DRY MATTER PRODUCTION, DIGESTIBILITY AND MINERAL CONTENT OF *ERAGROSTIS SUPERBA* PEYR. AND *E. CURVULA* (SCHRAD.) NEES AT SAMFORD, SOUTH EASTERN QUEENSLAND

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ABSTRACT

Dry matter production, mineral content and in vitro digestibility were measured on one accession of Eragrostis superba *and* 24 *accessions of* E. curvula *cut every four and eight weeks.*

Dry matter production from E. superba *exceeded* 24,000 *kg/ha/annum under eight week cutting and that of the* E. curvula *accessions ranged from* 13,000 *to* 27,000 *kg/ha/annum. Dry matter yields under four week cutting were approximately half those under eight week cutting for the same period.*

E. superba *and several* E. curvula *accessions were little affected by frost and their cool season production was higher than that reported for* Paspalum spp., *pangola grass and* Setaria sphacelata *cv. Nandi.*

The in vitro digestibility and mineral content of the Eragrostis *herbage was of the same order as that of a number of commercial species at four and eight weeks regrowth.*

INTRODUCTION

Although known to be one of the highest producing grasses in summer rainfall areas of temperate and cool subtropical areas of South Africa, *Eragrostis curvula* has been largely disregarded in tropical and subtropical Australia even though plant introduction trials throughout Australia have shown that the species warrants further trial because of spring and winter greenness and reasonably high palatability (Leigh and Davidson, 1968).

E. superba has been regarded as an important component of pastures in drier parts of Kenya due to its acceptability by cattle and fairly high protein content (Dougall and Bogdan, 1958).

The experiment reported here was designed to measure dry matter production of one accession of *E. superba* and the various agronomic types of *E. curvula* defined by Leigh and Davidson (1968) at four and eight week cutting intervals.

MATERIALS AND METHODS

The 25 accessions listed in Table 1 were germinated in flats in November, 1968 and planted in 4 m × 1 m plots at 20 cm spacing on a gleyed podzolic soil at Samford, near Brisbane, S.E. Queensland in early February, 1969. Plots were cut back twice before the start of the trial period on 2 July, 1969. A plaid design was used incorporating a 5 × 5 lattice for varieties and randomised blocks for cutting frequencies of four and eight weeks, in three replications. The sample area for each cut was 1.8 × 0.8 m.

All plots were fertilized with 200 kg/ha superphosphate and 100 kg/ha muriate of potash at the beginning of the trial. Nitrogen (as ammonium nitrate) was applied at the rate of 45 kg/ha over all plots at eight weekly intervals (after the appropriate cut) starting 2 July, 1969.

Plots were cut to 5 cm and the oven dry material from each variety was bulked over replicates, ground, mixed and subsampled for chemical analyses.

In vitro digestibility was determined by the method described by Minson and McLeod (1972); N, P, K, Ca, Mg, Na by autoanalyser technique (Hegarty, Robins and Simons, unpublished). N values were determined on every cut, P values were determined on every second cut only for the four week material and for every eight

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TABLE 1
Eragrostis curvula *accessions used with Commonwealth Plant Introduction (C.P.I.) number, agronomic type and origin*

Variety	C.P.I. Number	Agronomic Type (Leigh and Davidson 1968)	Origin of Accession
1	30368	curvula	Ermelo, S. Africa
2	30369B	,,	selection from 30369
3	30369	,,	Rietvlei, S. Africa
4	30369A	robusta green	selection from 30369
5	30369	curvula	selection from 30369
6	30372	chloromelas	S. Africa
7	30372B	,,	selection from 30372
8	30373	tall chloromelas	Witbank, St. Africa
9	30374	chloromelas	Frankenwald, S. Africa
10	30374	,,	selection from 30374
11	30376	robusta blue	Schagen, S. Africa
12	30377	robusta intermediate	Grootfontein, S. W. Africa
13	30377A	,, ,,	selection from 30374
14	30379	robusta green	Athol, S. Africa
15	30380	robusta blue	Melrose, S. Africa
16	—	,, ,,	West Australian local strain 1
17	—	,, ,,	,, ,, local strain 2
18	43215	robusta	Argentina, ex Australia
19	43216	,,	Argentina
20	43217	,,	Argentina ex Rhodesia
21	43218	,,	Argentina
22	30373A	robusta blue	selection from 30373
23	24924	curvula	Argentina
24	33053	,,	New Guinea
25	36443	Eragrostis superba	Nigeria

week cut, and K, Ca, Mg, Na values were determined on four and eight week regrowth in January and July, 1970 only.

