2004 HEASLIP ARID ZONE RESEARCH SCHOLARSHIP

THE EFFECTS OF GRAZING ON THE PRODUCTION OF BUFFEL GRASS (*CENCHRUS CILIARIS*) SEED

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Introduction

Buffel grass (*Cenchrus ciliaris*) was deliberately established in Central Australia in the early 1960's by CSIRO (Latz, 1991) and has since spread through Central Australia into National Parks and along roadways. Initially, it was purposely sown for soil reclamation work in areas such as the Alice Springs airport, but is now widely used by pastoralists as feed. (CSIRO CSE, date unknown). Buffel is popular with some pastoralists as it is drought hardy and once established it can withstand continuous heavy grazing (White, 1996).

Some pastoralists believe that aggressive hedging or burning benefits the production of seed in buffel, and is therefore at its best when being heavily grazed. (Grant Heaslip, pers. comm.). Others believe that this is not so, as the plant biologically sacrifices reproduction for its ability to recover (David Albrecht, pers. comm.). This has caused a great deal of debate as to whether grazing promotes or reduces seed production, hence the reason for completing this study.

The buffel sown in the late sixties in the Alice Springs district didn't respond to the environment well, but over the past forty years has come to adapt to and thrive under the local conditions. While buffel was once at it's best in the tropical rains, it has adapted to be quite virile and prosperous during the winter rains, which is not an original trait of the grass. (Grant Heaslip, pers. comm.).

In areas where buffel is considered a nuisance, broad scale control is unlikely. The most appropriate method of broad scale control would be biological, which requires a large source of funding. Funding would be unlikely due to its popularity amongst the pastoralist community (David Albrecht, pers. comm.). On a smaller scale, combination methods of spraying with either burning or mowing/slashing have proven effective methods of controlling buffel. Hot burning is required and is best in open country without trees or shrubs. Spraying before rains is important as the grasses in both cases would resprout and recover prolifically.

The study investigates the effects that different grazing and rainfall regimes have on the production of buffel seed. The results of the study suggest the best ways to manage the seed production in relation to these regimes, both for those wanting to control or enhance the spread of buffel grass.

It was hypothesised that grazed buffel grass plants would produce less seed heads than ungrazed ones. This was reasoned as grazed plants would have to put more energy into regrowth at the expense of reproduction.

Methodology

Study Sites

Four sites for research were selected from various areas both north and south of Alice Springs (Figure 1). To draw an accurate comparison of an ungrazed and grazed population each study site was chosen so that the two areas were divided by a fence i.e. one side was grazed the other ungrazed. This was to ensure that the difference in environmental factors between the populations was kept to a minimum. Each site was photographed and marked by GPS. See appendix one for photographic site reference.

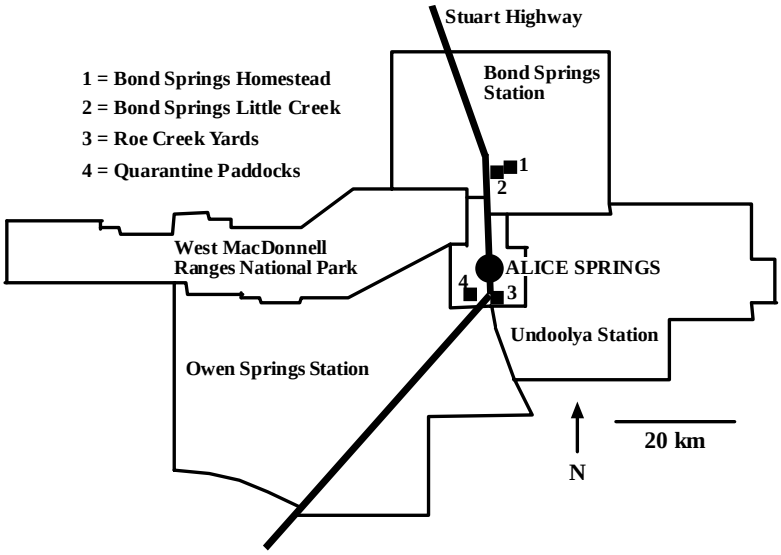

Figure 1. Locations of each study site near Alice Springs, NT.

