Burning and exclosure can rehabilitate degraded black speargrass (*Heteropogon contortus*) pastures

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Abstract

As part of a larger study of native pasture production at a number of sites throughout Queensland, degradational changes in pasture composition of a black speargrass (*Heteropogon contortus*) pasture at a site in poor condition in southern Queensland have been shown to be reversible by management of grazing and the use of fire. Protection from grazing and annual spring burning have led to black speargrass increasing from 20% to 70% and the poor quality wire grasses (*Aristida* spp.) decreasing from 70% to 16% composition by weight, or 15% to 57% and 68% to 37% respectively composition by basal area over the four years 1986–1990.

The results imply that practical rehabilitation might include burning in spring for at least 2 years and lenient stocking or grazing deferment during the subsequent growing period.

Resumen

*Los cambios en la degradación de la composición de las pasturas de black speargrass (*Heteropogon contortus*) en una localidad de condición pobre al sur-este de Queensland, registrados como parte de un estudio extenso de las pasturas nativas en varias localidades a través de Queensland, han mostrado ser reversibles mediante el manejo del pastoreo y el uso del fuego. La quema anual en la primavera y la protección contra el pastoreo resultaron en un incremento del black speargrass de 20% a 70% y una reducción de las gramíneas de baja calidad (*Aristida *spp.) de 70% a 16% en peso o de 15% a 57% y de 68% a 37% en la composición basal respectivamente, durante 1986-1990.*

Los resultados indican que una rehabilitación práctica podría incluir la quema en la primavera cuando menos durante 2 años y una carga animal baja o un pastoreo diferido durante el subsiguiente período de crecimiento.

Introduction

Black speargrass (*Heteropogon contortus*) dominant pastures are an important resource for the beef cattle industry in Queensland because these pastures occupy 25 million hectares and support at least 3 million beef cattle. Increasing grazing pressure, caused by increasing economic pressures and drought in recent years, are resulting in deleterious changes in the composition of these pastures (Anderson *et al.* 1984). In the southern inland region, black speargrass is being replaced to varying degrees by unpalatable wiregrasses (*Aristida* spp.) (Paton and Rickert 1989). Such degradation is believed to lower beef production, although quantitative data are lacking. A recent survey of beef producers in this region has indicated that almost 70% of respondents rated research into native pasture composition as a high priority area for research (G.B. Robbins, unpublished data).

Many options for the management of native pastures require economic evaluation, requiring a knowledge of how pasture production interacts with climate, stocking rates, frequency of burning, shrub invasion, tree regrowth and land degradation. A group of pasture scientists is collaborating to measure native pasture production at 15 sites throughout Queensland to develop a general model for pasture production in northern Australia (McKeon *et al.* 1988). Repeated measurement at one of these sites in the central Burnett area of the southern speargrass region has

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indicated, *inter alia*, a potential management option for rehabilitating degraded black speargrass pastures. This short communication describes the changes in pasture composition at that site between 1986 and 1990 and compares these changes with pasture composition at two adjacent sites in 1990.

Methods

Site and treatment

In October 1986, a 30 × 30 m site on a prairie soil (Uf6; Northcote 1979), with uniform vegetation dominated by wiregrass in black speargrass grassland, was exclosed at Brian Pastures Research Station, Gayndah and has remained ungrazed. Within this site, three plots each 8 × 15 m were located. This site was not replicated as it represented one of a network of similar sites throughout Queensland.

The whole site was burnt in October 1986 but since then certain areas within the site have remained unburnt in order to measure the effect of carry over pasture from winter on the subsequent summer growth. This has resulted in plots 1 and 2 being burnt annually since 1986 (October 1987, December 1988 and October 1989) and plot 3 being left unburnt since 1986.

Pasture composition was sampled (see below) in plots 1 and 2 in April each year between 1987 and 1990. In April 1990, additional measurements were made to compare pasture composition under annual burning in exclosure with that burnt once in exclosure (plot 3) and with that in the adjacent, grazed area. Two plots were harvested in this adjacent area which is grazed continuously at 3.2 ha/beast and was burnt in October 1986 and October 1989 as part of normal management practice.

Measurements

At each sampling, 4 quadrats (1.0 × 0.5 m) were harvested in each plot. In each quadrat, species composition of the grasses (black speargrass, wiregrass and other species) was estimated visually prior to cutting to ground level for yield determination. A comparison of visual estimates with harvested weights of individual components on two separate occasions indicated close agreement between the two methods.

Basal area of perennial grasses (Goodall 1952) was determined in December 1986 and December 1989 in plots 1 and 2 of the exclosure treatment. A point frame, with five points spaced 10 cm apart, was used to record "strikes" on perennial grass species from 100 locations in each plot.

Results

Rainfall

Seasonal rainfall varied during the period covered in this study. "Typical" seasonal rainfall was experienced over the 1986–87 and 1988–89 pasture growth periods and summer drought experienced during the 1987–88 and 1989–90 pasture growth periods (Table 1).

