

THE HYBRID BETWEEN *PENNISETUM TYPHOIDES* AND *P. PURPUREUM* AS A POTENTIAL FORAGE CROP IN SOUTH-EASTERN QUEENSLAND

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ABSTRACT

The hybrid between Pennisetum typhoides and P. purpureum is a high yielding, perennial grass which produces good quality forage. Its dry matter yield is greater than that of S. alnum cv. Crooble and it is also superior to this grass in such characters as disease resistance, leaf percentage, nitrogen percentage in the stem, and stem digestibility. It is adapted to those areas of Queensland where S. alnum or pearl millet can be grown.

INTRODUCTION

The hybrid between *Pennisetum typhoides* (bullrush or pearl millet) and *P. purpureum* (napier or elephant grass) is easily made by hand pollination (Burton 1944) and its cytology has been extensively studied by many workers.

The possibility of using this hybrid as a forage crop has been investigated in some countries and it has been shown that it is able to produce more forage than napier grass in some circumstances (Jodhupur 1965) and more than pearl millet in others (Powell and Burton 1966). It has been suggested that in tropical countries it may behave as a perennial (Burton and Powell 1968) with higher yields and better forage quality than either parent.

The hybrid is sterile and would normally have to be established by planting stem cuttings. To overcome the problem of planting by hand, Powell and Burton (1966) have suggested a method for producing cheap seed of the hybrid by using a male sterile line of pearl millet.

In 1966 Dr. G. W. Burton provided a small sample of seed of the hybrid between Tift 23A pearl millet and the Merekon selection of napier grass. This was used in an evaluation experiment in south eastern Queensland where it was considered that the hybrid might replace the forage sorghums.

MATERIALS AND METHODS

The hybrid and pearl millet (cultivar unknown) were included as two entries in an experiment at Lawes (50 miles west of Brisbane), which also contained six cultivars and breeding lines of forage sorghum. The results for the sorghums are part of a series of experiments which will be reported separately. For the purposes of this paper the cultivars, Krish (*Sorghum* sp.) and Crooble (*S. alnum*) have been selected for comparison with the hybrid because these were the only perennial sorghums in the experiment which were commercially available.

The experiment was established from seed on a fertile prairie soil developed on alluvium on January 20, 1967. An initial dressing of 224 lb per acre of superphosphate was applied followed by applications of 100 lb per acre of nitrogen as urea in spring and summer of each season. The annual rainfall for 1967, 1968 and 1969 was 42, 33 and 34 in. respectively. Single row plots were used which were four feet apart and 12 feet long. The middle eight feet was harvested. There were four replications and different rows were cut at 8, 10, 12 or 15 weekly intervals. The cutting treatments were chosen to test the observation that the perenniality of forage sorghum is better when the harvest interval exceeds eight weeks.

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There was a mixture of about 20% of pure pearl millet in the seed of the hybrid. Because this was not realised until after the first harvest at the eight and ten weekly cutting frequencies, it was decided to treat these plants as if they had been plants of the hybrid.

RESULTS

Dry matter yield

In the first season the dry matter yield of the hybrid was significantly greater than that of Krish ($P < 0.05$). Crobble was highest yielding in the first season but was not significantly better than the hybrid (Table 1). For total yield and yield in the second and third seasons, the hybrid was superior to Crobble. The presence of pearl millet plants in the hybrid plots would have reduced the yield of the hybrid slightly in the first cut of each cutting regime. There was no regrowth on any pearl millet plants after the initial harvest so that the yields from the hybrid plots may have been reduced at subsequent harvests, because of the gaps in the rows which might not have occurred had the hybrid seed been pure.

TABLE 1
Dry matter yields (lb per plot) of Pennisetum and Sorghum spp. for three seasons (1967-69) and percentage plant survival at the end of the experiment

Variety	1967	Season 1967-68	1968-69	Total	% survival
Crooble	6.76	7.29	1.90	15.95	50
Pearl Millet	4.95	—	—	—	—
the hybrid	5.98	11.74	3.39	21.11	71
Krish	4.52	9.73	2.47	16.72	61
L.S.D.* 5%	1.12	2.62	0.87	4.59	16.6

* Least significant difference

There was no significant interaction between cultivar and cutting frequency and the results in Table 2 are means from the total experiment. The greatest yields resulted from the 12 weekly cutting regime and the eight weekly frequency of cutting gave the lowest yields.

