Grazing Management and its Effects on Groundcover and Runoff Control in Queensland. Australia

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Abstract

Grazing animals affect pasture properties by altering plant cover as well as physical impact of their hooves. Reduction in vegetation cover may increase the effect of raindrops in decreasing water infiltration rates and increasing runoff and soil degradation.It is largely assumed that rest period in grazing land can improve ground cover and so grass production through providing opportunities for maintaining plant vigor, seeding and seedling establishment and better sheep distribution ultimately decreasing runoff and sediment losses. However, application of rest period in the grazing management of some geographic locations have not supported this idea that rest period always leads to a higher vegetation level, and lower runoff. Study area (Traprock region of Queensland) with 580 mm rainfall is located in semiarid part of subtropical zone of Queensland and is a sheep grazing area with poor soil. Graziers in this region are concerned about the long term productivity and the impact of current grazing practices on their land and water resources, so in this research Time controlled grazing system which is a flexible rotational grazing with long period of rest is compared with the conventional grazing system (a continuous grazing without rest). This comparison is based on extensive pasture sampling and runoff data collection using two large instrumented plots. In spite of drought of the past 4 years, initial results illustrate higher production and ground cover as well as lower runoff and sediment losses in the Time controlled paddocks compared with the Conventional grazing management system. The relationship between vegetation and effective rainfall shows that the Time controlled system is more responsive to available moisture than Conventional. This improvement in cover and consequently decline in runoff volume is attributed to the expansion of root system over the rest period resulting in building up soil organic matter which in turn increases biological activity

Introduction

Sustainable pasture productivity is of concern for many pastoralists and graziers in Australia and the rest of the world. Declines in the quality and quantity of grassland forage as well as land degradation are becoming more apparent across the globe**.** These declines have been attributed to high grazing pressure or continuous grazing with no rest periods. Grazing animals affect native pasture properties by both altering plant cover type and density (Bari et al. 1993) and the physical action of their hooves (Blackburn 1983). Reduction in vegetation cover increases raindrop impact erosion (Busby and Gifford1981) and decreases soil organic matter (Johnston 1962), soil aggregates (Proffitt et al. 1995) and infiltration rates (Mwendera and Mohamed Saleem 1997). These effects may result in increased runoff, reduced soil water content and increased erosion (McIvor et al. 1995).

When grazing intensity exceeds a threshold and plant cover is reduced below a critical level, plant communities are prevented from producing and maintaining mulch or litter cover, and structural properties of the soil are changed, particularly those related to soil porosity. The result is increased runoff and soil erosion which trigger events ultimately leading to land degradation (Gifford and Hawkins 1978).
It is largely assumed that rest period in grazing land can improve ground cover and grass production which in turn decrease runoff and sediment transport and nutrient losses. This has been documented by many researchers including McIvor et al.(1995); *Lodge et al. (2003a) and Dowling et al.(2005) but there has been some adverse finding as well*. *Lodge et al. (2003a) showed that the* herbage mass, ground cover and litter mass were lowest in both of their continuously grazed treatments (grazing at 4 sheep/ha and at 6 sheep/ha) in comparison with the treatments where pastures were grazed for 4 weeks and rested for two different rest periods of 4 and 12 weeks in the north west of NSW. It is also reported that the total perennial grass cover has been greater under time-controlled than conventional grazing (*Dowling et al.2005). Regarding runoff and sediment losses* McIvor et al.(1995) reported that both runoff and soil loss were reduced by increasing ground cover, while for larger events ground cover reduced the rate of soil loss but not the volume of runoff

Materials and methods

Currajong property is located in the Traprock region 300 km west of Brisbane, a summer dominated rainfall area with about 78% of rain falling in the six months from October to March with average annual rainfall of 580 mm. A large scale field and lab investigation using a number of instrumented catchments and plots has being carried out in three sheep paddocks. Soil loss is measured as bed load (material that is deposited in the troughs constructed at the downslope end of the plots) and suspended load (finer material carried away by the flowing water). The study sites for vegetation cover were laid out across the 2 grazing management treatments (Time-controlled and Conventional) to investigate changes relating to herbage biomass, ground cover, basal area etc using a 0.25 m^2 quadrate. Time-controlled defined as a flexible rotational grazing system with large period of rest in pasture that seems to provide opportunities for improvement of ground cover, grass production resulting in higher soil and water conservation compared with conventional which sheep are in all over the year.

Results

The results presented in this paper are parts of an ongoing project with multiple objectives. Partial analysis of the collected data has produced some interesting results. Fig 1 shows that Time controlled grazing (TCG) is more responsive to rain than conventional. In other words, water use efficiency is higher in TCG.

