UROCHLOA MOSAMBICENSIS—AN EASILY ESTABLISHED PERENNIAL GRASS COMPANION FOR TOWNSVILLE STYLO

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ABSTRACT

The use of Townsville stylo (Stylosanthes humilis) *and superphosphate in native pasture in northern Queensland can lead to the loss of perennial grasses and an increase in volunteer annuals.* Urochloa mosambicensis *was successfully established by broadcasting seed into such pasture at two sites. One problem encountered was seed dormancy which delayed establishment. In one experiment better growth of* U. mosambicensis *occurred with seed bed preparation but growth without such preparation was satisfactory. In another experiment it was shown that fertilizer increased growth of both* U. mosambicensis *and native annuals but did not increase growth of native perennial grasses.* U. mosambicensis *dominated all plots after four years.*

INTRODUCTION

The cattle industry of the dry tropics of northern Queensland depends mainly on natural pasture consisting of various perennial tall grasses (Shaw 1957, Tothill 1969, Isbell 1969). The tropical legume Townsville stylo (*Stylosanthes humilis*) has been used with some effect to improve these pastures (Shaw 1961, Humphreys 1967, Shaw and 't Mannetje 1970). However, in the dry tropics heavy grazing and the build up of fertility with the use of superphosphate fertilizer has drastically changed the species composition of these pastures. The original perennial grasses died out and there was an increase in annual grasses and broad leaved weeds. This appears to be a long lasting effect in northern Queensland and the Northern Territory (Norman 1967, Ritson, Edye and Robinson, 1971) but in central coastal Queensland these changes occured only in seasons of low rainfall and were not permanent (Shaw and 't Mannetje 1970). It seems important that a perennial grass companion, resistant to heavy grazing is available for Townsville stylo pastures in order to reduce erosion, weed invasion and provide pasture stability.

Urochloa mosambicensis is a grass from the dry tropics of Africa which is very common in overgrazed situations and is prolific in seed set (Gillard 1969). Ecologically it seems well suited to fill a niche in North Queensland which has only recently been created by heavy grazing. In this paper two experiments are reported in which *U. mosambicensis* was established in grassland containing Townsville stylo in the dry tropics of northern Queensland.

MATERIALS AND METHODS

Experiment 1

The site was on Heathfield Station near Mingela in low rainfall country (annual rainfall 25 in.) west of Townsville. In the experiment four grasses were oversown on Townsville stylo dominated pasture with two levels of cultivation and two fertilizer treatments in a randomized block split for cultivation with four

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replicates. The grasses used were: *U. mosambicensis* (C.P.I.* 6559), buffel grass (*Cenchrus ciliaris* cv. Tarewinnabar), blue panic (*Panicum antidotale* C.P.I. 29017) and birdwood grass (*Cenchrus setigerus* C.P.I. 25441). Cultivation treatments were: uncultivated and cultivated to a fine tilth with a rotary hoe. The fertilizer levels were 112 lb and 672 lb/ac superphosphate. The subplots were 13.2 ft x 13.2 ft. The seeding rate was equivalent to 1.5 million live seeds per acre, broadcast on to uncultivated plots and raked into cultivated plots. The experiment was established on February 3, 1966 but no growth of the sown grasses occurred in that season. In 1970 good stands of *U. mosambicensis* only had established. Four quadrats of 16 x 40 in. were taken for dry matter yields from each of the *U. mosambicensis* plots on April 27, 1970 and again on April 2, 1971. The material was dried at 71°C for 48 hrs.