Rainfall and mean minimum temperature for each monthly growth period of the experiment are shown in Figure 1. The experiment was not irrigated.

The original intention was to run the experiment for two years but weed encroachment and death of a number of plants under four weekly cutting resulted in termination after only 12 months.

RESULTS

Yield data were statistically analysed for four periods: total year (2/7/69-15/7/70), winter/spring (2/7/69-3/11/69), summer (3/11/69-9/3/70) and autumn/winter (9/3/70-15/7/70). The mean yields (mean of 25 accessions) for four and eight week cuts at each cutting date are shown in Figure 2. Cutting every eight weeks gave significantly higher ($P < 0.01$) yields of dry matter, digestible dry matter and nitrogen than four weekly cutting for all periods of the year and for yearly total. In general, the mean yields from eight week cuts were approximately double those from four week cuts over the same period for dry matter and digestible dry matter but only 30% greater for nitrogen yield.

The analyses of variance did not detect any significant ($P < 0.10 > 0.05$) differences between accessions for any attribute, however the error terms in the analyses were inflated by variation and interaction between replicates, thus any non significance must be regarded as suspect. Using the crude L.S.D. method it is obvious from Table 2 that large differences in dry matter production between accessions did exist under eight weekly defoliation. Although the method is not strictly valid it does show a likely grouping of the accessions into distinct sets. Digestible dry matter and nitrogen yield showed similar grouping.

