfoot. Changes at Newbridge were small due to the high stocking rate used. The response by both pasture types to grazing tactics was slower than where more drastic measures are taken eg. herbicide application, though costs are less. In a perennial pasture, a permanent increase in desirable perennial components is likely to be slow because of the time taken for plant recruitment. though vegetative expansion will produce important earlier gains.

The communal grazing design used has the advantage that many potential grazing tactics can be screened using a fraction of the resources required by conventional designs (5). There are of course disadvantages, and these include the possibility of selective grazing, removal of nutrients from the plots to stock camps and inability to monitor animal performance. These effects may become important if experiments are long-term. However, since the main aim of these experiments was to screen the effects of a range of simple grazing tactics on pasture composition, and the results show that trends can emerge in the short- term, the design was considered appropriate. Future work would integrate these results into suitable farm practices.

The results indicate that responses to grazing tactics are more likely to occur when growing conditions for desirable species are favourable (ie. adequate nutrient status and soil moisture). The disadvantage of simply resting pastures to achieve botanical change is that paddocks may have to be removed from grazing at periods when feed is in short supply. However, if only a single paddock is removed, the increase in stocking pressure over the remainder of the farm can be minimised. Many producers stock conservatively and not all pastures on the farm are likely to require the same corrective procedures in the same year. Long rests can also be achieved by using long period rotations around paddocks. Further refinements to the technique may involve incorporating other cost-effective options to complement grazing rests eg. winter-cleaning, sod-seeding, slashing. burning. This may mean that similar results can be obtained with shorter rests from grazing (1,7).

In practical terms. flexible management operations will be required of landholders considering this approach. Before this can occur however, a thorough understanding of the mechanisms behind compositional change will be necessary.

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