Experiment 2

The site was at the C.S.I.R.O. "Lansdown" Pasture Research Station, south of Townsville which has an annual rainfall of 35 in. *U. mosambicensis* was oversown into uncultivated native pasture which had a high proportion of Townsville stylo. There were four fertilizer treatments and three seeding rates in a randomized block with two replicates. The fertilizer treatments were 0 = no fertilizer; P_4 = 448 lb/ac superphosphate, P_4N_1 = 448 lb/ac superphosphate and 217 lb/ac urea, P_4N_3 = 448 lb/ac superphosphate and 651 lb/ac urea. The seeding rates were 10, 20 and 50 lb/ac. The plots were 6.6 ft x 13.2 ft in size and were mown and raked off before seeding. The experiment was sown on February 14, 1967. No growth of *Urochloa* occurred that year but harvests for dry matter yields were taken on March 25, 1968 and March 30, 1971. Each harvest was of two quadrats 16 x 40 in. cut with hand shears and separated for botanical composition. The material was dried at 71°C for 48 hours.

RESULTS

Experiment 1

This experiment was sown in a very dry year with 3.53 in. of rainfall recorded from the date of sowing until the end of June 1966. The rainfall during subsequent years at Mingela was as follows:— 1966-67: 20.41 in., 1967-68: 31.92 in., 1968-69: 16.52 in., 1969-70: 9.23 in., 1970-71: 20.86 in. By 1970 the *U. mosambicensis* plots were well colonised, but the other sown species had not established except for one or two plants in the buffel grass plots which had been cultivated. The yields of the *U. mosambicensis* plots for 1970 and 1971 are shown in Table 1.

Cultivation had a significant effect on the growth of *U. mosambicensis* in both years. In 1970 uncultivated plots had a relatively small yield of *U. mosambicensis* compared to annual grasses but by 1971 the *U. mosambicensis* had about four times the yield of the annuals. The grass-legume balance was better on uncultivated plots in 1971 which may account for the higher total yield in that year. There were no significant differences in yield due to fertilizer application but it should be remembered that after the initial application in 1966 no maintenance dressings were given.

Experiment 2

The rainfall at "Lansdown" is higher than at Mingela as is shown by the rainfall figures for the years of the experiment:— February-June 1967: 22.68 in., 1967-68: 37.97., 1968-69: 12.91 in., 1969-70: 17.69 in., 1970-71: 24.66 in.

* Commonwealth Plant Introduction

TABLE 1

Dry matter yields (lb/ac) of pasture in which U. mosambicensis *was sown with and without cultivation at two levels of fertilizer*

	1970				1971			
	Urochloa mosambicensis	Townsville stylo	Annual grasses	Total	Urochloa mosambicensis	Townsville stylo	Annual grasses	Total
Uncultivated								
112 lb Superphosphate/ac	144	279	372	795	995	1751	288	3034
672 lb Superphosphate/ac	479	198	370	1047	1235	1360	354	2949
Cultivated								
112 lb Superphosphate/ac	1005	120	126	1251	1626	240	36	1902
672 lb Superphosphate/ac	834	30	153	1017	1823	390	48	2261
Least significant difference at 5%	432	213	204	NS	647	804	266	431

NS = not significant.

TABLE 2

Dry matter yields (lb/ac) of pasture in which U. mosambicensis *was broadcast into the sward at four rates of fertilizer*

Fertilizer (lb/ac)	1968					1971				
	Urochloa mosambicensis	Perennial grasses	Annual grasses	Townsville stylo	Total	Urochloa mosambicensis	Perennial grasses	Annual grasses	Townsville stylo	Total
No Fertilizer	18	1267	289	827	2401	4696	0	0	46	4742
448 Superphosphate	135	1577	626	701	3039	4713	0	0	289	5002
448 Superphosphate + 217 Urea	374	1818	574	714	3479	4151	0	6	253	4410
448 Superphosphate + 651 Urea	491	1447	919	321	3179	5818	0	0	21	5839
Least significant difference at 5%	72	NS	262	NS	NS	NS	—	—	NS	NS

TABLE 3

Nitrogen and phosphorus percentages on a dry matter basis in the herbage taken from experiment 2

