

EFFECT OF NITROGEN FERTILIZER REGIME ON PASTURE YIELD AND COMPOSITION AND MILK PRODUCTION FROM ANNUAL CLOVER PASTURE OVERSOWN INTO TROPICAL PASTURE

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SUMMARY

Four nitrogen fertilizer regimes were applied to irrigated, high density, annual clover pastures which had been oversown into a tropical pasture in April. Pastures received no nitrogen fertilizer (control); nitrogen in autumn only; nitrogen in autumn and winter only; and nitrogen in autumn, winter and spring. Nitrogen fertilizer applied in winter increased winter clover yields by 10kg DM/ha/day and spring clover yields by 7 kg DM/ha/day. Nitrogen applied in spring markedly increased spring couch grass yields but reduced clover yields. Milk yields followed clover yields, and were significantly higher in winter for treatments receiving winter nitrogen ( $P < 0.05$ ).

Results indicated that where annually planted clovers are growing with base tropical grasses, nitrogen should be applied in winter but not in spring if clover and milk yields are to be maximised and costs minimised.

INTRODUCTION

Since 1976, the use of annually planted high density clover (*Trifolium spp*) pastures as sources of additional feed over the late autumn to spring period has increased substantially on irrigated dairy farms in Queensland (Chopping *et al.* 1982a). Such pastures have produced up to 17000 kg milk/ha over this period (Chopping *et al.* 1982a; 1982b). In a cutting experiment with clovers oversown into tropical grass pasture, Goodchild *et al.* (1982) measured an 18% increase in pasture yield in winter and a 12% increase in spring when 50 kg Nitrogen (N)/ha/month was applied. Nitrogen fertilizer applied to intensive clover pastures for the period autumn to spring accounts for over 30% of the total cost of the system. This experiment determined the effect of a number of nitrogen fertilizer regimes on production of pasture and milk from high density clover pastures over the period autumn to spring.

MATERIALS AND METHODS

The experiment was conducted at Ayr Research Station (alt. 13 m; lat. 19° 36'S; long. 147° 23'E) in a tropical coastal area of predominantly summer rainfall (1092 mm annual average).

Clover (*Trifolium spp*) pastures were oversown in April into 6.9 hectares of a base pasture of irrigated couch grass (*Cynodon dactylon*). The area was divided into 16 equal paddocks to accommodate a randomised block experiment with four nitrogen fertilizer treatments and two replicates, each with two pasture replicates. Pastures were stocked at 7.0 cows/ha with six animals per treatment replicate. Cows in each treatment replicate grazed pasture in a two paddock rotation of three weeks in, three weeks out. Pastures were rationed with a forward electric fence shifted three times/week. Treatments were:-

- T1 No applied N - control (C)
- T2 N applied in autumn only - at oversowing and first grazing (total 168 kg N/ha).
- T3 N applied in autumn and winter only - at oversowing and the first three grazings (total 336 kg N/ha).

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T4     Applied in autumn, winter and spring - at oversowing and each grazing (total 504 kg N/ha).

Couch pastures were slashed, burned, disced twice and oversown with a clover seed mixture of 20 kg/ha T. subterraneum cv. Clare and 5 kg/ha T. repens cv. Ladino. Eight paddocks (grazing rotation 1) were prepared and planted between 1st and 4th April, 1980, and the remaining eight paddocks (grazing rotation 2) between 19th and 22nd April, 1980. At oversowing all areas received 500 kg superphosphate (9% P), 125 kg muriate of potash (50% K) and according to treatment nil or 183 kg urea (46% N) per hectare. Pastures received 50 mm of spray irrigation every seven to fourteen days.

All pastures were grazed lightly five to six weeks after oversowing (first grazing). Full grazing pressure and milk production recording commenced at the start of the second grazing on 2nd June, 1980, and continued until 17th November, 1980. All animals were supplemented with molasses containing 1% mono ammonium phosphate, group fed in the paddock at the rate of 2 kg/cow/day.

The 48 lactating Friesians entering the trial on 2nd June consisted of 24 multiparous cows and 24 primiparous heifers and had a mean calving date of 24th April, 1980. Half of the animals in each treatment replicate were replaced after 12 weeks by more recently calved animals. Eight cows and 16 heifers were replaced by 24 multiparous cows. Mean calving date after replacement was 5th June, 1980.