Table 1. Seasonal rainfall between summer 1985–86 and autumn 1990 and long term seasonal means for Brian Pastures Research Station

Year	Summer (Dec–Feb)	Autumn (Mar–May)	Winter (Jun–Aug)	Spring (Sep–Nov)
1986	469	112	112	156
1987	322	90	86	190
1988	107	127	202	78
1989	302	167	135	176
1990	141	309		
Long-term mean	287	202	105	124

Changes in botanical composition

Annual burning

Wiregrass was the major component of total yield in April 1987 and April 1988. However, black speargrass became the major component in April 1989 and April 1990 and wiregrass became only a minor component (Figure 1). Large variation in total yield and components of total yield occurred between years and reflected large differences in seasonal rainfall (Table 1).

Changes in the contribution of black speargrass and wiregrass to total basal area between December 1986 and December 1989 (Figure 2) reflected changes in the yield contribution of these two pasture components (Figure 1).

Other treatments

Burning once (October 1986) with exclosure and burning twice (October 1986 and October 1989) with grazing both failed to increase the yield of black speargrass in the pasture (Figure 3).

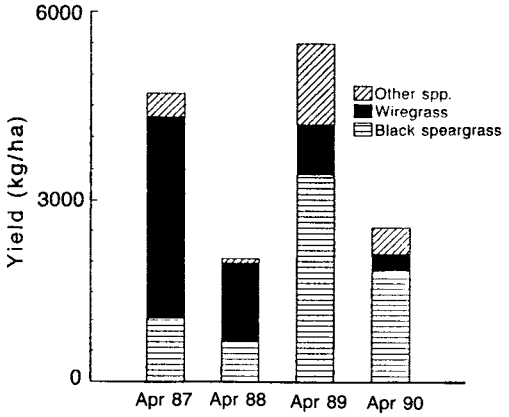

Figure 1. Components of pasture yield (kg/ha) with four annual burnings and exclosure in black speargrass pasture between 1987 and 1990 measured annually in April.

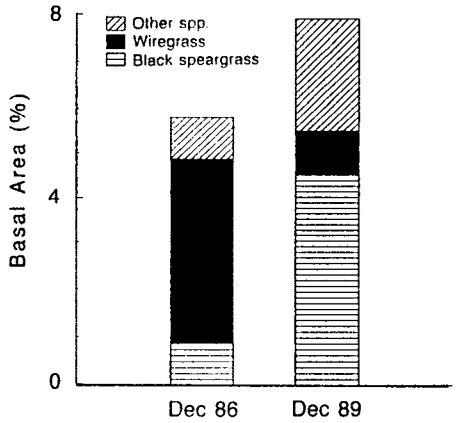

Figure 2. Components of basal area (%) with annual burning and exclosure in black speargrass pasture in 1986 and 1989.

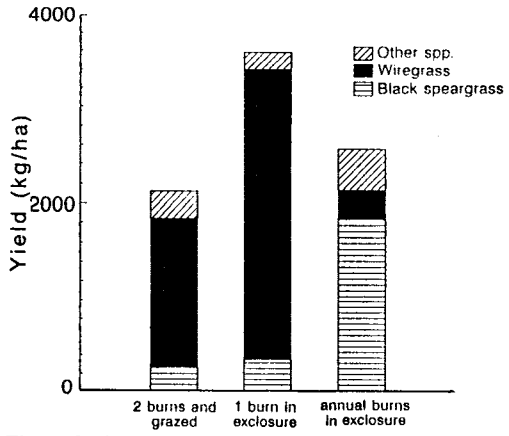

Figure 3. Components of pasture yield (kg/ha) following two burns with grazing, one burn in exclosure and four annual burnings in exclosure in black speargrass pasture in 1990.

Discussion

Annual burning in spring, and exclosure over four subsequent years, has resulted in a major increase in black speargrass at the expense of wiregrass. This result is consistent with other data on the effects of burning in black speargrass pastures (Tothill 1983); the latter study suggested a climatic influence on the effectiveness of burning, which did not decrease wiregrass in a dry year. The plant mechanisms involved in this change in pasture composition are not apparent from this experiment. However, fire is known to promote both seed production (Woodhouse 1964, Lazarides *et al.* 1965) and seedling recruitment (Tothill 1969) in black speargrass while no similar data are available for wiregrass. Neither burning once in exclosure nor burning twice under continuous grazing resulted in major changes in pasture composition.

Rehabilitation involving total exclosure for three to four years would probably be unacceptable to the grazing industry because of lost animal production. Our results from this experiment and those of Paton and Rickert (1989) indicate that rehabilitation requires some combination of repeated burning and deferment of grazing. These considerations indicate the necessity to understand separately the processes involved in repeated burning and in grazing deferment following fire. For example, black speargrass is susceptible to heavy grazing during summer but relatively insensitive to heavy grazing during winter (Scattini 1973, Mott *et al.* 1991). Thus, rehabilitation may be possible using spring burning over two or three years in conjunction with some form of deferred grazing over summer.

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