THE USE OF OPEN COMMUNAL GRAZING DESIGNS TO SCREEN OPTIONS FOR GRAZING MANAGEMENT

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Abstract

An open communal grazing design is described that enables a large number of grazing tactics to be concurrently evaluated in small plots under common grazing conditions. Pasture data indicated that the same level of utilisation occurred inside the experimental plots as in the surrounding field. However, differential grazing may occur where plots have divergent composition. The open communal design was economical using <5% of the land, livestock and fencing resources of alternative designs. The limitations of the open communal design as a research tool are also discussed.

Keywords: Grazing management, experimental design, communal grazing

Introduction

The complexities of grazing ecosystems are such that the relative merits of different grazing tactics can only be conclusively established in comparative experiments. Due to expense and logistics, conventional grazing experiments are limited to simple factorial-type designs (Michalk and McFarlane 1978). While these types of design enable comparisons of whole systems to be made including collection of animal production data, they have to be somewhat rigid which means that the impacts of components of each system are difficult to tease out (Kemp and Dowling 2000). As a cost-effective alternative to the conventional approach, small plot trials have been used to examine the impacts of different utilisation levels on major pasture species. Such experiments often use cutting techniques to simulate the effects of grazing animals, but this does not always produce the same pasture composition as results from grazing.

Communal grazing designs have proven useful to simulate grazing in small plot experiments. Michalk and McFarlane (1978) used a closed communal design with treatment plots arranged in a 'wagon wheel' configuration around a common watering point to evaluate a range of grazing options for lucerne (*Medicago sativa*). A comparison with a conventional grazing design showed no significant differences for the same treatments in pasture growth and composition. However, for the closed communal design to work, animal numbers needed to be continually adjusted to maintain the desired stocking rate as plots were opened and closed to grazing, and the total grazing area available at any time to be large enough to maintain at least 5 adult sheep, the minimum required for sheep to behave as a flock.

To overcome these limitations, an open communal design was developed by placing small fence, plots within a larger grazing field. This also enabled the area of plots to be reduced to less than the 0.05 ha advocated by Michalk and McFarlane (1978) and removed the need to continually adjust livestock numbers. This paper describes an open communal design that has been successfully used as a tool to screen simple grazing tactics in on-farm locations. It discusses its merits, costs compared to alternative designs, and addresses the major criticism that the results achieved in the small plots of the open communal grazing design are not the same as those measured at the paddock scale.

Material and Methods

In this design, plots were laid out within a phalaris (*Phalaris aquatica*)-legume (*Trifolium repens*, *T. subterraneum* and *M. sativa*) pasture that was stocked at 16 DSE (dry sheep equivalents) / ha over the 4-year study that commenced in June 1989. Plots were opened or closed to grazing as specified by a range of treatments designed to compare the impact of strategic rest based on season or plant phenology with a continuously grazed control treatment. Continuous grazing is the management most commonly practiced by producers in the high rainfall zone (>600 mm/yr) of temperate Australia. The ratio of plot size (10 x 15 m) to the paddock (2.3 ha) was small so that the opening and closing of plots had an insignificant effect on the overall grazing pressure. Plots were arranged in a nearest neighbour design in 4 separate blocks spaced around the field.

Within each plot a randomly chosen permanent diagonal transect with 10 fixed equidistant sampling points along it was established to measure pasture yield (using rising plate meter method) and composition (dry weight ranking procedures described by Tothill *et al*. 1992). Measurements were taken every 6 weeks. Permanent transects were also established at random locations in the field surrounding the small plots and measured using the same procedures. Three treatments (continuous grazing; spring rest and spring short where addition grazing pressure was applied) are presented in this paper to compare results obtained in small plots with those measured in the surrounding field using regression analysis to assess grazing uniformity within the design.

Resources required for conventional, closed communal and open communal designs were estimated for an experiment consisting of 12 treatments, 3 replicates and a stocking rate of 10 DSE/ha. Fencing including input and erection costs was estimated at $A 5000/km.

Results

Comparison of pasture yield (both green dry biomass and total dry biomass) between the continuously grazed control and the surrounding field showed that most of the points measured over the experimental period clustered around the 1:1 line (Figure 1). Linear relationships explained 77% and 67% of the variation in green and total dry matter yield between the continuously grazed plots and the surrounding field. Data on pasture growth rates and composition (not presented) also showed no significant difference between the control treatment and the surrounding field. These results suggest that the same level of utilisation occurred inside the experimental plots as in the surrounding field.

In the spring rest treatment, grazing deferment resulted in higher standing biomass compared to the surrounding field, but this biomass differential was reduced to that of the surrounding field within a 6-week period after being opened to grazing. This is reflected in the slope of the line of best fit (0.93 and 0.95 for green and total DM) between the spring rest and field data that was not significantly different from 1 (Figure 1). However, for the spring short treatment where additional grazing pressure was applied to reduce phalaris competitiveness, the line of best fit was significantly different from 1 (Figure 1) with the less biomass present in the treatment plots compared to the surrounding field. This was due to a shift in pasture composition with a higher legume proportion that increased utilisation at other times of the year because the legume made the pasture more attractive to sheep than the surrounding field (Kemp *et al*. 1993).