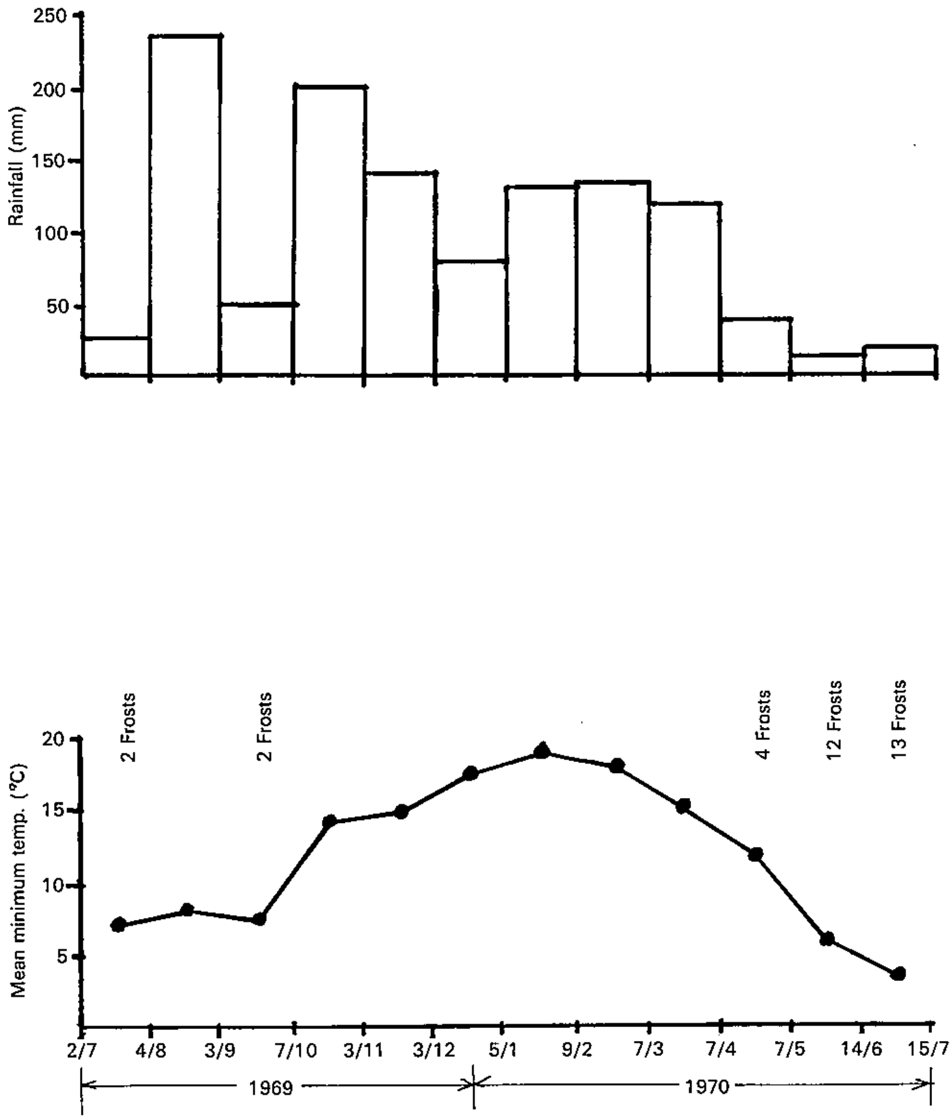

FIGURE 1
Rainfall and mean minimum temperature of growth periods.