Data Collection

The four study sites each had population quadrats of varying size, dependent on the density of the grass. Site 1 (Roe Creek Cattle Yards) was located along the western fence line of the Roe Creek Yards running parallel to the Stuart Highway. Both the grazed and ungrazed populations at this site were 1000m². Site 2 (Bond Springs Homestead) was located 50m south of the homestead on Bond Springs Station. The grazed population was 900m² in area and stock had been removed 6 weeks prior to the measurements being taken. The ungrazed population was 400m² in area due to the higher grass density. Site 3 (Bond Springs Little Creek) was also located on the station, along the perimeter fence of the homestead near the main grid entrance. Both the grazed and ungrazed populations were 400m² in area. Site 4 (Arid Zone Research Institute Quarantine Paddocks) was located 150 metres west of a water trough. The ungrazed area of 400m² was situated in a 10 metre wide double fenced strip of land that had never been grazed. The adjacent grazed section was 1600m².

For each of the grazed and ungrazed populations, 20 different plants were randomly selected. This was done using a random number table. The number table gave double digits numbers,

which were used such that the first digit would be the number of steps in one direction and then the second number the number of steps in a direction perpendicular to the previous i.e. If the number of the table was 26, then two steps forward (or backward) would be taken and then six steps left (or right) from that position. The closest plant to the final position was selected for measurement. The original starting point for this action at each site began at the GPS marker.

The heights and widths of each plant were recorded. The height of the plant was deemed to be the highest point in which any part of the grass grew, and the width was measured as the basal width of the grass. Both were measured to the nearest centimetre using a standard tape measure. The width measurement method changed during the study. Roe Creek plants had their canopy width measured, whereas all other sites had basal width measured. In hindsight, all plants should have had their basal width measured.

The number of seed heads was then counted on each plant. If one or more seeds remained attached to the tiller, the seed head was counted.

Results

Each site was under the effects of different rainfall and grazing conditions. Table 1 shows Roe Creek and Quarantine Paddocks had more actively growing plants due to higher rainfall. It also shows that Roe Creek had received the least degree of recent grazing whereas Bond Springs Little Creek and the Quarantine Paddocks had endured the heaviest of recent grazing.

Table 1: Summary of environmental and grazing pressures on each of the four sites.

Location	**Rainfall**	**Time Since Grazed Last**	**Growth Activity**	**Degree of Grazing**			
				U	*NR*	*G*	*HG*
GRAZED							
Roe Creek Cattle Yard	42.4 mm	8-10 Weeks	100% green	0	20	0	0
Bond Springs HS	6 mm	Approximately 6 Weeks	100% dry, 25% w/green shoots	0	0	20	0
Bond Springs Little Creek	6 mm	Continuous (intermittent)	45% dry, 55% green	3	3	2	12
Quarantine Paddock	42.4 mm	Continuous (regular)	100% green	0	2	9	9
UNGRAZED							
Roe Creek Cattle Yard	42.4 mm		100% green	20	n/a	n/a	n/a
Bond Springs Homestead	6 mm		100% dry, 35% w/green shoots	20	n/a	n/a	n/a

Bond Springs Little Creek	6 mm		30% dry, 70% Green	20	n/a	n/a	n/a
Quarantine Paddock	42.4 mm		100% green	20	n/a	n/a	n/a

Note: U = ungrazed, NR = not recently grazed, G = grazed and HG = heavily grazed. The numbers used in the degree of grazing column is the number of plants grazed to that level, each site totalling twenty. See photos (appendix two) for visual reference to the classification of grazing. Rainfall is the amount of rain (in millimetres) received in that area 45 days prior to the experiment.

Figure 2 represents the average heights of the grass plants on each site. As expected, the heights of the ungrazed grasses were significantly greater than that of the grazed grasses, except for the case of Site 2 in which the height was not significantly different.

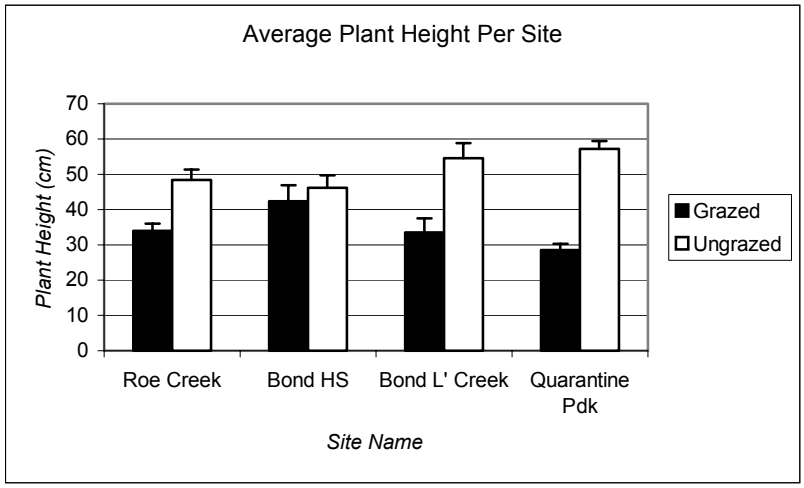

Figure 2: The average height of the grasses at the four study sites. Error bars represent standard errors.

