HARDY LEGUMES FOR IMPROVING BEEF PRODUCTION

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SUMMARY

Two hardy legumes, Aeschynomene falcata and Glycine tabacina were sown into native pasture in the Clarence River Valley for evaluation under grazing. Sown and native pastures, fertilized at low rates of superphosphate, were compared for botanical composition, nutritive value and pasture and animal production. Nitrogen content of the diet and intake of heifers were increased significantly on pastures sown with legumes. Increases in liveweight gain from sown pastures appeared gradually over three years. Early results suggest these hardy legumes would improve native pasture and could give a low cost increase in beef production.

INTRODUCTION

Plant introduction research at Grafton has placed emphasis on pasture legumes which establish and persist with low inputs of fertilizer and do not depend on good management for survival (Wilson 1978). Two such legumes, Bargoo jointvetch (Aeschynomene falcata) and native glycine (Glycine tabacina P7874), have been selected for evaluation under grazing. Both have potential for improving the quality of native pastures on poor sandy soils in the Clarence River Valley (Hennessy and Wilson 1974; Cohen and Wilson 1981). Cohen (1978) has shown that a small improvement in the quality of the diet of cattle grazing native pastures in this area substantially increases liveweight gains. The amount of legume eaten was a major contributor to this increase. This paper reports the early results of an experiment to compare beef production from native pastures with that from pastures sown to these two hardy legumes.

MATERIALS AND METHODS

Jointvetch and native glycine were established in native pasture at Fineflower, 65 km north-east of Grafton. The area is typical of the beef-cattle breeding country of the Clarence River Valley. The pastures comprised a mixture of native grasses (which include Hyparrhenia, Themeda, Imperata, Capillipedium, Dichanthium, Bothriochloa species) and carpet grass (Axonopus affinis). These were previously unfertilized and were on a sandstone soil of low available phosphate level (10 p.p.m., bicarbonate test).

In January, 1979 all pastures were lightly cultivated and treatment-pastures were oversown with a mixture of 4 kg of jointvetch and 2.5 kg native glycine seed per hectare. At the time of sowing, superphosphate was applied at 250 kg/ha to the control-pasture and two treatment-pastures, and at 125 kg/ha to a third treatment-pasture. In March each year applications were continued at 125 kg/ha to all pastures except one treatment-pasture which received 250 kg/ha initially and 0 kg/ha annually. Each treatment and the control comprised four replicate 1.63 ha paddocks. Two weaner Hereford heifers (average wt 170 kg) were allocated to each paddock in March, 1980 and replaced two years later.

Liveweight gains were calculated from overnight-fasted liveweight measurements made at 6-weekly intervals. The nutritive value of the diet of heifers grazing control and treatment-pastures., fertilized at 250 kg/ha superphosphate initially and 125 kg/ha annually, was estimated in late winter, spring, summer and autumn each year from 1981. Organic matter digestibility and nitrogen contents

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were determined from samples of the diet collected on 3 days from groups of three oesophageally-fistulated steers. Organic matter intake of the heifers was estimated using the chromic oxide dilution technique. The yield and botanical composition of the pastures were also estimated (Tothill et al. 1978) at these times each year. Soil samples were taken before superphosphate was applied each year and analysed for available phosphorus level (bicarbonate test).

RESULTS

Differences between mean liveweight gains of heifers grazing the various pastures appeared gradually over three years (Table 1). In the second year, 1981/82, heifers on one pasture-treatment sown to the two hardy legumes and receiving annual superphosphate had a mean liveweight gain greater than those of heifers on other pastures. In the third year, 1982/83, heifers on both sown pastures with annual superphosphate had gains that were greater than those of heifers on other pastures.

Table 1 Mean daily liveweight gains (kg/hd/day) of heifers grazing pastures (at 1.23 heifers/ha) with and without hardy legumes 1980-83

Pasture	Superphosphate (kg/ha) sowing/annual	Autumn	Winter	Spring	Summer	Year
				1980/81		
Native	250/125	.028	-.045	.239	.438	.166
+ Legumes	125/125	.124	.027	.196	.362	.179
+ Legumes	250/125	.119	-.051	.167	.607	.212
+ Legumes	250/0	.090	.018	.159	.385	.164
				1981/82		
Native	250/125	.142	-.261	.319^{b}	.503	.175^{b}
+ Legumes	125/125	.185	-.106	.571^{a}	.531	.295^{a}
+ Legumes	250/125	.078	-.256	.516^{a}	.528	.216^{b}
+ Legumes	250/0	.124	-.181	.470^{a}	.421	.208^{b}
				1982/83		
Native	250/125	.106	-.125	.223^{b}	.518^{b}	.172^{b}
+ Legumes	125/125	.271	-.014	.451^{a}	.607^{ab}	.321^{a}
+ Legumes	250/125	.126	.003	.343^{ab}	.670^{a}	.275^{a}
+ Legumes	250/0	.126	-.049	.275^{b}	.435^{c}	.190^{b}