An attractive feature of the open communal design is the minimal resources required. For example, Table 1 shows that open communal needed <5% of the land, livestock and fencing resources of the conventional design for a 12 treatment x 3 replicate experiment.

Discussion

The open communal design can cost-effectively screen options for grazing management practices through measurable effects on pasture composition, forage-on-offer and plant community structure (Kemp *et al*. 2000). Because a small plot size can be used, more treatments can be concurrently studied at a single site than is possible with alternative designs. However, it is stressed that the open communal design should only be used as research tool to select potentially useful grazing options. It should not be used to specify systems for on-farm use because it cannot measure animal production on a treatment basis. The final step in a research program would be to use a conventional grazing design to test the most successful treatments obtained from the open communal design screening.

The occurrence of differential grazing among plots that have divergent compositions may limit the use of the open communal design in some situations. However, from another large study that used the open communal grazing design at 22 different sites, Kemp and Dowling (2000) reported that differential grazing was more likely to occur when the grazing pressure imposed at a site was considerably lower than the potential. The need to maximise treatment contrasts was also important to overcome any differential utilisation that may occur between treatments, since animals have free choice as to which of the open plots they would graze and when. Simple contrasts set in an open communal design to compare the effects of grazing or not grazing, based on either calendar dates or plant phenology has provided useful data to define critical rest periods for a wide range of pasture species in temperate Australia (Kemp *et al*. 2000).

Stock camps and areas where other animals may congregate (*e.g*. common fences) should also be avoided to minimise animal behaviour problems. The design worked best when sited in a uniform part of the field with replicates and treatments set out in a large contiguous block. Each plot needs to be fenced on three sides to prevent animals making access tracks through some plots and to minimise any variation in patterns of grazing behaviour, even if all plots are open to grazing.

References

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Table 1 - Cost of alternative designs

Item	Conventional	Closed communal	Open communal
Plot size (ha)	0.5	0.05	0.015
Area required (ha)	18.0	1.8	0.54
Animals required (number)	180	18	10+
Total fencing (km)	11.1	2.3	0.5
Total cost/site ($)	55,500	11,500	2,500
Cost/treatment ($)	4,625	958	208

Costs estimated for 12 treatments x 3 replicates with a stocking rate of 10 DSE/ha. Fencing costs based on current estimate of $5,000/km that includes materials and erection.

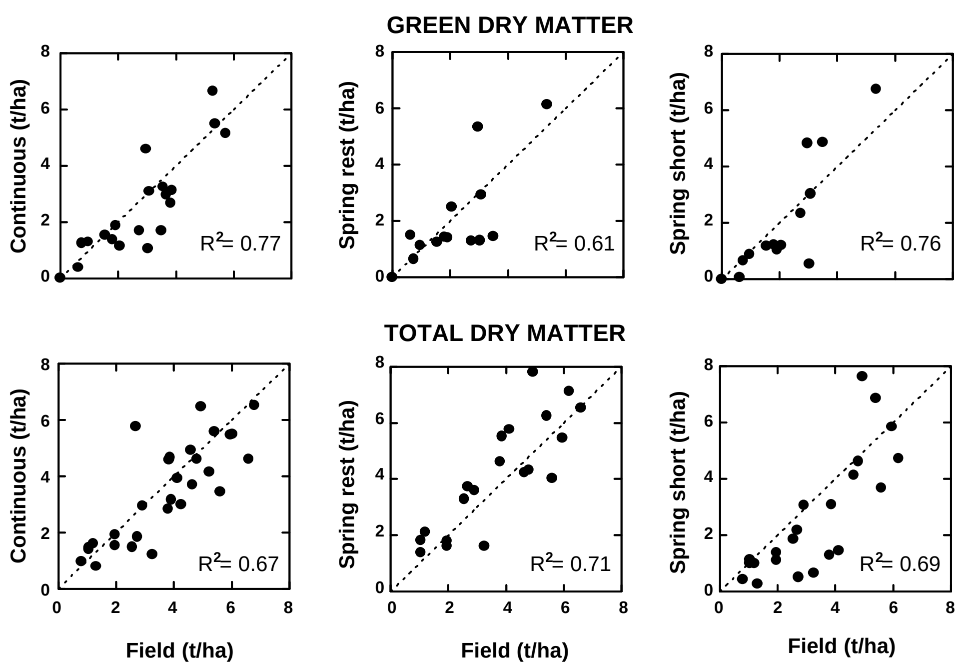

Figure 1 - Comparisons between green dry and total dry feed-on-offer (t/ha) on the continuously grazed control, spring rest and spring short treatment against that measured in the surrounding field. R^2 values refer to the line of best fit.