Fertilizer (lb/ac)	Urochloa		Perennial grasses		Annual grasses		Townsville stylo	
	% N	a% P	% N	% P	% N	% P	% N	% P
No fertilizer (O)	1.03	0.097	0.64	0.062	0.91	0.092	2.08	0.111
448 superphosphate (P_4)	0.91	0.194	0.75	0.112	0.89	0.199	2.26	0.168
448 superphosphate + 217 urea (P_4N_1)	1.79	0.209	0.85	0.085	1.50	0.169	2.44	0.201
448 superphosphate + 615 urea (P_4N_3)	2.91	0.183	1.15	0.104	2.01	0.156	2.93	0.192

Least significant difference. P = 0.05 for %N — 0.36 for %P — 0.016 P = 0.01 for %N — 0.505 for %P — 0.022

Harvests of this experiment were made in 1968 and 1971. There was no effect of seeding rate and seeding rates have been pooled in Table 2, in which the yields of the components of the sward in 1968 and 1971 are given. In 1968 the yield of the *U. mosambicensis* was significantly affected by fertilizer level although at that time it formed only a small part of the sward. Annual native grasses also responded to fertilizer level but the perennial native grasses (mainly *Heteropogon contortus* and *Bothriochloa bladhii*) did not show significant differences between fertilizer treatments. By 1971 *U. mosambicensis* was well established in the plots and no other grasses were present. The effect of fertilizer applied four years earlier was not present in 1971. In these plots, which were protected from grazing, Townsville stylo yields were severely reduced, presumably because of the grass competition.

The grass components of this experiment from the 1968 harvest were analysed for nitrogen and phosphorus content and the results of this analysis are shown in Table 3. The perennial native grasses had a small but significant increase in phosphorus content in treatments where superphosphate was applied. There was also a relatively small increase in nitrogen content of these grasses in response to nitrogen fertilizer, which was only significant at the highest level of fertilizer. The annual native grasses and *U. mosambicensis* responded similarly to fertilizer. The nitrogen and phosphorus content of both increased significantly with each level of fertilizer application, and both had higher nitrogen and phosphorus contents than the perennial native grasses which differences were significant in most instances. The *U. mosambicensis* had the highest nitrogen content at the highest fertilizer level.

DISCUSSION

In the dry tropics of northern Queensland native pastures which have been improved with Townsville stylo and superphosphate fertilizer are susceptible to invasion by volunteer annual grasses and broadleaved weeds. There is an urgent need for a perennial pasture grass which can be oversown without cultivation into Townsville stylo pastures to form a stable mixture free from weed invasion. Norman (1967), working in the Northern Territory, used buffel grass as a companion for Townsville stylo, but found that cultivation was required and even after three years annual grasses had increased rather than decreased.

In the two experiments reported here, it has been shown that *U. mosambicensis* can be established from seed broadcast into Townsville stylo-annual grass swards. In both experiments no establishment occurred in the year of sowing. Later experience has shown that seed dormancy is common in this grass and seems the most likely explanation for the delayed establishment. This will have to be overcome or taken into account if *U. mosambicensis* is to be used commercially. Seed dormancy was broken with time in these experiments and growth in the second and subsequent years was satisfactory.

In experiment 1, the effect of seed bed preparation persisted until 1971, five years after sowing, with 82% of *U. mosambicensis* present on cultivated plots and 37% on uncultivated plots. In experiment 2, results in the second year were strongly influenced by fertilizer application. The *U. mosambicensis* and annual grasses both showed marked responses to fertilizers indicating an ecological similarity. Native perennial grasses on the other hand did not show a significant response in yield to fertilizer. By 1971 the *U. mosambicensis* had almost displaced the native grasses, annual and perennial, despite the fact that no maintenance dressings of fertilizer had been applied. The Townsville stylo yields were also reduced and this is not unexpected in an ungrazed situation. Austin (1970) has shown that the *U. mosambicensis*—Townsville stylo balance in pastures in the Northern Territory is sensitive to stocking rate and presumably balanced pastures of this mixture in the dry tropics of northern Queensland will also depend on grazing management.

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