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BURNING AND EXCLOSURE CAN REHABILITATE

DEGRADED *Heteropogon contortus* PASTURES

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ABSTRACT

Changes in composition at a native pasture site in poor condition in southern Queensland have indicated that *Heteropogon contortus* dominance can be restored by exclosure and annual spring burning. Such a treatment changed a pasture composed of 70% *Aristida* spp. and 20% *H. contortus* (by weight) in April 1987 to one composed of 16% *Aristida* spp. and 70% *H. contortus* in April 1990.

Basal area data indicated a pasture composition of 68% *Aristida* spp. and 15% *H. contortus* in December 1986, compared with 13% *Aristida* spp. and 57% *H. contortus* in December 1989.

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

INTRODUCTION

Heteropogon contortus (black speargrass) 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. In the southern inland region, *H. contortus* is being replaced in many cases by unpalatable *Aristida* spp. (wiregrass)(1). Such replacement 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70% of respondents rated research into native pasture composition as a high priority area for research (G.B. Robbins, unpublished data).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 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 (2). Repeated measurement at one of these sites has indicated a potential management option for rehabilitating degraded *H. contortus* pastures. This paper describes the changes in pasture composition at that site between 1987 and 1990 and compares these changes with pasture composition at two adjacent sites in 1990.

METHODS

Site and Treatment

In October 1986, a 30 x 30 m site on a prairie soil (Uf6, (3)) with uniform vegeta dominated by *Aristida* spp. in *H. contortus* grassland was exclosed at Brian Pastures Research Station, Gayndah and has remained ungrazed. Within this site, three plots each 8 x 15 m were located as replicates.

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 replicates 1 and 2 being burnt annually since 1986 (October 1987, December 1988 and October 1989) and replicate 3 being left unburnt since 1986.

Pasture composition was sampled (see below) in replicates 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 (replicate 3) and with that in the adjacent, grazed area. Two replicates 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 x 0.5 m) were harvested in each replicate. In each species composition of the grasses (viz. *H. contortus, Aristida* spp. 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 (4) was determined by the senior author in December 1986 and December 1989 in replicates 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 replicate.

RESULTS

Rainfall

Seasonal rainfall varied during the period covered in this study. "Typical" season 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).

Changes in botanical composition

Annual burning

Aristida spp. was the major component of total yield in April 1987 and April 1988. However, *H. contortus* became the major component in April 1989 and April 1990 and *Aristida* spp. 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).

April 1990 sampling

Burning once (October 1986) with exclosure and burning twice (October 1986 and Oct 1989) with grazing both failed to increase the proportion of H. contortus in the pasture (Figure 2).

Table 1. Seasonal rainfall between summer 1985-86 and autumn 1990 in relation to the long term seasonal means for Brian Pastures Research Station.

Year	Summer (Dec-Feb)	Autumn (Mar-May)	Winter (June-Aug)	Spring (Sept-Nov)
1986	469.2	111.8	111.6	155.6
1987	321.6	89.6	85.8	190.4
1988	106.8	127.4	201.8	77.8
1989	302.0	166.6	134.6	175.8
1990	140.8	308.6		
Long term mean	287.3	201.7	105.4	123.8

Changes in Basal area

Changes in the contribution of *H. contortus* and *Aristida spp.* to total basal area between December 1986 and December 1989 (Figure 3) mirrored changes in the yield contribution of these two pasture components (Figure 1).

DISCUSSION

Annual burning in spring and exclosure over four summer growing periods has resulted in a major increase in *H. contortus* at the expense of *Aristida* spp. This result is consistent with other data on the effects of burning in H. contortus pastures (5). The plant mechanisms involved in this change in pasture composition are not apparent from this study. However, fire is known to promote both seed production (6,7) and seedling recruitment (8) in *H. contortus* while no similar data are available for *Aristida* spp.
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 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, *H. contortus* is susceptible to heavy grazing during summer but relatively insensitive to heavy grazing during winter (9). Thus, rehabilitation may be possible using spring burning over two or three years in conjunction with some form of deferred grazing over summer.