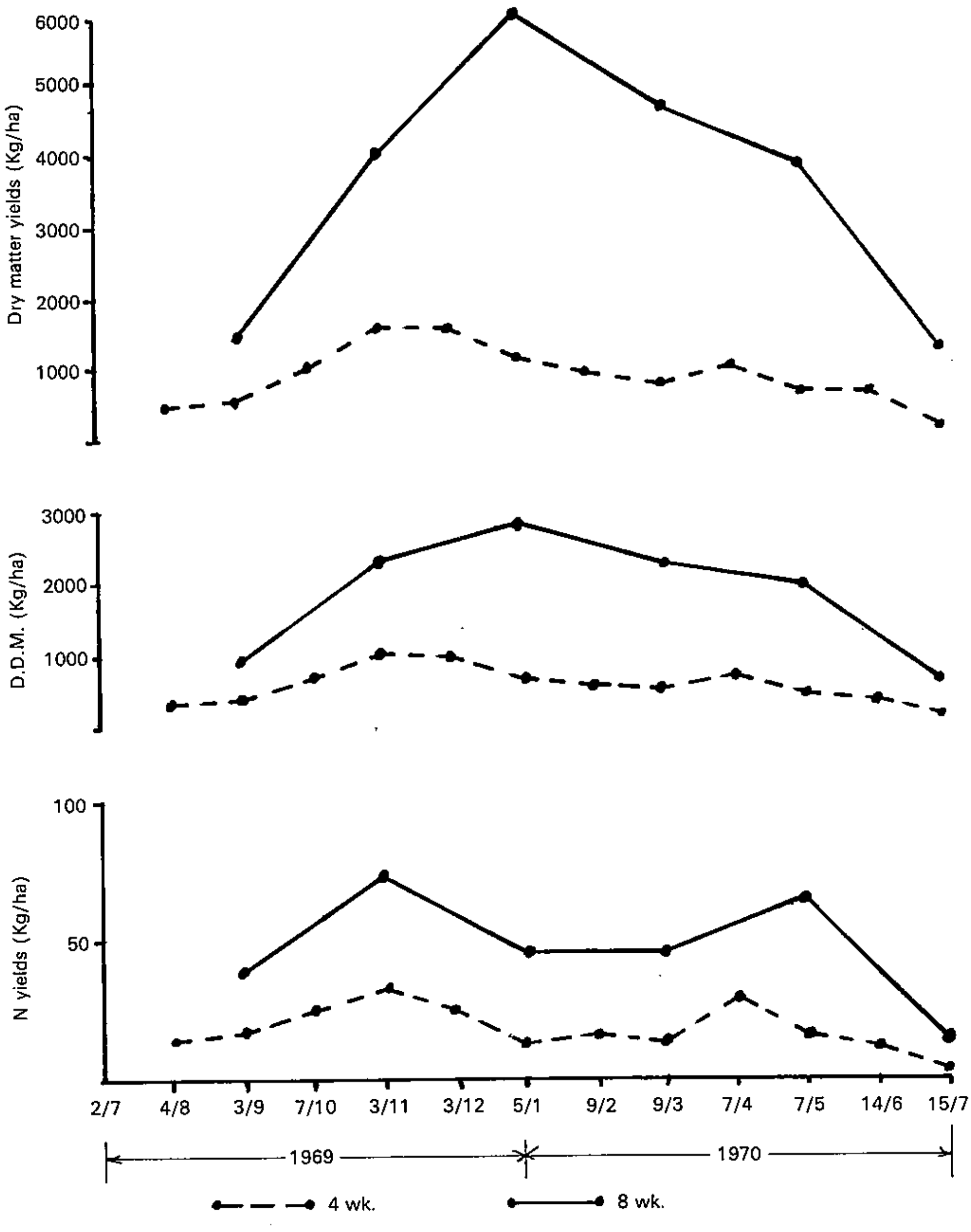

FIGURE 2
Mean dry matter, digestible dry matter and nitrogen yields of the 25 lines when cut 4 and 8 weekly.

TABLE 2
Mean dry matter yields (kg/ha) for 8 week cuts

2/7/69-15/7/70		2/7/69-3/11/69		3/11/69-9/3/70		9/3/70-15/7/70	
Variety	Yield	Variety	Yield	Variety	Yield	Variety	Yield
15	27168	15	7033	15	14440	21	6596
21	25539	9	6958	18	12950	6	6592
18	24772	21	6761	21	12822	25	6292
20	24463	25	6752	10	12465	1	6201
25	24268	5	6573	20	12392	22	6063
9	24239	20	6217	9	12339	18	5882
22	24015	21	6120	22	12165	10	5867
2	23857	18	5940	5	12129	20	5855
6	23621	22	5786	2	11780	15	5695
5	23617	6	5768	6	11262	7	5466
10	23359	14	5757	25	11225	14	5466
1	22404	3	5610	1	11182	2	5315
14	21903	8	5478	3	11159	9	4942
7	21809	7	5354	7	10989	16	4942
3	21153	16	5242	14	10680	5	4915
16	19681	19	5114	17	10102	8	4583
11	19409	10	5022	11	10008	13	4571
19	18821	1	5022	19	9541	12	4471
13	18334	11	4974	16	9498	11	4427
8	18034	13	4759	12	9115	3	4384
12	17634	4	4523	13	9003	19	4166
17	17602	12	4048	4	8752	4	4070
4	17345	24	3885	8	7974	17	3963
23	13243	17	3542	23	6509	23	3498
24	12856	23	3235	24	5624	24	3347

Means connected by the same straight lines were not significantly different from one another (L.S.D. P = 0.05)

The annual dry matter yields from four weekly cutting ranged from 5,000 to 12,000 kg/ha and although no significant differences could be detected, the accessions tended to rank in much the same order as that obtained under eight weekly cutting. No significant accession x cutting frequency interaction was detected in the analyses.

Figure 3 illustrates the higher digestibility, nitrogen and phosphorus percentages in four week regrowth as opposed to eight week regrowth.

The mean K, Ca, Mg, Na values in four and eight week regrowth in January and July, 1970 are shown in Table 3.

TABLE 3
Mean levels of K, Ca, Mg, Na in 4 and 8 week regrowth material in January and July, 1970

	January			July		
	4 wk	8 wk	Sig. of Diff.	4 wk	8 wk	Sig. of Diff.
K %	0.924	0.719	**	0.385	0.404	n.s.
Ca %	0.276	0.192	**	0.384	0.358	*
Mg %	0.176	0.137	**	0.190	0.204	n.s.
Na %	0.091	0.141	**	0.097	0.098	n.s.

