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Townsville stylo for deferred dry season grazing

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Summary

The experiment compared two genotypes of Townsville stylo (*Stylosanthes humilis*) (TS) for dry season grazing at Parada. This approach was common at Katherine, NT, but not in Queensland. The TS was established on cultivated land with 250 kg/ha/year Mo-superphosphate for the first two years.

Dry matter yields of TS varied widely between years and the erect Katherine line always outyielded the prostrate Carpentaria line. However, there was no significant difference in liveweight gain between lines. Animal performance was positively correlated with pasture quality factors such as N%, rather than with yield factors.

Spoilage of standing hay during the dry season at Parada, and in similar dry climates in far north Queensland, may not be as severe as elsewhere in Queensland where TS is adapted. Steers continue to gain weight during the dry season when grazed on such conserved pastures.

INTRODUCTION

Townsville stylo (*Stylosanthes humilis*) (TS) has long been recognised as an important pasture legume in northern Australia (Humphreys 1967) and while ecological variants whose performance differed greatly in field (Cameron *et al.* 1977) and phytotron (Downes *et al.* 1967) were recognised some years ago (Cameron 1965; Downes 1966), no results of grazing studies using contrasting plant types have been published.

The aim of our work was to assess the effects on animal performance of two lines of TS when saved for dry season grazing. This method of utilisation was highly effective in the Northern Territory (Norman 1964; Norman and Stewart 1967) and had been advocated in Queensland (Downes 1965) although most reported studies in Queensland have involved continuous grazing of TS pastures.

The desired contrasts were in maturity and plant habit. The natural distribution of maturity types in TS confirms the adaptive significance of this character (Cameron 1967). On the other hand, robust erect forms were expected to compete better with volunteer species, and so yield substantially more total dry matter even if too late flowering for high seed yields. Under a system of deferred grazing, competitiveness could be a more important character than it is where continuous grazing is practised.

MATERIALS AND METHODS

Design and site

The two lines selected for study were among those examined in the phytotron by Downes *et al.* (1967): Carpentaria (early flowering, prostrate) and Katherine (late mid season, erect). They were sown as a randomised block with two replications using 1.21 ha paddocks at the Queensland Department of Primary Industries' former Parada Research Station (17° 9′S, 145° 14′E; elevation 500 m). An adjacent 12.20 ha paddock of unimproved native pasture served as a control. Soils were a mosaic of solodics (Type 35) and ground water podzols (Type 32) (McDonald 1976; Crack 1978) carrying tropical mid height grasses in open mixed eucalypt woodland.

Sowing

The trial area was cleared and cropped in 1963–64, then cultivated and sown to Townsville stylo in November 1964. Seed-in-hull (2.2 kg/ha) was broadcast mixed with 250 kg/ha of granulated Mo-superphosphate (9.6% P, 10% S, 20% Ca, 0.03% Mo). The paddocks were fertilised again at the same rate in November 1965.

Management of Townsville stylo

Following sowing, the paddocks were grazed in the early wet season to check grass growth then left ungrazed from mid February until stocked for experimental grazing. Similar early wet season grazing was undertaken in later years as required.

From 1965 to 1968 the paddocks were stocked (1.65 head/ha) during the dry season (Shorthorn steers in 1965, Brahman cross otherwise): 29 July to 4 November 1965; 7 September to 16 November 1966; 28 June to 15 November 1967; and 12 June to 13 November 1968. Mean initial liveweights and standard deviations are given in Table 2. Grazing was stopped by the new season's first storms in 1966 and 1967. In 1965, grazing continued until all available forage had been consumed. In 1968 the animals began losing weight after 10 weeks, so grazing was ended near the mean date of the previous three years. Animals were weighed weekly (correct to 2.3 kg) and ticks, buffalo flies and internal parasites controlled as necessary.

Native pasture control

During the pre-trial period in 1965 (4 weeks), the cattle all grazed the paddock, and maintained weight. In subsequent years the native pasture was stocked for only the same periods as the legume paddocks. Stocking rates were 0.78 head/ha in 1965, 0.16 in 1966, 0.46 in 1967 and 0.14 in 1968 when the animals had access to an additional 2.4 ha which had the same cultural history, including fertiliser, as the TS paddocks.

Pasture data

Pasture yield was estimated in each TS paddock before grazing each year by cutting the material on 20 quadrats (each 0.4 m x 1.0 m) to ground level, separating into TS and other species, and oven drying at 100°C to constant weight. Samples were analysed for nitrogen (N) and phosphorus (P). Pasture data were not recorded from the native pasture.

