# The role of time control grazed pastures in farming systems

E. C. Anderson[A], R. S. B. Greene[A], J. Field[A] and I. Packer[B]

[A]School of Resources, Environment and Society, Australian National University, Canberra ACT 0200
[B]Department of Infrastructure, Planning and Natural Resources, Cowra, NSW 2794

Pasture production relies on the ability of pastures to sustain high levels of production over long periods of time. Stability of pastures is thus important within a grazing operation, as stable pastures can lead to sustainable grazing enterprises. Concern over the sustainability of pastures in high rainfall zones (HRZ) has arisen due to the declining perennial grass content (Kemp *et al.* 2000). These areas are typically set stocked (SS) and pasture composition has tended towards decreasing pasture productivity, despite introduced pastures. These were once promoted as the saviour for these HRZ, as sown perennials could increase water use, provide a good perennial grass cover and thus increase carrying capacity (Scott 1997). However, high levels of external inputs may cause adverse pasture conditions and soil degradation. For example, increased soil acidity of high rainfall areas has been attributed to high fertiliser use and increased clover in the pasture mix, affecting pasture growth which can result in erosion (Charman 2000). The need to study other systems that are not so reliant upon these inputs was the impetus for this study.

This research continued the work of Ticehurst (1996) that compared the impacts of one form of rotational grazing, time control grazing (TCG), with set stocking (SS) after the TCG system had been in place 3 years. Whilst anecdotal support at this stage was strong for TCG there was a lack of empirical evidence, possibly because the systems had not been in place long enough for substantial effects to be realised. The current study continued the research by investigating the treatments after they had been in place for 10 years. The results from the Ticehurst (1996) study were used as benchmarks enabling the changes in the system over time to be measured.

## Methods

The study consisted of field and laboratory work that investigated a range of soil physical and chemical properties that may be adversely affected by grazing, as well as a pasture composition study. The study was carried out across 5 sites in the Southern and Central Tablelands of NSW, in the HRZ. Two treatments per farm were set up to compare SS and TCG. Two transects per treatment were used for pasture and soil measurements:

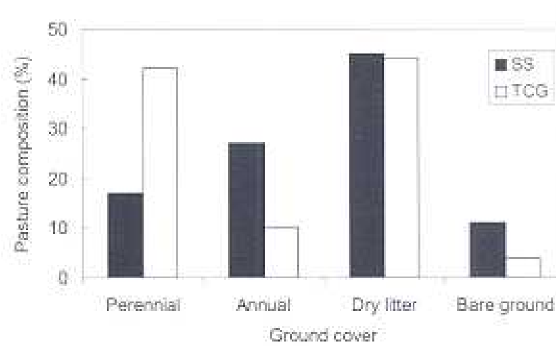
- A range of soil tests were carried out including (but not limited to) infiltration, organic carbon, pH and EC.
- A pasture study was undertaken using the step-point system, along 50 m transects, to measure differences in species composition.

## Results and discussion

Findings show increased soil health under TCG through improved functioning of the system. Soils from the TCG treatments had overall higher organic carbon concentrations and pH levels, and lower electrical conductivity (Table 1). Steady state infiltration rates were also higher in the TCG treatments. Visual observations revealed differences in compaction between the 2 systems, as the SS systems had a compacted layer at 5-10 cm depth.

Pasture results indicated a trend towards perenniality in the TCG system (Fig. 1), compared with SS ($P<0.05$). Higher perenniality in the system can result in increased ground cover (Kemp *et al.* 2000), which may protect the soil from runoff and erosion through increased infiltration. Infiltration rates have been

**Figure 1. Pasture composition**



found to be highest under the dense plant communities (Pluhar *et al.* 1987; Wood and Blackburn 1981), which is supported by increased infiltration under TCG compared with SS (Table 1). This contributes to increased rainfall use efficiency of the system (Le Houréou 1984), which is particularly important during drought years, as the system is able to maximise benefits from any rainfall received. Increasing the perennial component of pastures can lead to minimising nitrogen leaching and thus soil acidification, and even decreasing inputs of lime (Helyar 1991). Increased perenniality of TCG in this study is supported by a corresponding slight increase in surface pH compared with SS (Table 1).

**Table 1. Soil organic carbon, pH, EC and steady state infiltration rate of time controlled grazing (TCG) and set stocking (SS) as an average across sites, 2004**

| Grazing system | Soil test |
|---|---|
| | *Organic carbon (%)* |
| TCG | 2.636 ± 0.303 |
| SS | 2.066 ± 0.281 |
| | *pH (1:5 water or $CaCl_2$)* |
| TCG | 5.073 ± 0.2132 |
| SS | 4.889 ± 0.2132 |
| | *EC (1:5 water) (μm/cm)* |
| TCG | 83 ± 35.1 |
| SS | 86 ± 35.1 |
| | *Steady state infiltration rate (mm/h)* |
| TCG | 162.8 |
| SS | 110.6 |

TCG may allow a system to produce more biomass which is thus available for utilisation by the animals (Savory 1999) and dry matter pasture records from the 1996 study indicated that the TCG system consistently produced more biomass than SS. Throughout 1996 the SS biomass levels fluctuated more than TCG. The findings from the current study (where the systems have now been in place for 10 years) also indicated changes in species composition. There was a greater number of weed plants recorded for the SS treatments than TCG, suggesting that there was higher weed control in the TCG system probably because perennial plants were out competing annual colonisers by optimising growth conditions. The lower amount of bare ground evident in the TCG treatments may also be contributing to this factor.

## Conclusions

Results from these studies indicate that a number of soil degradation issues may be successfully ameliorated by TCG. Increased ground cover and perenniality in the system can lead to increased water usage, which may help control rising water tables. Therefore TCG as a method of rotational grazing may have a potential role in meeting the challenge of sustainable grazing systems.

## Acknowledgments

The authors gratefully acknowledge the farmers involved in this study for their willing co operation; and to DIPNR, Central West region, and the ANU for their financial support of the project.

## References

Charman PEV (2000) Other forms of soil degradation. In 'Soils: their properties and management'. (Eds PEV Charman, BW Murphy). (Oxford University Press: Sydney)

Helyar K (1991) Do perennial pastures reduce soil acidity? In 'Proceedings of the 6th Annual Conference of the Grassland Society, NSW' pp.64-71. (NSW Grassland Society Inc.: Orange)

Kemp DR, Michalk DL, Virgona JM (2000) Towards more sustainable pastures: lessons learnt. *Australian Journal of Experimental Agriculture* **40**, 343-356.

Le Houérou H (1984) Rain use efficiency: a unifying concept in arid-land ecology. *Journal of Arid Environments* **7**, 213-247.

Pluhar JJ, Knight RW, Heitschmidt RK (1987) Infiltration rates and sediment production as influenced by grazing systems in the Texas Rolling Plains. *Journal of Range Management*, **40** 240-243.

Savory A (1999) Holistic Management. A new framework for decision making. (Island Press: Washington DC)

Scott, JM (1997) Pasture Establishment. In 'Pasture production and management'. (Ed JM Scott). (Inkata Press: Melbourne)

Tirehurst JL (1996) 'Overgrazed but under stocked: A comparison of grazing systems in the Southern Tablelands, New South Wales, Australia.' Honours thesis, Australian National University, Canberra.

Wood MK, Blackburn, WH (1981) Grazing systems: their influence on infiltration rates in the rolling plains of Texas. *Journal of Range Management* **34**, 331-335.