A COMPARISON OF DRY MATTER YIELD AND MINERAL CONTENT OF THREE FORMS OF *CYNODON* WITH *DIGITARIA DECUMBENS* AND *D. DIDACTYLA*

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ABSTRACT

Dry matter production and mineral content of three "giant star grass" (Cynodon dactylon) *introductions from Kenya were compared with local* C. dactylon, Digitaria decumbens *and* D. didactyla. *The material was grown at Samford, S.E. Queensland, under a high level of nitrogen fertilization* (672 *kg/ha/annum*) *and cut every four weeks.*

D. decumbens *outyielded all* Cynodons *at all times of the year. It produced* 28,000 *kg/ha dry matter over* 12 *months compared with* 20,000 *kg/ha from the best of the Kenyan* Cynodons *and* 11,000 *kg/ha from local* Cynodon. D. didactyla *production over* 12 *months* (14,000 *kg/ha*) *was of the same order as that of the introduced* Cynodons *but winter production was three times that of the* Cynodons.

Mineral contents of the herbage did not differ with respect to N, P, K, Mg and Ca, but D. decumbens *had much higher sodium contents than the other test species.*

The yields of the Kenyan accessions were seriously affected by plant deaths which occurred during a period of severe soil waterlogging in the winter months.

INTRODUCTION

Cynodon dactylon (green couch or Bermuda grass) is widely distributed throughout the world with many ecotypes and cultivars differing in size, leaf and stem texture, chromosome number, etc., and is generally regarded as good fodder (Burton, 1951; Edwards and Bogdan, 1951). A particularly large form known as "Giant Star Grass" (Edwards and Bogdan, 1951) occurs in East Africa and three accessions of this material were introduced from Kenya in 1965.

As cool season and winter growth are the most important features of highly productive pastures in S.E. Queensland a cutting trial under a high level of nitrogen fertilization was carried out at Samford, near Brisbane, S.E. Queensland to compare these attributes of the Kenyan accessions with commercial pangola grass (*Digitaria decumbens*), local blue couch (*D. didactyla*) and local green couch (*Cynodon dactylon*).

MATERIALS AND METHODS

The accessions and their Kitale (Kenya) numbers were C.P.I. 37896 (K. 51405) and C.P.I. 37897 (K. 53669) designated as "medium-large" types with leafy herbage of high grazing value, and C.P.I. 37898 (K. 56357), a giant, apomictic type generally regarded as having low palatability due to thick stems and harsh leaves (Bogdan, 1958).

The six grasses were planted vegetatively in three randomised blocks on a gleyed podzolic, sandy loam soil at Samford on 2 March 1966. Plants were spaced 20 cm apart in plots of 2 m^2. Prior to planting the area had been fertilized with a standard basal dressing of molybdenised superphosphate (500 kg/ha), potassium chloride (125 kg/ha), copper sulphate (8 kg/ha) and zinc sulphate (8 kg/ha). Nitrogen as ammonium nitrate was applied at 112 kg N/ha about one month after planting and growth cut back several times before the start of the trial on 21 October, 1966 when plots were cut back to approximately 4 cm above ground level with a rotary mower and fertilized with 112 kg/ha nitrogen. Thereafter plots were cut to the same height every four weeks and fertilized with 112 kg/ha nitrogen after every second cut to give a total of 672 kg/ha/annum applied nitrogen.

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TABLE 1

Mean and 1966/7 rainfall and minimum temperature data, Samford.

	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Total
Mean rainfall (mm)	87	133	139	149	135	95	51	62	44	22	50	68	1034
1966/7 rainfall (mm)	228	100	278	163	257	44	148	524	49	15	4	131	1941
Mean Min. Temp. (°C)	12.8	16.1	17.2	17.2	15.0	12.2	7.8	6.1	3.9	3.9	7.8	12.2	
1966/7 Min. Temp. (°C)	13.8	16.4	16.4	17.8	17.2	13.7	10.4	12.3	6.0	5.1	7.0	13.9	
No. frosts 1966/7	—	—	—	—	—	—	1	—	4	9	1	—	

Whole plots were sampled and dried in a forced air oven at 82°C, bulked over replicates, ground, mixed and subsampled for chemical analysis. Replicates were ground separately on several occasions to enable possible varietal differences in chemical composition to be confirmed statistically.

N, P, K, Ca, Mg, Na were determined by auto-analyser technique (Hegarty, Robins and Simons, unpublished).

The frost tolerance ratings in Table 3 are means of visual ratings on each replicate for percentage green material remaining after four frosts in the range 0 to —3°C in late July 1966. The material frosted was approximately 10 weeks regrowth and in general, four weeks regrowth rates up to two units lower than the figures shown in Table 3.

RESULTS

Rainfall and temperature data for the experimental period are given in Table 1. Extremely high rainfall in May and June coupled with water seepage onto the area resulted in the plots being waterlogged until early August. Light frosts (0–2°C screen temperature) occurred in May, July, August and September with one heavy frost (—1°C) in August.

Although scheduled to run two years the experiment was terminated after 12 months because plants of C.P.I. 37897 and 37898 had died. By July 3, 1967 only one replicate of both these accessions had complete plant cover. Approximately 80 per cent of the wettest replicate was dead in each and deaths in the other replicate were 20 per cent for C.P.I. 37897 and 80 per cent for C.P.I. 37898. No other members of the experiment were affected.

