PERFORMANCE OF PERENNIAL STYLO PASTURES ON A HIGH PHOSPHORUS SOIL IN THE DRY TROPICS

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SUMMARY

Over eight years, two systems of cattle grazing were compared. One was a traditional station system of low stocking rates in large native pasture paddocks; the other comprised relatively small paddocks of native pasture reinforced by oversowing perennial stylo and also grazed at low stocking rates.

Despite frosts, fires and drought the stylo pastures remain in sound condition. Cattle weight gains on stylo were reliably higher in the wet season and early dry but lower and more unreliable over most of the dry season. Possible uses of the reinforced pasture are suggested.

INTRODUCTION

In the monsoonal dry tropics of Australia, soils with high levels of available phosphorus are uncommon (Williams and Andrew 1970). Such a soil occurs over some 13 000 km^2 of north eastern Queensland. Because of the relatively good agricultural characteristics of these basalt-derived euchrozems (Isbell *et al.* 1976), there has been a concentration of pasture research in the area. Work on species evaluation, legume establishment and plant nutrition culminated in a test of grazing systems combining results from previous experiments.

This report is a comparison of two grazing systems during the period 1973-81. One system was the traditional large (>1 000 ha) paddock native pasture system. The other comprised relatively small (<100 ha) native pasture paddocks reinforced with oversown legumes.

MATERIALS ANDMETHODS

The site has a median annual rainfall of 834 mm and has previously grazed beef cattle at a stocking rate of about 10 ha per animal. The soil is a well-drained red clay loam (Gn 3.12) with more than 200 ppm acid extractable phosphorus and less than 4 ppm phosphate-extractable sulphur in the 0-10 cm surface layer. Natural vegetation is open ironbark woodland over a grassy understory dominantly *Themeda australis* with minor *Heteropogon triticeus*.

Site preparation consisted simply of burning the grass in December: 1973. Seed of stylo was mixed with single superphosphate and the mixture spread through a spinner broadcaster over 33 ha to give a fertilizer rate of 125 kg/ha (12.5 kg S/ha) and a viable seed rate of 3.4 kg/ha. The bulk of the area was sown to Graham stylo (*Stylosanthes guianensis* cv. Graham) but there were also 4 ha of *S. scabra* (three lines) and 3 ha of *S. viscosa* (two lines). All these lines are perennial.

The oversown area was lightly grazed through most of 1974. Yearling cattle grazed at 0.8 ha from September 1974 through 1977. In 1978 and 1979, animals had access to 7 ha native pasture in addition to 0.8 ha stylo but from January 1980 the native pasture area was reduced to 4 ha. During the period 1974-1981, groups selected from the same initial mobs grazed station paddocks under station management at stocking rates of 0.1 to 0.25 animals/ha. Cattle were weighed at

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strategic intervals 2-4 hours off pasture. Rank, uneaten pasture was removed by burning in December 1976 and again in October 1979. Pastures were frosted in most years, heavily in 1974, 1975 and 1978. Pasture samples for chemical analysis were taken by imitative plucking, attempting to represent material being grazed.

Because work done in 1976 and 1977 had shown positive intake and liveweight responses to sulphur and sodium supplements given to animals offered legume dominant hay or pasture from this paddock (Hunter et *al.* 1978; 1979) ad *lib.* sulphur and salt supplement were offered year round after 1977. In January 1980 stylo was topdressed with Mexican dark elemental sulphur at a nominal rate of 40 kg/ha. Because of poor spreading and low availability of the coarser particles, less than one quarter of the area was effectively fertilized.

RESULTS

Stylo established well and dominated pasture from 1975 through 1977 (Table 1). Sulphur deficiency by 1976 resulted in less vigorous legume growth but at no time was there any sign of weed invasion. There was an increase in black spear grass from 1.2% of the grass in 1974 to 22% of the grass in 1979. Total pasture yield varied with rainfall (1977-78 November through March rainfall was 306 mm compared with a median of 658 mm) but was probably increasingly limited by sulphur deficiency after 1975 (Gilbert and Shaw 1981).

TABLE 1 Pasture DM yield and composition (kg/ha)

	Total	Grass	Legume	Other
1974	1 730	950	780	0
1975	6 750	1 250	5 500	0
1977	3 210	590	2 580	40
1978	1 000	780	220	0
1979	3 540	2 120	1 420	0

Stylo usually had at least twice the nitrogen concentration of grass and much higher levels of phosphorus (Table 2). However, sulphur levels were no higher, with the result that N:S ratios in stylo were extremely wide.