* L.S.D. P = 0.05 ** L.S.D. P = 0.01

DISCUSSION

The dry matter yields obtained in this trial were far greater than those generally reported from South Africa (Birch, 1967, Mappledoram and Theron, 1970). The eight week cuts yielded more than a number of *Paspalum* species grown at Samford

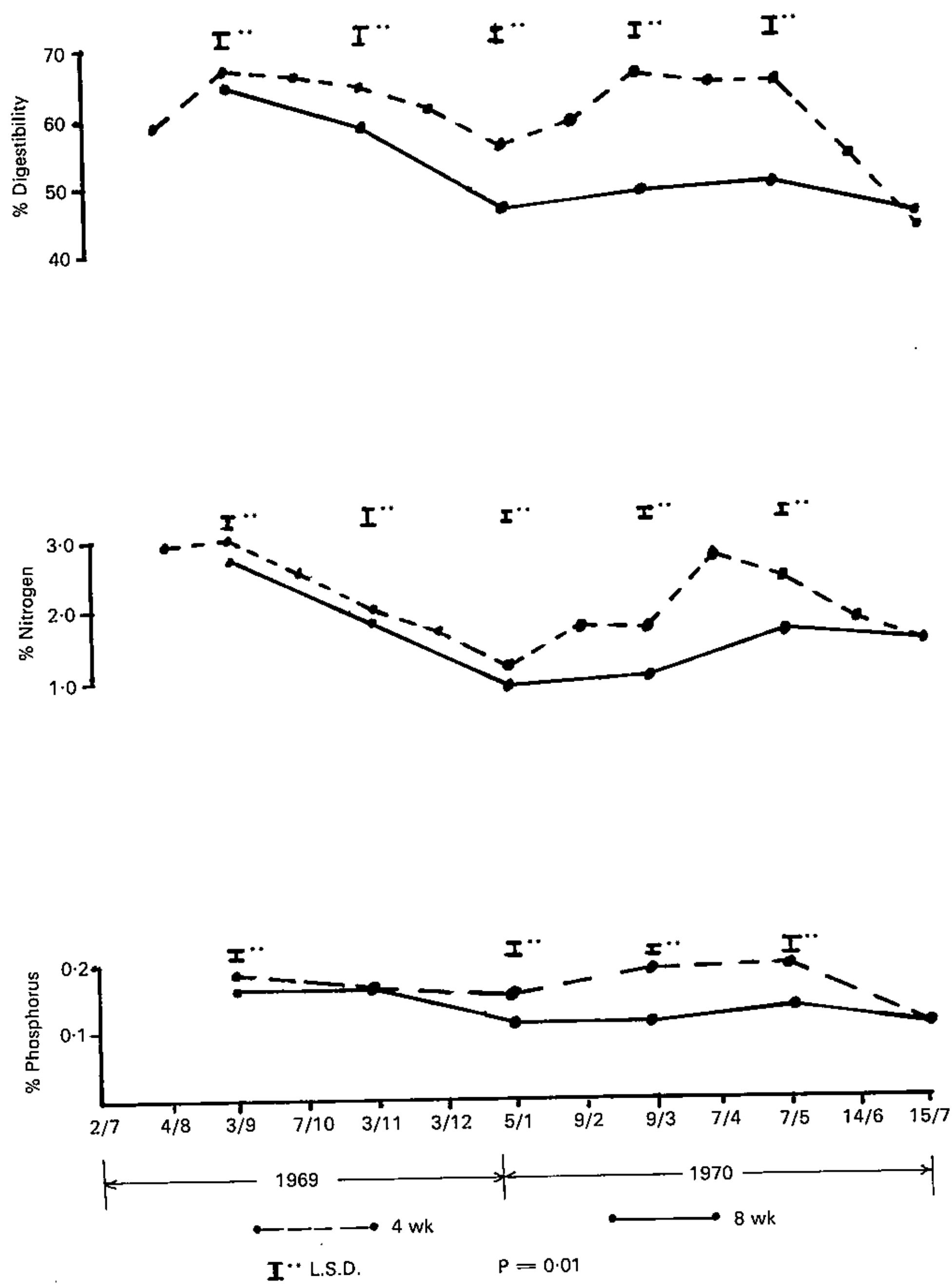

FIGURE 3
Mean digestibility, nitrogen and phosphorus percentage of all lines when cut 4 and 8 weekly.

(Shaw *et al.*, 1965) and were of the same order as irrigated pasture mixtures containing *Setaria sphacelata, Chloris gayana* and *Paspalum* species (Jones, *et al.*, 1968) grown at Samford under similar nitrogen levels and defoliation frequencies.

