THE COOL SEASON PRODUCTION OF SOME INTRODUCED GRASSES IN SOUTH-EAST QUEENSLAND

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ABSTRACT

Fifteen grasses were compared with pangola grass at Samford, S.E. Queensland in small swards cut every 30 *or* 60 *days over a period of two years and fertilized with* 476 *kg N* ha^{-1} yr^{-1}. *The mean yield for cutting at* 60 *day intervals was higher than that at* 30 *day intervals by* 26 *per cent over the cool season and* 40 *per cent over the year. Averaged over cutting interval, the mean cool season and annual dry matter yields of* Paspalum nicorae (*CPI* 39970) *exceeded pangola yields by* 150 *and* 54 *per cent respectively. Similarly high yields were obtained from two accessions of* Digitaria pentzii (*CQ* 911 *and CPI* 17661*B*).

INTRODUCTION

Pangola grass (*Digitaria decumbens*) is considered to be a valuable grass for the coastal lowlands of S.E. Queensland (Bryan and Evans 1971) but it grows very little when minimum screen temperatures fall below 11°C (Bryan and Sharpe 1965) and is very susceptible to the rust *Puccinia oahuensis*. This paper reports a cutting trial initiated in 1971 to compare seasonal production of pangola (CPI 18578) and a number of grasses which have shown potential for winter growth in plant introduction nurseries.

MATERIALS AND METHODS

Site

The experiment was conducted at the C.S.I.R.O. Samford Research Station near Brisbane, on a poorly drained meadow podzolic sandy loam soil with surface pH 5.8. The site has an intermittent perched water table in the top 60 cm and the soil is low in N, P, K, S, Cu, Zn, Mo. Mean minimum screen temperatures at Samford fall below 11°C for 5½ months per year. The mean annual and seasonal rainfall, number of frosts and frost period, together with relevant data for this experiment are as follows:

	Annual	Oct.-Mar.	April-Sept.	No. of frosts	Frost period	Lowest Terr. Min. °C
Mean	1034	711	324	10	May-Sept.	
1971/72	1484	1039	445	31	May-Aug.	−3.3
1972/73	1807	1285	522	10	June-Sept.	−0.4

Material

The grasses used in this experiment are listed in Table 1 together with their Commonwealth Plant Introduction (CPI) number, origin, habit and seed production ability. Accessions of *Digitaria eriantha* (CPI 41172), *D. scalarum* (Q8845) and *Hemarthria altissima* (CPI 40694) were also planted but were overrun by weeds (*Cynodon dactylon, Digitaria didactyla*) by the end of March 1972 and failed to persist beyond September 1972. The more cold tolerant *Setaria anceps* accessions were already being evaluated under grazing (Evans and Hacker 1971, Jones 1972) so were excluded from this experiment.

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TABLE 1

Accessions used in this experiment, their origin, habit and seeding ability

C.P.I.*	Name	Origin	Habit	Seed
18578	*Digitaria decumbens*	S. Africa	S	—
16267	,, *macroglossa*	,,	T	+
8489	,, *milanjiana*	,,	T/S	+
41192	,, ,,	Botswana	T/S	+
17661B	,, *pentzii*	S. Africa	T/S	—
CQ 911	,, ,,	,,	T/S	—
41184	,, ,,	,,	T/S	+
16778A	,, *smutsii*	,,	T	—
38869	,, ,,	,,	T	+
40657	,, *swazilandensis*	,,	S/M	+
40673	,, ,,	,,	S/M	+
50290	,, (hybrid)	,,	T/S	+
39970	*Paspalum nicorae*	Brazil	R/S	+
39976	,, *notatum*	,,	R	+
Kikuyu	*Pennisetum clandestinum*	local	R/S	+
29307B	*Setaria sphacelata* var. *stolonifera*	Rhodesia	R/S	+

*Commonwealth Plant Introduction number.
Habit: S = stoloniferous, forms sward; T = dense tufts, no stolons;
T/S = dense tufts with stolons; S/M = stoloniferous, forms dense mat;
R = rhizomatous; R/S = rhizomatous and stoloniferous.
Seed: + produces viable seed; — sterile or nearly so.

Design and treatment

The experiment was a split plot design with three replications. Accessions were grown in randomized plots, split for cutting frequency (30 or 60 days) and dry matter yields were measured over the period 1st October 1971 to 17th September 1973. The grasses were planted vegetatively at 20 cm spacing in plots 2 m × 4 m in March 1971. The area had previously received a standard basal fertilizer mix of Ca, P, K, Cu and Zn; it was topdressed with 246 kg ha^{-1} superphosphate and 125 kg ha^{-1} potassium chloride before planting. Nitrogen was applied in equal amounts after each 60 day cut to give a total of 476 kg ha^{-1} yr^{-1}. All plots were topdressed with superphosphate (246 kg ha^{-1}) and potassium chloride (125 kg ha^{-1}) at the end of twelve months.

Sampling was carried out by cutting 68 cm wide strips across each plot 5 cm above ground level. Plots were topped with a forage harvester after sampling.

Samples were dried at 82°C in a forced air oven, weighed and ground for chemical analysis of N, P, K, Ca, Mg, Na by autoanalyser technique (Williams and Twine 1967) to determine if the accessions had adequate levels of these elements for animal nutrition.

Other observations

Frost damage was assessed as percentage dead leaf on 23rd July 1972. Frosts were recorded 21 days out of the 23 in July to that date with ground temperatures down to −3.3°C. The terrestrial minimum was −2.8°C on 23rd July and the two previous days.