Weather

Rainfall totals (mm) during the wet (November to April) and dry (May to October) seasons of the experimental period, and the 18-year averages were:

Years	Wet season	Dry season
1964–65	543	25
1965–66	406	18
1966–67	865	122
1967–68	704	57
Average	751	51

The 1965–66 season was 47% below average; 1966–67 was a favourable year with 504 mm in March and 58 mm in June; and 1967–68 also had a favoured autumn. There were killing frosts in June and July 1965 and 1966, and in July 1968; but there was no serious frost damage in 1967. Monthly mean maximum temperatures ranged from 33.1 (November 1965) to 23.6°C (July 1966); and monthly mean minimums from 4.8 (July 1965) to 20.4°C (February 1967 and 1968).

Data analysis and presentation

Because of the minimum design with only one degree of freedom for each effect within years, there is a high likelihood of type II errors. Therefore, probabilities of $P<20\%$ have been indicated in the treatment comparisons in Table 1. This leniency was not extended to correlation and regression analyses; or to years and its interactions, which have 3 degrees of freedom.

Rate of liveweight gain (kg/head/day) (RLWG), calculated by linear regression of liveweight against time for individual animals and pooled by paddocks then lines, was used as the prime measure of animal production. Other measures derive from it. The shortest period of grazing was 70 days (in 1966). Therefore, for more rigorous comparison between years, RLWG was calculated for the first 70 days as well as for the full period each year.

RESULTS

Means of some pasture attributes are given in Table 1 and animal production data in Table 2. All attributes varied significantly between years, and there were some year×block interactions.

Table 1. Yield and composition of mature Townsville stylo pastures before dry season grazing at Parada

Attribute and line		1965	1966	1967	1968
Oven dry matter (ODM) (kg/ha)					
Legume	Carp.	240	1360	340	1120
	Kath.	880*	2240†	1190*	1750†
Other spp.	Carp.	1080	790	3040	3090
	Kath.	1160	510	3010	2960
Chemical composition (ODM basis)					
N% legume	Carp.	1.60	2.12†	1.92	1.31
	Kath.	1.25	1.90	1.85	1.33
N% other spp.	Carp.	0.60	0.67	0.70	0.57
	Kath.	0.67	0.82	0.65	0.55
P% legume	Carp.	0.09	0.23*	0.16	0.09
	Kath.	0.08	0.17	0.12	0.12†
P% other spp.	Carp.	0.10	0.13	0.12	0.11
	Kath.	0.09	0.16	0.10	0.11
Botanical composition (ODM basis)					
Legume (%)	Carp.	15.7	55.4	13.2	28.2
	Kath.	36.5*	70.5*	23.3†	36.5†

* Indicated mean is significantly higher than the other of pair at P=5%; †P=10%; ‡P=20%

Differences between years are significant at P=5% or less

Table 2. Animal production on mature Townsville stylo and native pastures saved for dry season grazing at Parada

Grazing period		Initial liveweight (kg±s.d.)	Rate of liveweight gain		
Start	Duration (days)		Carp	Kath. (kg/head/day)	Native
29 Jul 1965	98	207±15	0.249*	0.240	−0.296†
7 Sep 1966	70	234±28	0.457	0.546	0.208
28 Jun 1967	140	226± 6	0.263	0.230	0.365
12 Jun 1968	154	382±12	−0.104	−0.163	0.162

* All coefficients are significantly different from zero at P= 0.1%, except 1966 Native which is P=5%

†In 1965 the full period of grazing on native pasture was 84 days from 1 July

Pasture production

The erect Katherine line consistently outyielded the prostrate Carpentaria, but the latter tended to have higher N and P concentrations (Table 1). Although there were significant differences in TS yield between years, there was no year×line interaction. Both lines did exceptionally well in the drought year 1965–66 when a plague of lawn army worm (*Spodoptera mauritia*) severely damaged all grasses during the period 20 to 24 January, but did not affect either legume.

The yield of other species did not not differ significantly between lines of TS, but total yield was significantly higher in the Katherine line pastures.

Animal production

In all years the animals on TS pastures continued to gain weight for at least 70 days from the start of grazing (Table 2). In 1968 they lost weight thereafter and there was a small net loss (<5 kg/head) over the full period (154 days) in that year. There was no difference in animal performance between the two lines of TS.

