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PASTURE INVESTIGATIONS IN THE SANDY FOREST COUNTRY OF NORTH-WEST QUEENSLAND

3. Establishment Methods

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SUMMARY

On mottled grey earth soils, preplanting cultivation was superior to no cultivation for both plant population and dry matter yield of *Stylosanthes humilis* (Townsville stylo) in the first year, and for population in the second year. Superphosphate applied at establishment significantly increased dry matter yield in both years and increased population in the second year.

Townsville stylo broadcast at 8 kg ha^{-1} of seed pods onto uncultivated ground without fertilizer gave an adequate population by the second year, but superphosphate had to be applied for a large dry matter yield to be obtained.

***Macroptilium atropurpureum* cv. Siratro, *Urochloa mozambicensis*, *Cenchrus ciliaris* cv. American, and *C. setigerus* (Birdwood grass) gave very poor establishment.**

I. INTRODUCTION

Soil nutrient and species evaluation studies in the sandy forest country of north-west Queensland are reported in the first two papers of this series (Bishop 1974*a*, 1974*b*).

This paper reports a study of different establishment methods with particular reference to *Stylosanthes humilis* (Townsville stylo). The aim of the experiment, which was conducted at two sites, was to test the techniques of minimum cultivation and minimum fertilizer application on density of the resultant sward and its dry matter production.

II. MATERIALS AND METHODS

SITES. The two experimental sites, A and B, have previously been classified and a general description of the climate, vegetation and soils of the region has been given (Bishop 1974a).

TREATMENTS. A 2 x 3 factorial array of treatments was laid out in a randomized block design with four replications. Treatments were as follows—

Cultivation.—

1. Uncultivated (mowing with a lawn mower)
2. Cultivated (ploughed with a rotary hoe)

Fertilizer.—

1. Nil fertilizer
2. 120 kg ha^{-1} superphosphate
3. 120 kg ha^{-1} superphosphate plus 60 kg ha^{-1} urea

The pasture mixture used consisted of the following species—

1. *Stylosanthes humilis* (Greenvale Townsville stylo) at 8 kg ha^{-1} pods
2. *Macroptilium atropurpureum* cv. Siratro at 2 kg ha^{-1}
3. *Urochloa mozambicensis* at 1 kg ha^{-1}
4. *Cenchrus ciliaris* cv. American at 1 kg ha^{-1}
5. *C. setigerus* (Birdwood grass) at 1 kg ha^{-1}

MANAGEMENT. Plot size was 10 m x 1 m. At site A, trees had been removed 2 years previously. At site B, the plots were arranged between the undisturbed trees (*Melaleuca* spp. with a density of approximately 200 trees ha^{-1}). At both sites, at the time of site preparation, the dominant native grasses were *Aristida* spp. and *Chrysopogon fallax,* with approximately 400 kg ha^{-1} total dry matter yield at site A and 200 kg ha^{-1} at site B. All plots were mown to remove growth of native species and the cultivation treatment plots rotary-hoed 2 weeks before planting. A second ploughing was given at site B immediately before planting on 20 December 1969. Fertilizer was hand broadcast and raked in before broadcasting the seed on the soil surface. The legumes were not inoculated. The areas were not grazed or mown over the 2 years of the experiment.

Plant counts and dry matter yield were determined at site B from two 0·5 m^2 quadrats per plot on 13 March 1970 and 19 May 1971. At site B, plant counts were recorded on 13 March 1970.

Rainfall data are shown in the first paper of the series (Bishop 1974*a*).

Establishment conditions were poor with rainfall well below average in January and February 1970. Glenore homestead (19 km from site A and 3 km from site B) registered 6 mm, 9 mm and 88 mm on the three successive days following planting. In January, only three falls occurred, two of 25 mm and 12 mm on successive days early in the month and one of 10 mm towards the end of the month.

Establishment of species other than Townsville stylo was poor at both sites and data were recorded on Townsville stylo only.

TABLE 1

TOWNSVILLE STYLO POPULATIONS IN FIRST AND SECOND YEARS AT SITE B AND FIRST YEAR AT SITE A*. EQUIVALENT MEANS ARE IN PLANTS m^{-2}.