The average width of the grasses varied between the sites as shown in Figure 3. The average width of ungrazed plants was significantly higher at the Roe Creek and Bond Little Creek sites than that of the grazed plants. The average width of grazed plants at the Bond Springs Homestead was significantly greater than the ungrazed plants. There was no significant difference between the width of the grazed and ungrazed plants at the Quarantine Paddock Site.

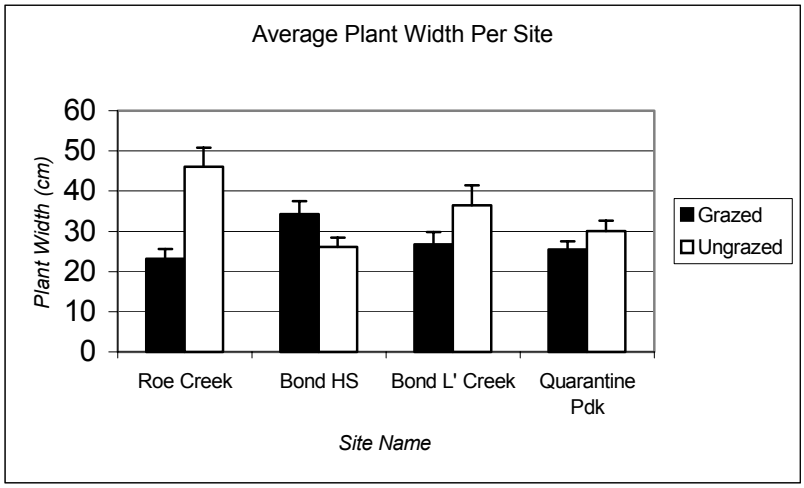

Figure 3: The average width of the grasses at the four study sites. Note that widths for Roe Creek sites cannot be directly compared to the other sites due to an error in methodology. Error bars represent standard errors.

As predicted, the average number of seed heads produced by grazed grasses was significantly less than that of the ungrazed grasses, as shown in Figure 4.

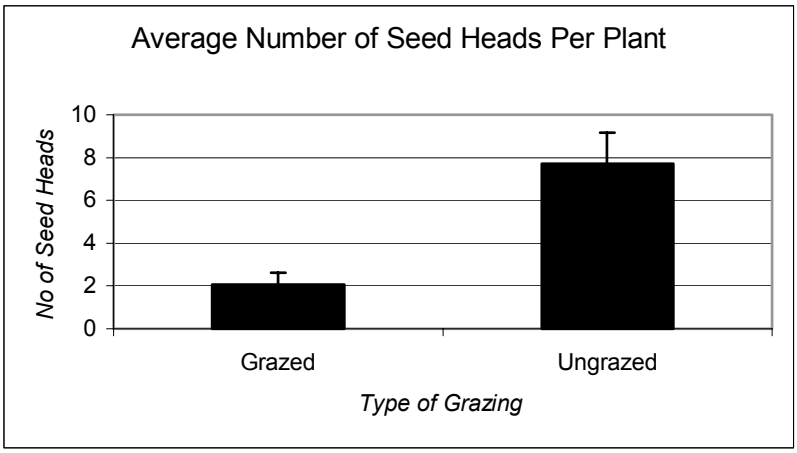

Figure 4: The average number of seed heads per plant for both grazed and ungrazed areas. Error bars represent standard errors.

However, this was not true for all four sites. Figure 2 shows the individual sites and the average number of seeds per sampled population. Site 2 (Bond Springs Homestead), Site 3 (Bond Springs Little Creek) and Site 4 (Quarantine Paddock) all had significantly lower seed head counts in the grazed populations. Interestingly, Site 1 (Roe Creek Cattle Yards) showed a significantly higher average seed head production in the grazed population.