(Values with unlike superscripts in the same column and year are different $P<0.05$)

Seasonal liveweight gains indicated typical periods of slow growth in autumn and winter and fast growth in spring and summer, In spring, 1981/82, heifers on all pastures with legumes had greater gains than those on the control. In both spring and summer, 1982/83, gains for one pasture with legumes and annual superphosphate were greater than those for either the control or the pasture with legumes but without annual superphosphate. In summer, 1982/83, the gain from the pasture with legumes but without superphosphate was less than that from the control.

Estimates of the quality of the diet of heifers on fertilized native pastures with and without legumes for 1981/82 are shown in Table 2. There was little difference in organic matter digestibility between pastures. However, the nitrogen content of the pasture with legumes was greater than that of native pasture in spring and summer. The mean organic matter intake of heifers on the pasture with legumes was greater than that of heifers on the control in spring.

Table 2 Organic matter digestibility (OMD%) and nitrogen content (N% OM) of pasture eaten and the organic matter intake (OMI kg/day) of heifers on native pastures with and without legumes fertilised initially at 250 kg/ha and annually at 125 kg/ha superphosphate - 1981/82

Pasture	Winter	Spring	Summer	Autumn
		OMD%		
Native	53.2^{a}	56.4^{b}	57.1	53.2
+ Legumes	47.5^{b}	57.7^{a}	56.0	54.1
		N% OM		
Native	1.17	1.72^{b}	1.28^{b}	1.22
+ Legumes	1.22	2.16^{a}	1.66^{a}	1.38
		OMI		
Native	4.88	5.17^{b}	7.11	4.86
+ Legumes	4.63	6.16^{a}	7.47	5.54

(Values with unlike superscripts in the same column are different $P<0.05$)

All pastures had similar total amounts of dry matter available. Average amounts available in March ranged from 1909 kg/ha in the first year after establishment to 3796 and 4956 kg/ha in the second and third years, respectively. The legume content was always greater in sown pastures than in the control but was not different between sown pastures with or without annual superphosphate. Average legume content in sown pastures, measured in March, ranged over the 3 years from 10.4 to 17.9% compared to 1.1 to 1.4% in native pasture. Both legumes persisted in the pastures but jointvetch was more prevalent than native glycine.

Available soil phosphate levels for all pastures after sowing were similar at 17.0 ppm. However, at the end of the second and third years, levels for the sown pasture without annual superphosphate were 11.5 and 7.5 ppm respectively. These were well below the average levels for the other pastures at these times, which were 19.0 and 13.4 ppm respectively.

DISCUSSION

Bargoo jointvetch and native glycine greatly increased the legume content of native pasture in spring and summer. The effect of these hardy legumes on animal production was seen in the second and third years after establishment. Liveweight gains in spring and summer from pastures with legumes and annual superphosphate were much greater than those from native pasture. Annual applications of superphosphate appeared necessary to maintain this increased gain.

In the third year, liveweight gains from the pasture with legumes but without annual superphosphate were generally lower than or similar to those from the control. The reason for this result was not clear as all sown pastures were similar in total dry matter available and legume content. However, soil phosphate levels from the sown pasture without annual superphosphate had fallen well below the presowing level.

Dietary nitrogen content, but not digestibility, was substantially improved in spring and summer, and pasture intake was increased in spring, by the addition of legumes. The liveweight gain response from sown pastures stressed the importance of dietary nitrogen content for increasing liveweight gain from these native pastures as was shown by Hennessy (1984).

The value of these hardy legumes for improving native pasture could be measured in terms of the liveweight gains obtained in the third year. Heifers on the two pastures with legumes and annual superphosphate gained 117 and 100 kg compared to only 63 and 69 kg for those on native pasture with annual superphosphate and on sown pasture without annual superphosphate respectively. From the relationship between liveweight and the incidence of oestrus in Hereford heifers established by Cohen et al. (1980), more than 85% of heifers on legume pastures with annual superphosphate would have been ready to mate at about 20 months of age, compared to only about 50% of heifers on other pastures. These liveweight gains compared favourably with a mean gain of 134 kg by similar heifers grazing heavily fertilized white clover/carpet grass pasture (available soil phosphate levels > 30 ppm, bicarbonate test) at 1.5 heifers/ha at the same site.

Early results suggest that the sowing of these hardy legumes with maintenance superphosphate would improve native pastures in much of the Clarence River Valley and could increase beef production from them at low cost.

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