Treatment	Site B				Site A	
	1970		1971		1970	
	Transformed mean	Equivalent mean	Transformed mean	Equivalent mean	Transformed mean	Equivalent mean
No cultivation	1·699	30	3·223	122	1·340	16
Cultivation	2·559	75	8·295	844	1·228	12
Nec. diff. 5%	0·375		1·493		n.s.	
1%	0·519		2·065			
Nil	2·194	53	4·225	214	1·081	8
120 kg super ha^{-1} ..	1·961	41	6·190	467	1·424	19
120 kg super ha^{-1} + 60 kg Urea ha^{-1}	2·232	55	6·861	575	1·347	16
Nec. diff. 5%	n.s.		1·829		n.s.	
1%			2·529			

n.s. F test not significant.

* $\sqrt{x+\frac{1}{2}}$ transformation applied before analysis.

III. RESULTS

POPULATION. Cultivation significantly increased Townsville stylo population at site B in the establishment year and this effect was again present in the second year (table 1). Superphosphate had no effect in the establishment year but increased population in the second year. Urea gave no additional benefit. At site A, populations were low and no significant responses were recorded.

TABLE 2

DRY MATTER YIELD (kg ha^{-1}) OF TOWNSVILLE STYLO AND OF NATIVE SPECIES FOR THE FIRST AND SECOND YEARS AT SITE B

Treatment		1970		1971	
		No cultivation	Cultivation	No cultivation	Cultivation
Townsville stylo	Nil fertilizer	15	303	164	383
	120 kg super ha^{-1}	139	890	1 541	1 547
	120 kg super ha^{-1} + 60 kg urea ha^{-1}	99	1 168	1 189	1 273
Nec. diff.	5%	311		847	
	1%	430		1 171	
Native species	Nil fertilizer	352	87	309	139
	120 kg super ha^{-1}	707	244	432	179
	120 kg super ha^{-1} + 60 kg urea ha^{-1}	1 241	127	500	96
Nec. diff.	5%	300		n.s.	
	1%	414			

n.s. F test not significant.

YIELD. At site A, Townsville stylo yield was insufficient to record. At site B, cultivation and both fertilizer applications significantly increased Townsville stylo yield in the first year and a strong cultivation x fertilizer interaction occurred (table 2). In the second year, the fertilizer responses were again present, but there was no difference between cultivation treatments. Yield of native species in the uncultivated treatments in the first year was doubled by superphosphate and trebled by superphosphate–urea. In the second year, yields were much lower and responses less.

IV. DISCUSSION

Of the species planted, only Townsville stylo at site B established successfully. Previous work (Bishop 1974*a*) indicated better performance of improved pasture species at site B, although successful establishment was achieved at site A with cultivation. The reasons for failure of the other sown species to establish cannot be identified, but low seeding rates, low seed quality and low and irregular establishment rains are possible explanations.

Although cultivation greatly increased the Townsville stylo populations in both years, sufficient plants established without cultivation treatments by the second year. These results are in contrast to the early work in the Katherine area of the Northern Territory where Norman (1961) found that cultivation before sowing was necessary for good establishment on a Tippera clay loam soil. However, subsequent work in the Northern Territory by Stocker and Sturtz (1966) and Miller (1967) showed that good establishment populations can be achieved without cultivation when heavy grazing or early wet season burning is used to remove excess growth of native pasture species.

Although the two fertilizer treatments did not significantly affect population in the establishment year, they greatly increased population in the second year. This would be because of increased seed production from the fertilized treatments.

In this experiment, negligible dry matter was produced without fertilizer. The low dry matter yields obtained from Townsville stylo are attributed to low rainfall and low fertilizer application. Previous work at site B (Bishop 1974*b*) has shown that with an application of 370 kg ha^{-1} superphosphate a yield in excess of 2 000 kg ha^{-1} can be expected. Bishop (1974*a*) has also shown that potassium and the trace element zinc are required for maximum production from Townsville stylo on these soils. Nitrogen appears to be of no long term benefit to Townsville stylo growth and could result in strong competition from native species in the absence of cultivation. (Nitrogen was applied to benefit the companion grasses but they failed to establish.)

This work indicates that Townsville stylo can be successfully established under below-average rainfall without cultivation on the mottled grey earth soils of the sandy forest country of north-west Queensland. Application of superphosphate at sowing is very beneficial.

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