All animals were fed a standard ration of "ad lib" lucerne hay and molasses for 14 days prior to entering the experiment. Milk production over the last seven days was used subsequently for co-variance analysis. For allocation to treatments animals were stratified according to co-variance milk production and calving date. Heifers and cows were allocated evenly across treatments. Milk yields were recorded at each milking and composite samples from two consecutive milkings per week were analysed for butterfat (BE') and solids not fat (SNF). Liveweights were recorded at entry and monthly thereafter. Pasture presentation yields and botanical composition were determined before second and subsequent grazings (eight occasions) and 21 days after the final grazing (two occasions) for each pasture replicate. Winter milk production was from pasture grown over the period late autumn and winter. Spring milk production corresponded to pasture grown over late winter and early spring.

## RESULTS

Pasture data are presented in Table 1. Autumn applications of nitrogen increased late autumn clover yields by 3 kg DM/ha/day (T2, T3 and T4 v's T1) but had no effect on winter clover yields (T2 v's T1). Winter clover yields were increased by 10 kg DM/ha/day in treatments where nitrogen was applied in winter. Spring clover yields were increased by 7 kg DM/ha/day where nitrogen was applied in winter but not in spring (T3 v's T1 and T2) but were reduced by 19 kg DM/ha/day when nitrogen was applied in spring also (T4 v's T3).

Seasonal patterns of DM production for Clare and Ladino clovers are shown in Figure 1. Mean cumulative yields over the period 10/5/80 to 4/8/80 showed that Clare clover produced 64% of the total clover yield. Winter N applications increased yields of Clare over this period but reduced those of Ladino. Mean cumulative yields to 4/8/80 were 2604 kg/ha (Clare) and 986 kg/ha (Ladino) with winter N (T3 and T4). Corresponding DM yields for treatments not receiving N in winter (T1 and T2) were 1478 kg/ha (Clare) and 1459 kg/ha (Ladino).

TABLE 1 Effect of nitrogen fertilizer regime on clover (*T. subterraneum* cv. Clare + *T. repens* cv. Ladino), couch grass (*Cynodon dactylon*) and total pasture yields over the late autumn, winter and spring growing periods

Period and species Nitrogen fertilizer regime	Pasture yield kg DM/ha			
	No. N	Autumn N	Autumn/Winter N	Autumn → Spring N
		168 kg N/ha	336 kg N/ha	504 kg N/ha
Late autumn (21 days)				
Clover	322	360	414	358
Couch	618	1352	1344	1010
Total	1285	2325	2050	2799
Winter (105 days)				
Clover	4984	4928	5875	6183
Couch	2121	2830	2959	2562
Total	7369	9147	10987	11031
Spring (84 days)				
Clover	4195	3982	4653	3027
Couch	2961	3950	4399	8697
Total	8457	9277	10956	14221

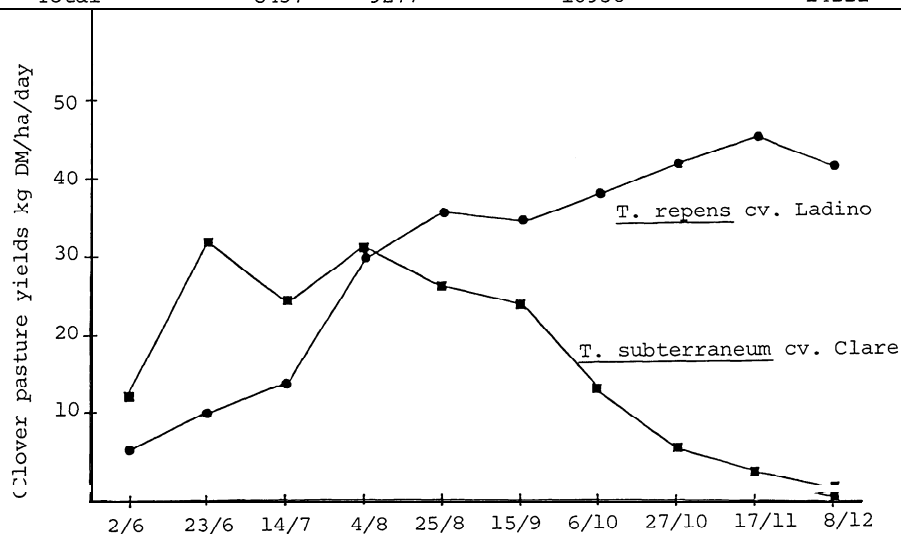


Fig. 1. Dry matter yield dynamics of clover species

Nitrogen applied in autumn increased late autumn couch grass yields by 29 kg DM/ha/day and winter couch yields by 7 kg DM/ha/day. Additional winter N did not increase winter couch grass yields. Applying N in spring increased early and late spring couch grass yields by 29 and 74 kg DM/ha/day respectively (T4 v's T3). For both T3 and T4 clover and couch grass yields on offer over the spring grazing period were increased relative to T1 and T2.