TABLE 2
Dry matter yields (lb per plot) from four cutting regimes for the three seasons (1967-69) and percentage plant survival at the end of the experiment. (Pearl millet data not included)

Cutting Frequency	1967	Season 1967-68	1968-69	Total	% survival
8 weekly	4.49	5.76	1.66	11.91	46
10 weekly	5.19	8.71	2.09	15.99	52
12 weekly	5.93	9.76	2.43	18.12	65
15 weekly	6.18	7.45	2.30	15.93	57
L.S.D.* 5%	.74	1.17	N.S.	2.38	11.3

* Least significant difference

Persistence

At the end of the experiment the persistence of the hybrid was significantly better than that of Crobble (Table 1). There was no interaction between cutting regime and the three grasses which showed some persistence, and the percentage plant survival at each cutting frequency is shown in Table 2. Survival at a 12 weekly cutting frequency was significantly better than at an eight weekly frequency.

Quality

Krish and the hybrid were significantly ($P < 0.01$) more leafy than Crooble under every cutting regime. The decrease in percentage leaf with age of regrowth is shown in Fig. 1.

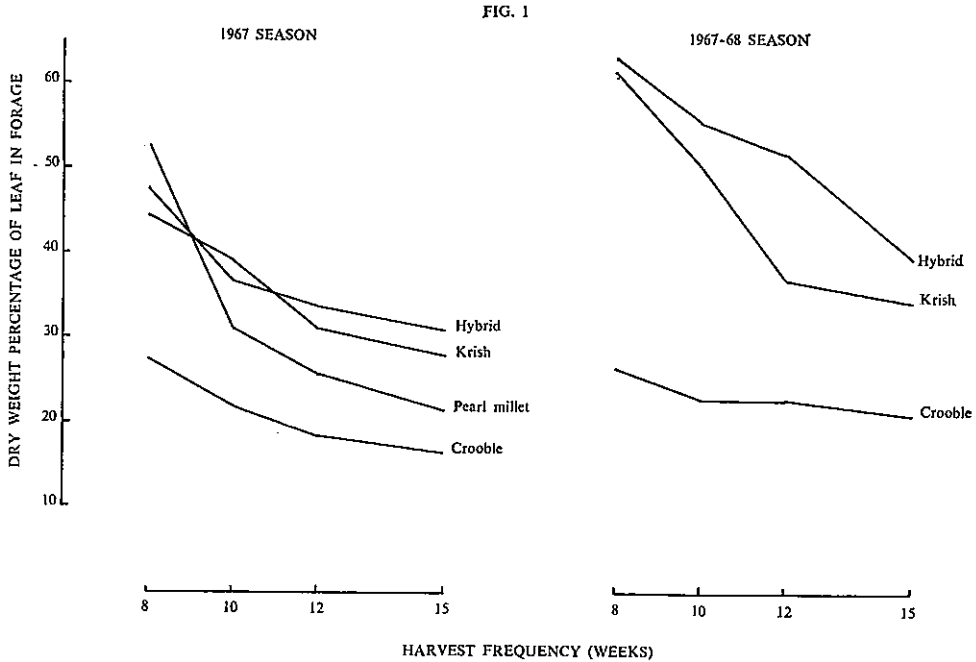


Figure 1. The effect of time of cutting on leaf percentage of Crooble, Krish, pearl millet and the hybrid (*P. typhoides* × *P. purpureum*)

The concentration of nitrogen in the forage was measured only during the first and second seasons. Determinations were made on samples bulked over replications and therefore no statistical analysis is possible. However, Fig. 2 shows that the nitrogen concentration of the leaves of the hybrid, Crooble and Krish were very similar and that the stems of both Krish and the hybrid had a higher nitrogen concentration than those of Crooble.

In vitro digestibility (McLeod and Minson 1969) was measured on an eight week harvest in the second season. The digestibilities of leaf blade and stem plus leaf sheath samples were: Crooble 56.2 and 57.0; Krish 56.8 and 67.2; and the hybrid 58.4 and 65.6. At this stage Crooble had just commenced flowering, but neither Krish nor the hybrid had flowered.