Two studies examining the rehabilitation of degraded *H. contortus* pastures have commenced at Brian Pastures Research Station. One of these studies examines the effect of a range of annual spring burning strategies (burn for 0,1,2 or 3 years) on pasture composition under both grazing and exclosure. The second study examines the effect of annual spring burning followed by deferred summer grazing (for 0,2,4,6 months or 0 months but at half stocking rate) on pasture composition. Permanent quadrats in both grazed and ungrazed treatments in the burning strategies study should indicate plant processes leading to the rehabilitation of pastures through burning and the exclusion of grazing.

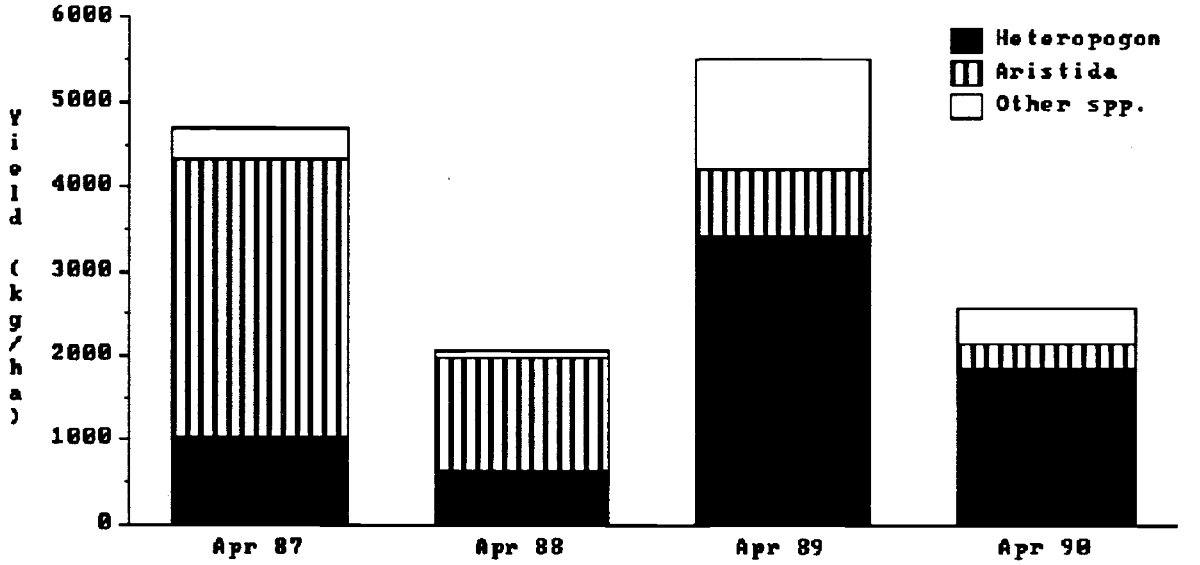

Figure 1. Pasture composition under annual burning with exclosure in H. contortus pasture between 1987 and 1990.