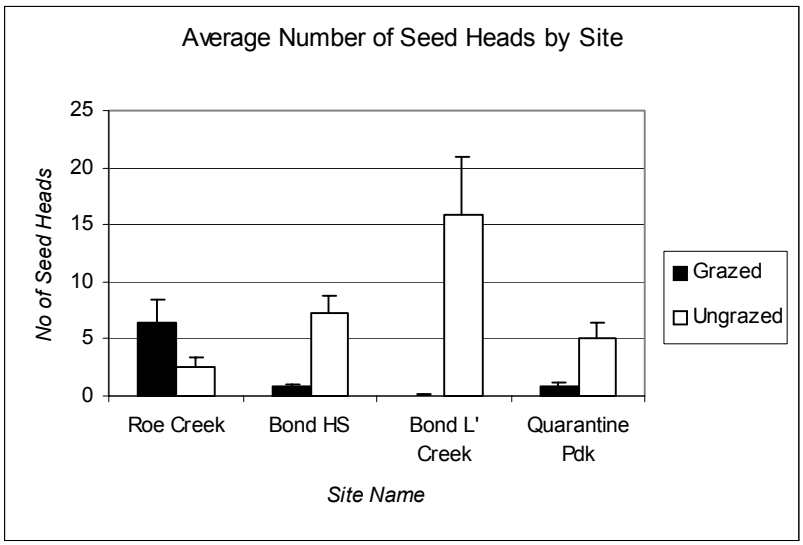

Figure 5: The average number of seed heads per plant for the four study sites. Error bars represent standard errors.

Discussion

As expected, when comparing the effects of grazing on grazed and ungrazed grasses, the ungrazed plants were significantly taller. The Quarantine Paddock and Bond Little Creek sites had received the heaviest recent grazing pressure and subsequently showed the greatest difference in height between the grazed and ungrazed population on their respective sites.

The average widths of the plants for each site were quite variable. Grazed plants at the Bond Springs Homestead were significantly wider than the ungrazed plants. This pattern was reversed at the Roe Creek and Bond Little Creek sites. These variations tend to suggest that grazing pressure did not have a consistent influence on the width of the grasses in this study.

During dry conditions, such as those received at both Bond Springs sites, ungrazed *Cenchrus ciliaris* appears to produce more seed than grazed plants. Bond Springs Station received a total of 6 mm in rain over the 45 days prior to the experiment and the growth activity of both grazed and ungrazed plants at the Bond Springs sites was low. This suggests that if rain doesn't occur during the resting period, grazed plants will not produce much seed.

Roe Creek Cattle Yards were well rested from grazing, with the last of any grazing occurring six weeks prior to the beginning of the experiment. The area had also received substantial rainfall in those 45 days leading into the data collection. This period of rest from grazing and good rainfall had evidently given the right conditions for the grasses to flourish and the grazed population produced significantly more seed heads than the ungrazed population. The Quarantine Paddocks also received similar rainfall, but the grazing pressure was continuous and quite heavy (as the site was located 150 metres from a drinking trough). There was some evidence of seed production within the heavily grazed grasses but the ungrazed population produced a significantly higher

number of seed heads. Thus it appears that good rainfall, followed by (or in conjunction with) rest from grazing, may produce more seed than if the grazing was continuous.

The results suggest that for people wishing to increase the seed production of buffel grass, rest from grazing pressure (or intermittent rather than continuous heavy grazing) should be employed. To rapidly increase recovery and seed production, good rainfall is required. Therefore for ideal promotion of seed set, the grass should be rested (or grazed intermittently) during and/or immediately following times of good rainfall.

For those attempting to minimise seed production, this study would suggest that any mechanical intervention that is equivalent to grazing, such as mowing, should be heavy and continuous during the dry periods. During times of rainfall the reduction techniques should be heavy and employed immediately before rapid growth and reproduction in the plant occurs.

As this was a short-term project, there are many more questions that require investigation in terms of buffel seed set, grazing and rainfall. It would be interesting to study this interaction over an entire year to get a greater picture of how seed set interacts with the various pressures. Would the patterns observed hold true over the course of a year? Which plants would produce more seed? Such an experiment could also determine the best ways for minimising or maximising seed sets. A similar investigation into grazing effects would be to study whether grazed or ungrazed grasses produce more seeds per tiller, as opposed to seed heads per plant.

Conclusion

The average seed head production of ungrazed buffel grass was higher than that of grazed buffel in dry conditions. However, good rainfall following several weeks rest from grazing allowed grazed plants to produce more seed heads than their ungrazed counterparts.

Acknowledgments

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