Mean RLWG on TS was higher than on native pasture in 1965 (P=0.1%) and 1966 (P=5%), but lower in 1967 (P=1%) and 1968 (P=0.1% for the full period, but not significant over the first 70 days). However, even in 1967 when RLWG was lower on TS than on native pasture, liveweight production (kg/ha) was higher on the TS because stocking rate was 3.6 times higher than on native pasture.

On the basis of 16 observations (4 paddocks×4 years) there were no significant correlations between RLWG and pasture yield attributes, except for negative correlations (P=5%) with other species yield (r=−0.59) and total yield (r=−0.52). This dilution effect of other species is also implicit in the positive correlations (P=5%) between RLWG and quality attributes: legume N% (r=0.57), total pasture N% (r=0.61), legume P% (r=0.52) and total pasture P% (r=0.57).

DISCUSSION

In this experiment involving TS pastures saved for dry season grazing, liveweight gain continued for at least 10 weeks of the dry season; and in two of four years, for a longer period. It is very likely that liveweight gain over a longer period would have been possible in 1966 had grazing commenced earlier than September. However, in three of four years, steers grazing deferred native pasture continued gaining weight during the same periods. In two of these years (1966, 1968) stocking rate was low. In 1967 it was much higher, but this was an exceptionally good season with nearly 60 mm of rain in June and no serious frost damage.

In 1968, the small net loss on TS after 10 weeks of gain may be attributed to the relatively large animals in this draft (about 70% heavier than previous years). This, combined with the long period of grazing, 22 weeks to 13 November, put a very high demand on the pasture.

The erect Katherine line outyielded the prostrate Carpentaria in all years (Table 1), which is consistent with the results of a number of comparisons of prostrate and erect lines in small swards (Ive and Fisher 1974; Gillard 1977; Cameron *et al.* 1977). On the other hand, Carpentaria tended to have higher N and P concentrations, which could follow from its expected higher proportion of seed (Downes *et al.* 1967).

In spite of agronomic differences between the two lines, animal performance on them was similar and the mean reached a peak of 0.50 kg/head/day in 1966, when our pastures were heavily legume dominant. This figure compares with Northern Territory figures of 0.58 (Norman 1964) and 0.66 (calculated for the first 10 weeks from Norman and Stewart's (1967) regression.) Our 1966 results indicate that TS was acceptable fodder late in the dry season, even though drought had caused premature senescence of the stand and there had been noticeable putrefaction following showers (total 11.7 mm) on 9 of 14 days in mid

April. This observation appears in conflict with those of Winks *et al.* (1974) and McCown *et al.* (1981) who reported that mouldy forage was unacceptable to cattle.

It has recently been shown that the best predictor of spoilage of standing dry forage is duration of high relative humidity rather than rainfall (McCown and Wall 1981). During the showery period at Parada in April 1966, 9 a.m. relative humidity (Stevenson screen) did not exceed 83% and the mean was 69%; mean 3 p.m. relative humidity was 61%. Moreover, although terrestial minimum temperature fell below dew point on 11 of the 14 days, dewfall, that is the duration of 100% relative humidity, is normally much higher near the top of the canopy of standing vegetation than near the ground (Baier 1966).

We speculate, therefore, that although the top of the sward was blackened by mould, lower leaves and stems were sheltered by those above and the bulk of the sward was still acceptable to cattle when grazed. The relatively dry air at Parada, even in showery conditions, probably inhibited mould growth and prevented more extensive spoilage.

In Queensland, the dry season value of TS has mostly been documented at sites such as Lansdown and Swan's Lagoon, more prone to unseasonal rainfall than Parada, often with relatively low legume yields, and under systems of year round grazing compared with our deferred system. The normal absence of unseasonal rain combined with moderate yields of legume could explain why dry season grazing appeared to be more effective at Parada, and why naturalised Townsville stylo pastures have provided highly effective dry season grazing at places like Georgetown (Anning 1980). When good unseasonal rain does occur, 1967 in our case, cattle gain weight on native pasture (Table 2).

Whether pasture should be deliberately saved for dry season grazing is a moot point. Apart from the risk of deterioration through weathering, and the risk of total loss by fire, there seems little doubt that greater overall animal production per unit area will result from grazing during the growing season when the rate of live weight gain is highest (Norman 1970; Woods 1970; Edye *et al.* 1971; Wesley-Smith 1972; Winks *et al.* 1974; Shaw 1978, Gillard *et al.* 1980).

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