Susceptibility to rust and other diseases was estimated as percentage of leaf covered by pustules and lesions in May 1972, January 1973 and May 1973. Symptoms were more evident on older leaves (60 days) than young regrowth.

Final weed content in Table 2 is the mean percentage weed content in the plots on a dry weight basis at the final sampling.

All observations given in Table 2 are means for both cutting frequencies.

RESULTS

Cool season yield

Cool season for this experiment was defined as the 180 days sampling period occurring from April to September. Averaged over two years (1972, 1973), cool season yield was 14 per cent of the annual average, being 11 per cent in the frosty 1972 season and 17 per cent in the slightly warmer 1973 season. There was no year × accession interaction.

Accessions and cutting frequencies differed ($P < 0.001$) and there was no interaction. Accessions with mean yields over two years greater than pangola are indicated in Table 2. *Paspalum nicorae* (CPI 39970) yielded 200 per cent more than pangola when cut every 30 days and 100 per cent more when cut every 60 days. The average dry matter yield under 60 day cutting was 26 per cent higher than 30 day cutting.

TABLE 2

Mean annual and cool season yields, frost damage, fungal damage (usually rust) and final weed content averaged over cutting frequency

	Mean yield				Percentage		
	Cool Season		Annual				
C.P.I.	Rank	Kg ha^{-1}	Rank	Kg ha^{-1}	Frost	Rust	Weed
39970	1	4520**	1	27950*	6**	1**	2
17661B	2	4480**	2	25390	63	2**	1
CQ 911	3	4380**	6	22440	40**	4**	1
41192	4	3230*	5	23790	63	18*	2
40673	5	2980	7	21240	63	15*	1
Kikuyu	6	2890	12	14640	4**	7**	1
29307B	7	2870	10	18330	22**	16**	18
16778A	8	2850	3	24090	33**	31	4
38869	9	2770	4	24060	50*	24	3
16267	10	2670	9	18390	43**	18*	10
40657	11	2350	8	18930	63	32	2
39976	12	2200	15	10920*	42**	1**	10
50290	13	2080	13	14230	77	7**	27*
pangola	14	1850	11	18210	77	40	5
41184	15	1020	16	8740**	60	25	18
8489	16	910*	14	13510	73	17*	53**

Cool season: Ranks 1-10, 3-11, 4-14, 11-15, 12-16 are not different ($P < 0.01$)

Annual: Ranks 1-11, 3-13, 6-14, 8-15, 12-16 are not different ($P < 0.01$)

* Differs ($P < 0.05$) from pangola (CPI 18578)
**Differs ($P < 0.01$) from pangola (CPI 18578)

Annual yield

Yields given in Table 2 are means of the two 360 day periods between October and September 1971/72, 1972/73. There were significant differences between accessions and cutting frequencies ($P < 0.001$). On average, 60 day cutting yielded 40 per cent more than 30 day cutting but there was a significant accession × cutting frequency interaction ($P < 0.01$). Accessions 17661B and 38869 yielded more than pangola ($P < 0.05$, and $P < 0.01$ respectively) under 60 day cutting but did not differ from it when cut every 30 days. Accessions 8489, 39976 and 41184 did not show any response to decreased cutting frequency.

Although several accessions yielded more than pangola over the two years the difference was only significant for *Paspalum nicorae* which yielded 65 per cent higher under 30 day cutting and 45 per cent higher under 60 day cutting. Weed contents were negligible in the most productive accessions (Table 2).

Chemical analysis

Accessions differed in mean content of N, P, K, Mg, Na ($P < 0.01$) and Ca ($P < 0.05$) but none was deficient in any element. Of the more cool season productive accessions, *P. nicorae* and *D. milanjiana* (CPI 41192) had higher K and Mg but lower Na than pangola ($P < 0.01$). *P. nicorae* was also lower in P content. Material cut every 30 days was higher in N, P, K and Ca ($P < 0.01$) than material cut at 60 day intervals.

DISCUSSION

Paspalum nicorae (CPI 39970) and *Digitaria pentzii* (CQ 911 and 17661B) were outstanding in their cool season growth when compared to pangola and were at least equal to it in annual production. *Digitaria milanjiana* (41192) also performed well. The tufted accessions 16267 and 16778A which have performed well in earlier cutting trials (Strickland 1974) at Samford were probably adversely affected by cutting height which was nominally 5 cm but in fact was often much less due to the very wet conditions allowing the harvesting machine to sink in the soil.

There was no obvious relation between frost damage, assessed as amount of leaf burn occurring after frost, and growth in the cooler months of the year. For example kikuyu, which had the least leaf damage, ranked only sixth for cool season production whereas 17661B and 41192, which were among the most frosted, ranked second and fourth in production.

Marked differences in rust infection were observed, the accessions most productive in the cool season being among the least infected.

The results are sufficiently promising to warrant trials of the more winter productive accessions under grazing, particularly in regions where low temperatures limit growth. There was no evidence from this experiment that low mineral content of any of the grasses would limit animal production nutritionally (A.R.C. 1965, N.R.C. 1963).

Finally, the winter productivity of *Paspalum nicorae* in this experiment is consistent with its geographical distribution as outlined by Barreto (1956), namely the cooler subtropical parts of southern Brazil, northern Argentina, Paraguay and Uruguay. Similarly, the *Digitaria pentzii* introductions came from cool, subtropical South Africa.

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