PRELIMINARY EVALUATION OF TWELVE TROPICAL GRASSES WITH LEGUMES IN NORTHERN CAPE YORK PENINSULA

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ABSTRACT

This paper reports the preliminary evaluation of tropical grasses grown on an infertile yellow earth in an area of northern Cape York Peninsula with mean annual rainfall of 1700 *mm.*

The dry matter production of twelve grass species grown with a mixture of five legumes was estimated over three years. Brachiaria decumbens *cv. Basilisk,* Paspalum plicatulum *cv. Rodd's Bay and* B. ruziziensis *cv. Kennedy gave the highest dry matter yields in the first half of the wet season whilst in the second half of the season the yield of Basilisk was almost double that of the next most productive species* Setaria anceps *cv. Nandi.*

Of the five legumes sown only Stylosanthes guyanensis *cv. Schofield persisted after three years.*

INTRODUCTION

A large area of northern Cape York Peninsula has an annual rainfall in excess of 1500 mm but the native vegetation (Pedley and Isbell 1971) is of little or no use to the grazier because of its poor quality and low productivity. A project aimed at development of pastures for beef production in this zone was commenced in 1970. A site for experimentation (11°45'S, 124°33'E) was selected on the eastern side of Cape York Peninsula some 120 km north of Weipa. Details of the location, soils, climate and native vegetation have been given by Isbell, Jones and Gillman (1976). Briefly, the soil is an infertile yellow earth (Gn2.64) which supports a vegetation of low closed heath. The average annual rainfall is 1700 mm giving a growing season of 28-30 weeks.

No information was available concerning the productivity of tropical grasses in the area or their compatibility with legumes. Thus a cutting experiment was commenced in 1971 to compare the performance of twelve tropical grasses when grown with a mixture of five legumes. The results of the experiment reported here were used as a guide to formulating pasture mixtures for use under grazing.

METHODS

The twelve grass treatments were sown with a common legume mixture in a randomised block design with three replicates.

Grass treatments

Species	Common or cultivar name
Paspalum plicatulum	Rodd's Bay
Urochloa mosambicensis	Nixon
Urochloa bolbodes	CPI 45608
Setaria anceps	Nandi
Setaria anceps	Kazungula
Panicum maximum	Hamil
Panicum maximum	Petrie
Brachiaria decumbens	Basilisk
Digitaria decumbens	Pangola
Brachiaria ruziziensis	Kennedy
Chloris gayana	Callide
Cenchrus ciliaris	Biloela

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Legume mixture

Species	Common or cultivar name
Macroptilium atropurpureum	Siratro
Centrosema pubescens	Centro
Stylosanthes humilis	Gordon
Stylosanthes guyanensis	Schofield
Pueraria phaseoloides	Puero

The site was prepared by burning the heath and ploughing twice to a depth of 15 cm in November 1970. The inoculated legumes were each sown at 2.2 kg ha^{-1} and the grasses (except pangola) at 5.6 kg ha^{-1}. Pangola runners were planted on a 30 cm (approx.) grid. Satisfactory germination of seeds was achieved in petri dishes prior to planting. The seed was mixed with soil and hand sown on each 5 m × 8 m plot on January 22, 1971. The fertilizer was applied with a spreader at a rate of 625 kg ha^{-1}—this contained 1.7% N, 16% P, 8% K, 16% Ca, 7.6% S, 0.25% Cu, 0.24% Zn and 0.03% Mo. The plots were lightly raked to cover the seed and pangola runners.

The plots were given a further dressing of 2.5 kg ha^{-1} each of copper and zinc in June 1971, then each November a dressing of 500 kg ha^{-1} superphosphate and 50 kg ha^{-1} potassium chloride. Establishment was estimated by counting plants in two 0.5 m^2 quadrats/plot in June 1971. Yields were obtained by cutting 2 quadrats (1 m × 0.5 m) per plot in mid- and late-wet season from 1972-74. These samples were separated into the individual species components and dried at 80°C. The material above 10 cm was removed from the plots by forage harvester after the mid-season harvest and by cattle after the late season harvest.

The data were analysed by analysis of variance. Data from treatments which failed were not included.