The robusta types from Argentina were consistently high yielding in all periods of the year. The South African robusta blue (C.P.I. 30380) produced the greatest amount of dry matter over all, even though its autumn production was down slightly. It's total yield of 27,000 kg/ha was of the same order as that obtained by Roberts and Carbon (1969) under irrigation in Western Australia. The curvula varieties from Argentina and New Guinea were consistently poorer than most other varieties with the West Australian strain No. 1 intermediate in yield, but producing about the same level reported from irrigated trials in Western Australia (Farrington, *et al.*, 1970).

During the winter/spring period of 1969 when four frosts occurred, *E. curvula* (C.P.I. 30380) and *E. superba* (C.P.I. 36443) produced dry matter at the mean rate of 57 and 54 kg/ha/day respectively. No published data is available on other species grown at Samford during this experiment, however earlier work at Samford indicated growth rates of 29 kg/ha/day from the best of 17 *Paspalum* introductions (Shaw *et al.*, 1965) and 36 kg/ha/day from *Setaria sphacelata* (Jones *et al.*, 1968) grown under similar levels of N fertilizer and frost incidence over the period July-October. At Beerwah, pangola grass produced 30 kg/ha/day over the same period (Evans, 1969) under similar N fertilizer and frost levels.

Autumn/winter dry matter production between March and July reported by the same authors had mean growth rates of 32, 36 and 45 kg/ha/day for *Paspalum*, pangola and *Setaria* respectively when up to nine frosts were recorded. In this trial, *E. curvula* (C.P.I. 43218) and *E. superba* (C.P.I. 36443) produced dry matter at the rate of 52 and 49 kg/ha/day respectively over the same period of the year when 29 frosts were recorded.

The robusta types of *E. curvula* and *E. superba* showed very little leaf burn in the severe 1970 frosts. This supports the findings of Leigh and Davidson (1968).

Although Rabie (1964) determined that the growing point of *E. curvula* remained at or below ground level until the reproductive phase of growth was commenced, Steinke and Booysen (1968) reported progressively less regrowth of this species with increased frequency of defoliation at 2.5 cm above ground level. The relative differences obtained between four and eight week regrowths were similar to those obtained in this trial.

The seasonal fluctuation in mean digestibility and the levels recorded here are similar to those for a number of tropical species reported by Milford (1960), and of the same order with regard to time of year and age of regrowth as a number of grasses in commercial use in Queensland (Minson, 1972).

With the exception of eight week regrowth material in the summer months, nitrogen contents were sufficient to maintain animals in positive nitrogen balance and would not adversely affect intake (Milford and Minson, 1964). The mean nitrogen yield of the four week cuts (213 kg/ha) represented 80% recovery of the applied N fertilizer but the eight week cuts (mean 285 kg/ha) obviously utilised nitrogen from a source in addition to that applied as fertilizer.

Although four week regrowth generally contained more phosphorus than older material, the levels were lower than generally considered desirable for animal production (Whitehead, 1966). Potassium and magnesium levels were adequate for animal nutrition at both sampling dates and age of regrowth but calcium and sodium were not (Whitehead 1966); however, the data presented refer to whole plant material and grazing animals are able to select a higher quality diet than whole plant composition indicates.

All accessions maintained relatively pure stands under eight week cutting but under four week cutting *Cynodon dactylon* invaded several of the least productive accessions and by August 1970, C.P.I. numbers 30369, 30372, 30376, 24924 and Western Australian strain 2 were completely dominated by *C. dactylon* with less than 30% of the Eragrostis plants surviving. As the trial was only intended as a preliminary screening of these accessions, the trial was then terminated.

The high cool season yields obtained with the Argentine accessions of *E. curvula* (particularly C.P.I. 43218), the South African C.P.I. 30380, and *E. superba* coupled with their generally high yielding ability at other times of the year, suggest that these accessions warrant further study as pasture components in the subtropics of Australia. The quality of these accessions measured in terms of digestibility and N content is on a par with other grasses in commercial use and the robusta types in general appear to be well grazed by stock (Roberts and Carbon, 1969). However further experimentation is required to test if satisfactory weight gains can be achieved with *Eragrostis.*

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