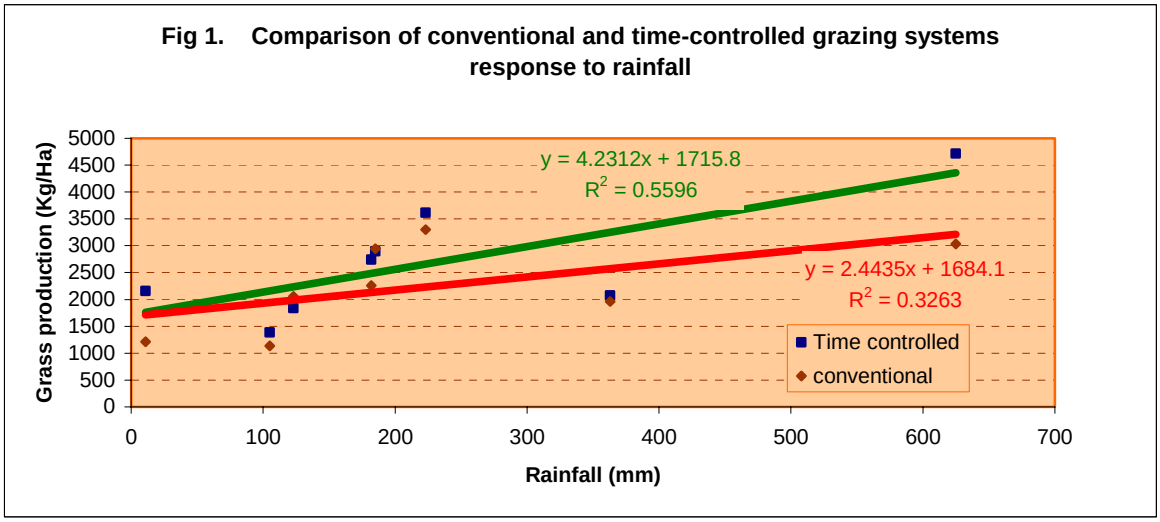

Fig 1. Comparison of conventional and time-controlled grazing systems response to rainfall

The results also indicate that there has been same improvement in ground cover and other components of grass growth in the TCG plots and catchments over the course of the study, leading to fewer runoff events with lower average event magnitude (Fig 2). A comparison between open pasture and treed shows that plots under the trees have a significantly lower runoff than the open pasture for the same rain events.

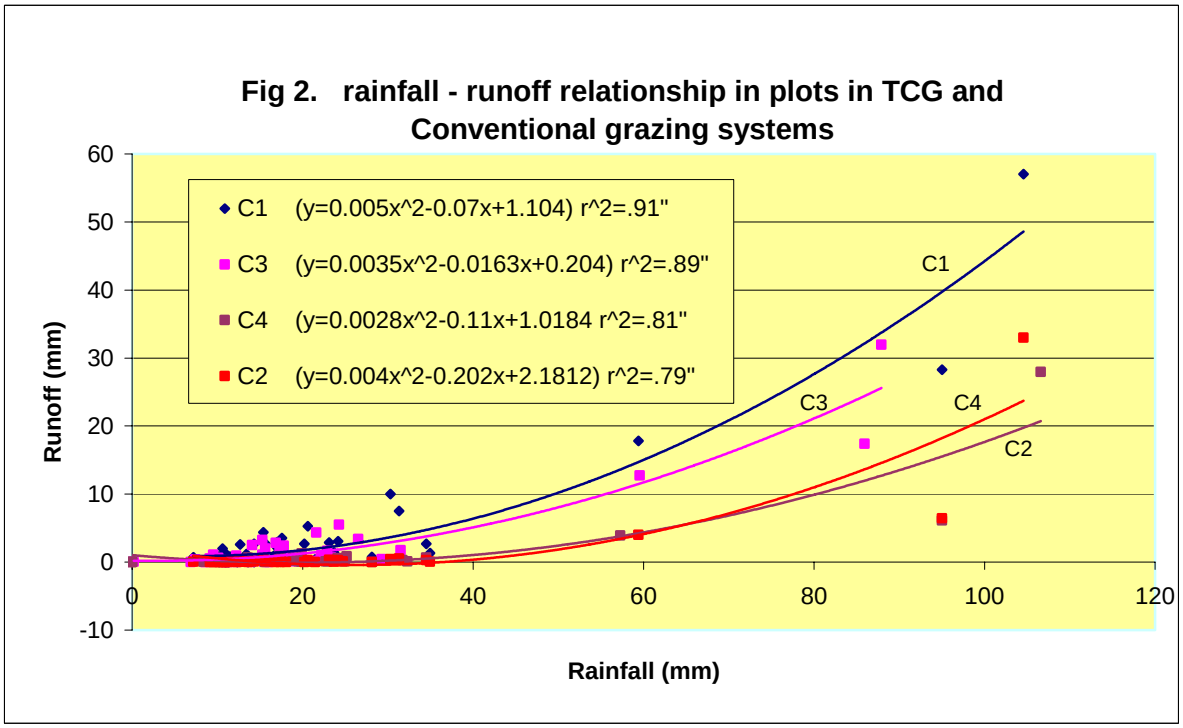

Fig 2. rainfall - runoff relationship in plots in TCG and Conventional grazing systems

There appears to be a minimum amount of rain per event that produces runoff from the large plots. The threshold for the initiation of runoff from the two grazed plots (C1 and C3) was around 8-10mm per event and approximately 15mm – 25mm for the two treed plots (C2 and C4) (Fig 2).

Discussion and conclusions

The curvilinear relationships between rainfall and runoff for the plots indicate that an increasing percentage of rainfall is converted into runoff for larger events. Analysis of the March 2002 event showed that more than 50% of the rainfall was converted into runoff and the overall runoff coefficient for the event on plots ranged from 30 – 50% . Due to the very low percentage of bed load in total sediment come from the plots (ranged between 5% and 25%, suspended load was the predominant form of sediment transport at all sites indicating that raindrop splash may be the predominant process controlling sediment supply in spite of the cover levels.
Improvement in vegetation and decline in runoff volume under Time-controlled grazing is attributed to the effect of rest period, resulting in maintaining plant vigor, seeding and seedling establishment and better sheep and thus urine and feces distribution which in turn leads to root expansion consequently higher soil organic mater and water content.

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