RESULTS

Rainfall

Rainfall data for the four wet seasons 1971-74 are presented in Table 1. The monthly averages for the now defunct McDonnell Telegraph Station, some 10 km from the plots, are also given.

TABLE 1

Monthly rainfall (mm) for McDonnell and the experimental period 1971-1974.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1971	265	209	555	803	0	20	9	19	10	10	104	144	2148
1972	209	282	373	329	39	70	8	7	38	0	3	53	1411
1973	297	509	172	176	55	30	5	2	0	13	319	311	1889
1974	320	373	422	105	51	10	1	4	13	10	101	190	1600
McDonnell Average 1888-1928	473	383	297	150	41	14	13	10	5	14	92	221	1713

Establishment

In June 1971 all the grasses were present except pangola (Table 2) although Callide and Biloela were at very low densities (< 1 plant m^{-2}). The grass treatments had no significant effect on legume establishment. The mean number of plants per square metre was as follows, viz. Siratro 7, Centro 2, Gordon 51, Schofield 8 and Puero 5.

Production

The plots were first mown off in June 1971. Harvests to obtain dry matter yields were commenced in 1972 and data for the subsequent six harvests are presented in Table 2. No indigenous or other weeds were present in this experiment. Grass and

TABLE 2

Plant counts in June 1971, dry matter yields (kg ha^{-1}) and percentage grass in the sward.

Grass cultivar	Grass Plants (m^{-2})	10.iii.72 Yield	%	6.vii.72 Yield	%	26.iii.73 Yield	%	2.vii.73 Yield	%	22.ii.74 Yield	%	7.viii.74 Yield	%	Total Grass Yield	Late season grass yield (% of total)	Total Sward Yield*
Basilisk	14	1,630	41	1,530	55	3,245	53	1,965	53	4,270	76	3,325	70	15,965	43	27,160
Kennedy	4	555	22	80	4	4,065	55	700	27	4,170	52	1,485	46	11,055	20	26,315
Petrie	4	90	3	720	37	2,625	41	880	32	4,560	74	2,475	65	11,350	36	23,943
Nandi	12	175	5	900	34	2,000	32	1,010	41	2,575	46	2,830	75	9,490	50	23,772
Kazungula	8	1,145	36	935	37	2,955	51	905	44	4,130	74	2,320	73	12,390	34	22,195
Rodd's Bay	2	620	19	285	14	2,995	44	1,330	60	5,100	70	2,210	87	12,540	30	20,665
Hamil	14	330	15	865	43	2,465	51	1,130	58	4,135	84	2,000	62	10,925	37	19,350
Biloela	<1	0	0	0	0	245	4	65	2	545	10	400	9	1,255	37	19,295
Callide	<1	0	0	0	0	0	0	0	0	0	0	0	0		—	19,085
U. bolbodes	40	0	0	40	2	1,885	37	650	29	2,235	58	970	41	5,780	30	18,705
Nixon	4	0	0	100	3	1,715	37	775	41	1,855	56	1,045	35	5,490	35	17,675
Pangola	0	0	0	0	0	0	0	0	0	0	0	0	0		—	16,965
L.S.D. for yields ($P < 0.05$)		625		395		1,360		440		1,900		1,155		2,610		3,480

* Total sward yield = Total grass yield + Total legume yield.

legume yields for 1972 were poorly related to the plant counts of the previous year. Centro and Gordon were absent and the dominant legumes in 1972 were Schofield and Puero which formed an average of 54% and 28% of the sward dry matter respectively. Siratro was present only in March 1972 when it comprised 3% of the sward dry matter. By March 1973 Puero comprised only 2% of the dry matter and thereafter Schofield was the only legume present.