Local *C. dactylon* (weed) which had invaded the plots of C.P.I. 37897 and 37898 at this time and later invaded C.P.I. 37896 was hand sorted from the harvested material. The yields given in Table 2 are from residues of sown species in plots where weed invasion occurred.

Table 2 shows the annual (21/10/66 to 27/10/67) cool season (11/4/67 to 27/9/67) and winter (3/7/67 to 24/8/67) dry matter yields, annual nitrogen yields and weed content in plots of the six test species on 26/10/67.

TABLE 2

Seasonal dry matter production, annual nitrogen yield and weed invasion of C. dactylon, D. decumbens *and* D. didactyla *cut four weekly.*

Species	Dry matter yields (kg/ha)			N yield kg/ha	Weed % 26/10/67
	Year	May-Sept.	Jul.-Aug.		
D. decumbens	27771	4478	1382	480	nil
D. didactyla	14307†	2755*	1431	304†	6.7
C. dactylon local	10847†	1687†	318†	205†	nil
„ „ C.P.I. 37896	19687†	3201	508†	387*	33.3
„ „ C.P.I. 37897	15706†	2399†	523†	322†	51.7
„ „ C.P.I. 37898	15305†	1333†	193†	296†	86.7
L.S.D. 5%	4468	1392	521	83	
L.S.D. 1%	5933	1849	693	110	

* Significantly different from *D. decumbens* ($P < 0.05$)
† „ „ „ „ „ ($P < 0.01$)

Digitaria decumbens consistently outyielded all *Cynodon* accessions throughout the year, and the Kenyan accessions produced more dry matter for the year than the local *C. dactylon*. Both *Digitaria* species considerably ($P < 0.01$) outyielded all *Cynodon* forms in July and August when 13 frosts occurred but the May–September totals reflected the improved performance of C.P.I. 37896 in autumn

and spring. *D. decumbens* yielded 100 kg/ha more nitrogen than the best Kenyan *Cynodon* which was nearly 200 kg/ha better than local *C. dactylon*.

The mean mineral contents in Table 3 are based on 11 dates for nitrogen and five for phosphorus. The test species did not differ in P content at any time and only differed in N content in November 1966 when *D. didactyla*, C.P.I. 37898 and local *C. dactylon* exceeded *D. decumbens* ($P < 0.05$).

Sampling for K, Ca and Mg in April and September 1967 did not reveal any significant differences between species or sample times, the means being 1.93, 0.20 and 0.54 per cent respectively. The species did differ significantly ($P < 0.05$) in sodium content however. The level in *D. decumbens* (0.81 per cent) was nearly four times that of the *Cynodon* species and double the *D. didactyla* level.

TABLE 3

Frost tolerance, range and mean percentage of N and P in C. dactylon, D. decumbens *and* D. didactyla *cut four weekly.*

	Nitrogen (%)		Phosphorus (%)		Frost tolerance
	Mean	Range	Mean	Range	
D. decumbens	2.10	1.16–3.38	.22	.18–.28	60
D. didactyla	2.26	1.25–3.12	.22	.19–.26	70
C. dactylon local	2.11	1.33–3.14	.22	.17–.25	70
C. dactylon C.P.I. 37896	2.19	1.45–3.37	.21	.17–.25	30
C.P.I. 37898	2.27	1.43–3.05	.22	.18–.25	30
C.P.I. 37898	2.20	1.51–3.00	.21	.17–.25	30

DISCUSSION

Pangola (*D. decumbens*) was the outstanding grass in terms of seasonal dry matter production and nitrogen yield under the conditions of this experiment. Local blue couch (*D. didactyla*) had more even production of dry matter throughout the year than the *Cynodon* species and is obviously capable of high winter yields when adequately fertilized.

Although introduced as forms of *C. dactylon*, the Kenyan accessions were probably varieties of *C. nlemfuensis* and *C. plectostachyus* (Harlan, de Wet and Rawal 1970). These species occur naturally on well drained loam and sandy loam soils in frost free areas of Kenya receiving 625–800 mm rainfall per annum in a bimodal distribution (author's personal observation) which may account for the plant deaths which occurred under the conditions of severe waterlogging encountered during this experiment. The highest yield from the Kenyan accessions (19,700 kg/ha) in this experiment was similar to that reported by Rodel and Boultwood (1971) in Rhodesia, who used 450 kg N/ha and cut to 5 cm at less frequent intervals.

The overall yield of the Kenyan accessions was greater than that of the local *C. dactylon* and reflected the much greater bulk of these accessions during the summer months. The cutting height selected may have been too high to measure the full yield potential of the local *Cynodon* but it is doubted that a lower cutting height would have greatly affected the overall result of the experiment.

Mineral contents of all test species were adequate for animal production (Whitehead 1966) with the exception of phosphorus which was uniformly low in all species.

The atypical soil moisture conditions of this experiment had little effect on the yield of *D. decumbens* which was very similar to those obtained earlier at Samford in a series of cutting experiments using the same fertilizer and cutting regime.

Further investigations of the large African *Cynodon* species will be carried out on better drained soils as Rodel (1970) has reported live weight gains up to 900 kg/ha from *C. plectostachyus* fertilized with 450 kg N/ha and grazed for only five months.

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