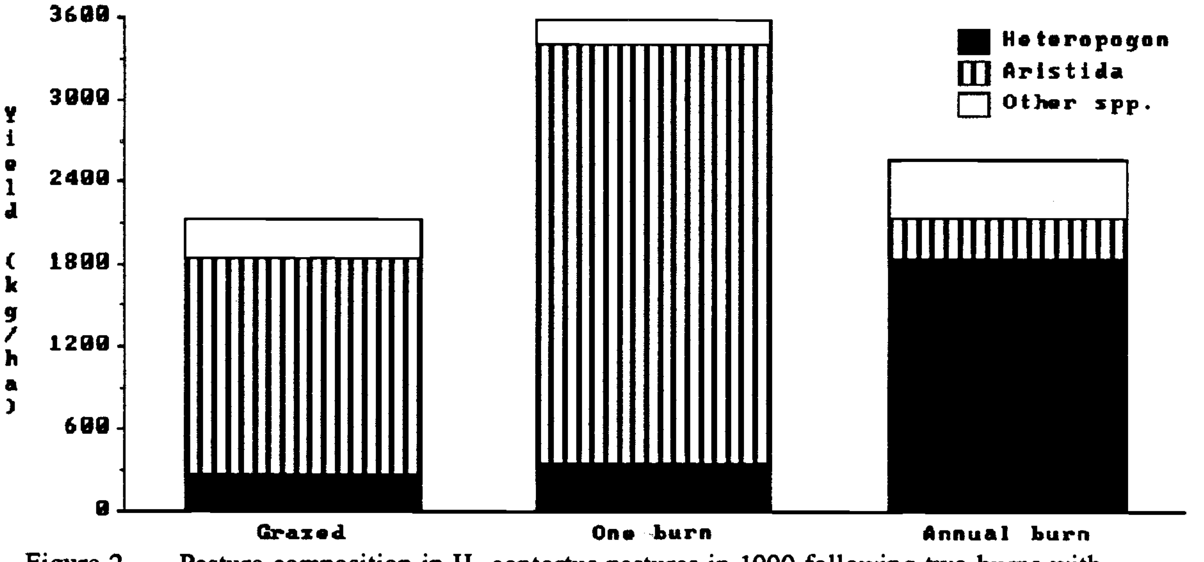

Figure 2. Pasture composition in H. contortus pastures in 1990 following two burns with grazing, one burn with exclosure and annual burning with exclosure.

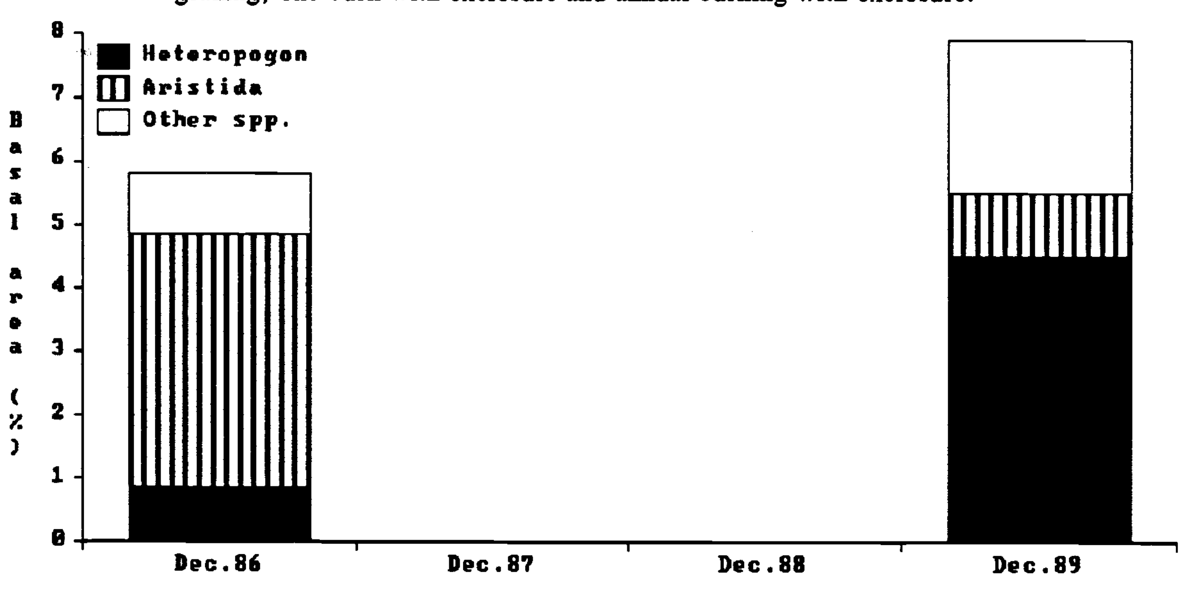

Figure 3. Basal area in H. contortus pasture in 1986 and 1989 with annual burning in exclosure.

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