TABLE 2 Seasonal variation in pasture and faeces composition in the improved system (means of 3 years)

	Feb	Apr	June	Aug	Oct
Grass					
Percent N	1.3	0.6	0.6	0.5	0.5
Percent P	0.24	0.14	0.16	0.11	0.10
Percent S	0.07	0.05	0.04	0.04	0.03
N:S ratio	19	13	15	12	17
Legume					
Percent N	2.3	1.5	1.5	1.1	1.5
Percent P	0.33	0.33	0.30	0.26	0.36
Percent S	0.10	0.06	0.05	0.04	0.03
N:S ratio	23	24	30	27	25
Faeces					
Percent seed	0	1.0(7.0)	1.0	0	0
Percent N	1.7	1.6	1.5	1.2	1.3
Percent P	0.58	0.42	0.44	0.37	0.39

Cattle ate all accessions of stylo readily during the growing season (January through May) but during the dry season grazed legume only where it was short from previous grazing. Stylo inflorescences were eaten avidly while they contained seed. up to 7% of the faeces was stylo seed during May and a significant amount of seed was present over 3 months (Table 2). Seed of all stylo accessions was found in faeces. Up to 40% of the seed of Graham in faeces was viable and all other lines also had viable seed. In the dry season of 1975, steers grazed all *Eucalyptus* foliage within 2 metres of the ground, despite the presence of green, though rank, legume.

Cattle on both native pasture and stylo gained weight rapidly (up to 1.1 kg/ day) in the wet season until a point between late April and mid-July. Those on stylo always lost weight during the dry season at rates up to 0.88 kg/day, while on native pasture dry season weight changes varied from losses of 0.32 kg/day to gains of 0.29 kg/day. Wet season gains were generally higher on stylo than on native pasture but on an annual basis, the greater dry season losses on stylo resulted in either only a small advantage (3 years) or a substantial disadvantage (2 years). The start of rapid weight gain on native pasture was closely associated with soil moisture replenishment, as suggested by McCown (1981).

Table 3 shows the mean monthly rate of liveweight gain on both pasture types. Most of these are means of five or six years but those for October and November and December are means of only four or three years respectively and should be regarded more cautiously. The mean feature of these patterns is the much greater dry-season variability of liveweight change on stylo and the lower variability on stylo in the March-April period.

TABLE 3 Mean monthly rate of liveweight change (kg/day)

	Native pasture		Stylo	
	Mean	S.D.	Mean	S.D.
September	0.10	0.18	-0.29	0.50
October	0.32	0.15	-0.02	0.61
November	0.35	0.15	0.27	0.25
December	0.35	0.15	0.43	0.20
January	0.66	0.33	0.91	0.40
February	0.66	0.33	0.91	0.40
March	0.57	0.21	0.62	0.13
April	0.34	0.19	0.57	0.06
May	0.17	0.12	0.44	0.25
June	-0.05	0.16	-0.04	0.31
July	-0.07	0.16	-0.19	0.24
August	-0.01	0.22	-0.27	0.22

DISCUSSION

The agronomic success of perennial stylo pastures with minimal intervention is undoubted. Under various forms of stress the legume component has been very persistent over eight years and at the lenient stocking rates employed there has been no sign of the extinction of native perennial grasses or the ingress of weeds, common phenomena at higher stocking rates with shorter-lived stylos (Ritson *et al.* 1971; Winks *et al.* 1974; Gardener 1980).

Despite the resilience of these stylos in the face of sulphur deficiency, their low nitrogen and sulphur concentra tion and wide N:S ratios in such circumstances must reduce their potential nutritive value to a large extent. Sulphur deficiency also appeared to result in poor dry season palatability, even when rumen sulphur was supplemented.

Apart from the April-June period, when cattle ate stylo quite avidly, preferred grazing was of short feed (grass or stylo, burnt or previously grazed), green grass leaves, green dicots other than stylo. Gardener (1980) also recorded high levels of seed in the diet during June and it seems likely that this is an important factor in maintaining gain on legume pastures after pasture growth stops (Playne 1974; McCown 1980).

Cattle on sulphur deficient stylo had an advantage over those on native pasture from January through May. During the dry season, cattle performed better and more reliably in large native pasture paddocks, despite the fact that cattle on stylo had access to native pasture at similar lenient stocking rates. This finding is in direct contrast to that of Winks *et al.* (1974) who found that smaller paddocks and higher stocking rates had no serious effect on animal performance in the lower Burdekin basin. The benefit of large paddocks must have come from the variety of grazing they offered compared to the uniform, small paddocks.

However, even these sulphur-deficient pastures have potential seasonal uses. One is to ensure a high plane of nitrition for maiden heifers before and during their first joining; the second is to ensure maximum weight on sale cattle being turned off in May or June. The first of these possibilities is now under commercial trial.

It is possible that stylo pastures adequately fertilized with sulphur would support higher levels of animal performance but the general pattern of the result is in good agreement with those from other species of *Stylosanthes* (Winks *et al.* 1974; Gillard *et al.* 1980; Gardener 1980) at other locations.

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