In 1972 the highest grass yields were from Basilisk and Kazungula, with the former having the greatest yield for both the mid-and late-wet season harvests. No Callide was present in 1972 and although Biloela persisted it, and both species of *Urochloa*, gave negligible yields in 1972. By mid-season 1973, all grasses but pangola, Biloela and Callide comprised more than 30% of the sward yield. This trend continued so that by mid-season 1974, the grasses comprised more than 45% of the sward yield. The most productive grass, Basilisk, showed good growth in each year and was by far the most productive species in the second half of the wet season (Table 2). The most consistent mid-season yields were from Basilisk and Rodd's Bay with Kennedy and Petrie prominent in 1973 and 1974 respectively. The dry matter yields of five cultivars, i.e. Kennedy, Petrie, Kazungula, Rodd's Bay and Hamil were similar, but their patterns of growth and compatibilities with the legumes differed. Kennedy gave only 20% of its total production at the late season cut and, possibly as a consequence, legume growth was highest with this cultivar so that the total sward yield was similar to that for Basilisk. The other four cultivars gave 30-37% of their total production at the late season cut but total sward yields differed as Rodd's Bay and Hamil tended to suppress legume growth.

DISCUSSION

The pattern of increasing yield of most of the grasses in each successive year of the experiment is indicative of the extremely low fertility of these soils—particularly the low total soil nitrogen values of approximately 0.05% (Isbell, Jones and Gillman 1976). The native flora does not include grasses, and it is not possible to grow exotic grasses without the addition of nitrogen from either fertilizer or legumes.

Plant material was not chemically analysed from this experiment but visually no deficiency symptoms were apparent apart from some chlorosis of grasses toward the end of each season. This was presumably due to nitrogen deficiency. The fertilizer dressings used here have subsequently been found adequate for good growth and maintenance of the legume component in the sward (Winter and Gillman 1976; Winter and Jones 1976).

Basilisk was consistently the highest producing grass—mainly as a result of its high production in the second half of the wet season. Although no estimate of dry season growth was possible since cattle grazed the plots during that period, it was considered to be negligible due to the low rainfall and the poor soil moisture storage characteristics. Thus, the late wet season growth characteristic of Basilisk, and to a lesser extent that of Nandi, is of particular importance when considering the requirements of grazing animals in the dry season. Grof and Harding (1970) also found that the annual yield of Basilisk was greater than that of other commonly used tropical grasses such as para grass, pangola, Hamil and common Guinea on the humid tropical coast of north Queensland.

Of the five grass cultivars which either failed to grow or gave little growth, i.e. Biloela, Callide, Nixon, *U. bolbodes* and pangola, the first four are better suited to lower rainfall more fertile areas but rainfall conditions at least appear adequate for pangola. As a consequence, a separate experiment was conducted by the author to compare the dry matter yields of pangola and Basilisk when grown with either Cook stylo or urea. For well established swards the dry matter yields of Basilisk were approximately 50% greater than those of pangola in each case.

The mean legume dry matter yield from swards with either little or no grass competition was approximately 18,000 kg ha^{-1} for the three year period—the major

component of which was Schofield stylo. The lack of persistence of Siratro, Centro, Puero and Gordon may have been due to one or a combination of several factors such as the experimental conditions imposed, extremely low soil fertility, low light intensities etc. Insects were not a problem and all species nodulated well. These species also failed to persist beyond the second season in an adjacent nursery (Reid, pers. comm.), so it is apparent that they have a low biotic potential in the area. Teitzel (1969) has noted that Centro is usually confined to more fertile soils and that Siratro often does not persist beyond two seasons on the wet tropical coast of north Queensland.

It is interesting to note that the two highest yielding swards contained prostrate grasses, i.e. Basilisk and Kennedy, whilst the next most productive swards contained erect *S. anceps* and *P. maximum* cultivars. This does not appear to be a consequence of the cutting regime as the dry matter yields at the second harvest do not indicate that any particular plant form was disadvantaged.

In any evaluation of grasses compatibility with legumes is of importance because of the oft found correlation of legume content and animal performance. Bryan and Evans (1971, 1973) found that body weight gains decreased when the legume content fell below 40%, which is higher than for most of the swards in this experiment in the fourth year. However, it is considered that aspects of compatibility are not best served by cutting experiments of this type but by grazing experiments since the artificial method of defoliation may itself influence the composition of the sward as well as the fertilizer levels (for example, see Hall 1974).

With the abovementioned considerations in mind, *B. decumbens* and *P. maximum* cultivars were chosen for further evaluation under grazing: the former for its outstanding growth and the latter for comparison because of their widespread use in other wet tropical areas and also because of the contrast in habits between the two species. Details of this comparison will be reported at a later date.

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