Milk yield and composition data are presented for two consecutive 84 day periods (Table 2). Winter milk production (2/6 - 25/8) was produced off pasture grown from 8/5 to 25/8. Spring milk production was from pasture grown from 4/8 to 17/11. Autumn applied N had no effect on milk yields in winter. Nitrogen applied in winter increased milk yields in winter and also for the first six weeks in spring ( $P < 0.05$ ). Over the full spring grazing period, treatment

effects on milk production were similar to those recorded in the winter grazing

TABLE 2 Effect of nitrogen fertilizer regime on milk production and composition from Friesian cows grazing irrigated annual clover pastures oversown into tropical pastures in April in North Queensland.

Parameter	Nitrogen (N) Fertilizer Regime			
	No N	Autumn N	Autumn/Winter N	Autumn → Spring N
Winter grazing period (2/6-25/8)				
Milk yield kg/cow/day	8.9 <sup>a</sup>	9.2 <sup>a</sup>	10.4 <sup>b</sup>	10.1 <sup>b</sup>
BF yield kg/cow/day	0.32 <sup>ab</sup>	0.30 <sup>a</sup>	0.36 <sup>c</sup>	0.35 <sup>bc</sup>
SNF yield kg/cow/day	0.70 <sup>ab</sup>	0.68 <sup>a</sup>	0.81 <sup>c</sup>	0.77 <sup>bc</sup>
LW change kg/cow	-38	-26	-29	-19
Spring grazing period (25/8-17/11)				
Milk yield kg/cow/day	9.6	9.0	10.5	10.6
BF yield kg/cow/day	0.33 <sup>ab</sup>	0.31 <sup>a</sup>	0.36 <sup>b</sup>	0.37 <sup>b</sup>
SNF yield kg/cow/day	0.74 <sup>ab</sup>	0.64 <sup>a</sup>	0.82 <sup>b</sup>	0.82 <sup>b</sup>
LW change kg/cow	15	25	12	11

Means in rows with different superscripts are significantly different ( $P \leq 0.05$ )

period, but the difference were not significant. In spring replacement cows (fresh) produced 1.7 kg/cow/day more than other cows ( $P \leq 0.05$ ) but there was no time of calving by treatment interaction, hence overall group means have been presented in Table 2.

#### DISCUSSION

Comparing milk and pasture yield data from this experiment showed that changes in clover yield had more effect on milk production than changes in either couch grass or total pasture yield. Responses to nitrogen fertilizer in winter would indicate that symbiotic nitrogen fixation may not be sufficient for maximum clover production. Crofts (1965) reported that legume rhizobial nitrogen fixation declines once soil temperatures fall below 22°C. The period over which N fertilizer increased clover yields in this experiment would support this. Increasing clover yields in winter had carry over benefits on spring clover yields provided no N was applied in spring. Spring response by couch grass to spring applications of N increased competition and reduced clover yields. Inclusion of early producing clover varieties such as Clare in annual clover mixes is warranted since in all treatments it produced more than 50% of clover DM over the important June/July period.

The results suggest that nitrogen should be applied to high density pastures in winter but not spring if clover and milk yields are to be maximised and costs minimised.

#### REFERENCES

- CHOPPING, G.D., MURRAY, A.J. and BIRD, A.C. (1982a). Proc. Aust. Soc. Anim. Prod. 14: 106.
- CHOPPING, G.D., THURBON, P.N., MOSS, R.J. and STEPHENSON, H. (1982b). Proc. Aust. Soc. Anim. Prod. 14: 421.
- CROFTS, F.C. (1965). In "Intensive Utilization of Pastures". p.76, editor, B.J. James, (University of New England : Armidale).
- GOODCHILD, I.K., THURBON, P., SIBBICK, R. and SHEPHERD, R. (1982). Aust. J. Exp. Agric. Anim. Husb. 22:138