DISCUSSION

The greater yielding ability of the hybrid in comparison to Krish and Crooble became apparent in the second season. In spite of the reduction of yield resulting from the contamination of the seed by pearl millet, the total dry matter yield of the hybrid over the three year period was greater than that of any other grass in the trial. Dry matter percentage in the forage of the hybrid was always significantly less than that of Crooble ($P < 0.01$) so that there was a greater difference in yield of green matter between the hybrid and Crooble.

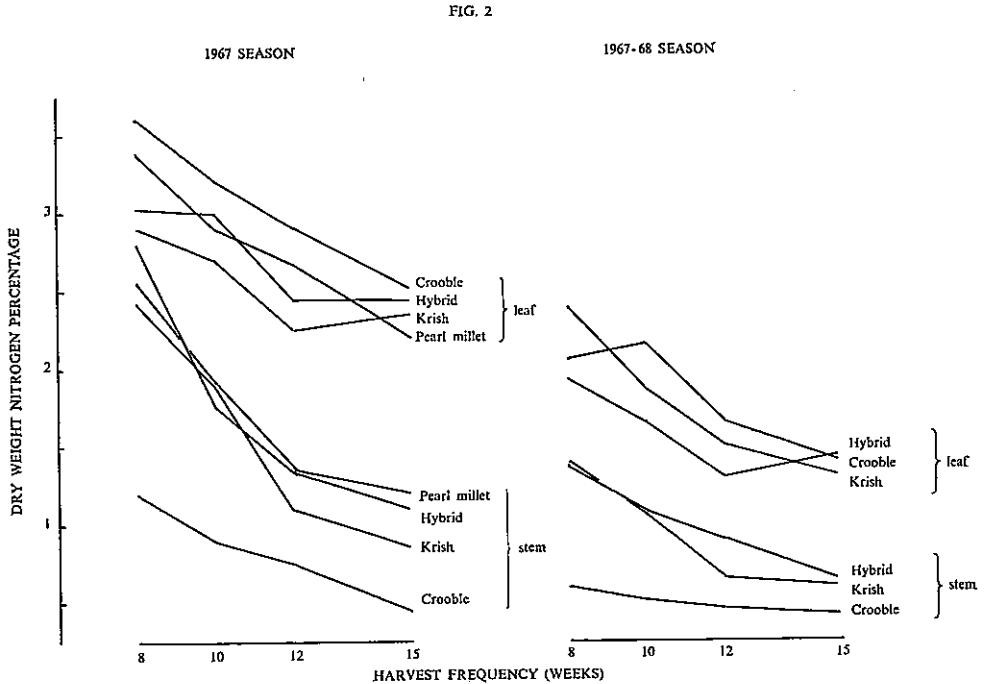


Figure 2. The effect of time of cutting on nitrogen percentage in leaves and stems of Crooble, Krish, pearl millet, and the hybrid (*P. typhoides* × *P. purpureum*)

At the end of the third season a large number of Crooble plants had died and those remaining were no longer very productive. These results indicate that, in this environment, Crooble can only be regarded as a biennial. This has been reported previously for *S. alnum* in South Africa by Edwards and Visser (1967). Pearl millet behaved as a strict annual and no regrowth occurred on any plot. This is in agreement with observations of poor recovery under some cutting regimes by Crowder and Michelin (1958) and Norman and Begg (1968).

The results from different harvesting frequencies showed that a 12 week period between harvests produced the highest dry matter yields but a forage with a low concentration of nitrogen. Other workers have shown that high yields of dry matter in sorghum are associated with infrequent cutting (Burger, Jackobs and Hittle 1958; Broyles and Fribourg 1959; Burns and Wedin 1964; Beaty *et al.* 1965; Burger and Hittle 1967; Worker and Marble 1968).

The hybrid was more persistent than Crooble and, besides producing a higher total dry matter yield, it was superior in percentage leaf, percentage nitrogen in the stem, and stem digestibility. It was also free from leaf disease. Although these results are based on a single small plot experiment the results justify a more detailed examination of the hybrid as a forage crop.

The hybrid is adapted to those areas where pearl millet and *S. alnum* can be grown. The climate in these areas is usually mild enough to enable hybrid seed to be produced commercially from a male sterile pearl millet following pollination by napier grass.

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