MILK PRODUCTION FROM AN UNIMPROVED AND AN IMPROVED GRAZING SYSTEM WITH AND WITHOUT A GRAIN SUPPLEMENT

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Summary

An improved and an unimproved system of pasture and animal management were compared over a two-year period. Half the cows on the improved system received a grain supplement according to their production. The production per cow was extrapolated into mean per ha production of 96 kg, 157 kg and 218 kg butterfat over the two years for the unimproved, improved and improved + supplement treatments respectively. Cows on the improved system receiving supplement produced significantly more butterfat than those not receiving supplement, but gave only low gross cash returns.

I. INTRODUCTION

Average milk yields of cattle in the lower elevations of countries in North-South 30° latitude are generally only 10-50 per cent of that acceptable in the 35-60° latitudes (McDowell 1966). Previous reports (Hudson *et al.* 1964; Colman, Holder and Swain 1966) indicated the probable production from dairy cattle on 'an improved system at Wollongbar. The generally lower production obtained on tropical pastures has been ascribed to low energy intakes (Glover and Dougall 1961) and this view is supported by work at Wollongbar in which cows were fed cut pasture in stalls (Dale and Holder 1968).

Previous grazing studies at Wollongbar, in a humid subtropical environment, were based on partial development systems incorporating both temperate and tropical legumes. The improved pasture system in this study was based on a complete development with *Glycine wightii* cv. Clarence (glycine) which appeared to be one of the most promising perennial legumes in this area (Murtagh, Mears and Swain 1964). An unimproved management practice was compared with two improved systems, one of which aimed at increasing energy intake by supplementation.

II. MATERIALS AND METHODS

(a) *Treatments*

The improved system incorporated summer calving, the use of glycine and fertilizers and an increased stocking rate. This was compared with an unimproved system consisting of spring calving, naturalized grasses receiving no fertilizer and a lower stocking rate. Half the cows on the improved system received a supplement of crushed oats according to their milk production.

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(b) *Pastures*

Both systems were at Wollongbar Agricultural Research Station. Each system occupied 9.7 ha. The unimproved pasture comprised kikuyu ***(Pennisetum clandestinum),*** paspalum (*Paspalum dilatatum*) and narrow leaf carpet grass ***(Axonopus** affinis*). The improved pasture was a mixture of kikuyu and glycine which received annually in spring 152 kg ammoniated super, 20 kg potash with molybdenum. The unimproved system received no fertilizer. Most of the glycine was established in 1965; 1.6 ha had been established in 1961.

(c) Animals

Ten cows mainly of Guernsey breeding due to calve in spring were allotted to the unimproved'system, and 18 similar cows due to calve in summer were allotted to the improved system. Cows were dried off when their butterfat production dropped below 0.14 kg/day in two successive. weekly tests or when they had completed 301 days of lactation. The cows were weighed every two weeks after morning milking.

(d) *Pasture and Animal Management*

The cows were rotationally grazed, one group on the unimproved area of six paddocks at 1.03 cows/ha, the other including unsupplemented and supplemented cows on the improved area of seven paddocks at 1.85 cows/ha. The rotation was decided following a weekly visual assessment of pasture growth. The supplement was given after afternoon milking, the allocation per day being reassessed after each weekly herd recording. Cows were supplemented according to their production of 4 per cent fat-corrected milk (F.C.M.) per day (Overman and Gaines 1933) as follows:—

1.8 kg supplement for production in excess of 9.1 kg F.C.M.

0.45 kg supplement for each 1 .1 kg F.C.M. in excess of 13.6 kg F.C.M. per day.

Heifers were supplemented as follows:—

1.8 kg supplement for production in excess of 6.8 kg F.C.M.

0.45 kg supplement for each 1.1 kg F.C.M. in excess of 11.5 kg F.C.M. per day.

(e) Statistical analyses

As there was no replication in space, an anlysis of variants using between-cow within-treatment variation as error confounds treatment with land in comparisons between unimproved and improved systems. Comparisons between the two improved systems are not confounded in this way.

Production curves were fitted using the model described by Wood (1969). Persistency of production was estimated by the method of Wood (1967).

III. RESULTS

The mean butterfat and milk production per cow and per ha for the 1966-67 and 1967-68 seasons are shown in Table 1. The feeding of a supplement on the improved system gave significantly ($P < 0.001$) more butterfat and F.C.M., increasing mean butterfat production from 90 kg to 129 kg in 1966-67 and from 79 kg to 107 kg in 1967-68. The differences in production between years, the years x supplement interaction and the difference in Iiveweight change between cows on the improved system receiving supplement and those not receiving supplement were non-significant ($P > 0.05$).

Mean butterfat production per cow on the unimproved system increased from 86 kg in 1966-67 to 100 kg in 1967-68. In the improved system, there was a decrease from 110 kg to 93 kg over the same period (Table 1).

IV. DISCUSSION

These results indicated that large increases in production can be obtained by the adoption of an improved system of pasture and animal management.

As the experiment was a comparison of complete systems, little information is available on the individual contribution of the factors affecting the production responses.

Seedbed preparation (8.1 ha) in the year preceding the trial would have caused a release of mineralised nitrogen (McGarity 1958). This may have increased pasture production on the improved system and thus increased animal production if pasture was at some stage limiting. Evidence from plot studies suggests that cultivation increases pasture production for at least two seasons (Colman, unpublished data). The difference in stocking rates between the systems may have accounted for the large differences in production per ha, although impressions gained from the weekly visual assessment were generally that both systems were run at a similar grazing intensity.

Per ha results (Table 1) have been calculated from per cow production figures but, as both groups of cows grazing the improved system were run together, the accuracy of this extrapolation depends on the validity of the assumption that cows on the improved system would have returned similar production figures had they been grazing as separate groups. Two factors would affect the validity of the assumption: (a) social fcailitation — Holder (1965) found no evidence of social facilitation in dairy cattle, and (b) any modification of pasture intake caused by the feeding of the grain — Holmes and Jones (1964) and Leaver, Campling and Holmes 1968) suggested that a reduction in pasture intake usually occurs when grain is fed.

The mean per cow production obtained from cows grazing the improved system but receiving no supplement was 10 per cent lower than that obtained from cows on the unimproved system. This contrasts with a mean increase of 48 per cent obtained from the partially developed system described by Colman, Holder and Swain (1966). The stocking rates used in this experiment were higher than those used by Colman, Holder and Swain (1966). This may have caused a decline in per cow production, or the use of temperate legumes in their partially developed system could have resulted in greater per cow production than occurred here where only a tropical legume was used.

There was a difference in the production response curves between years and between systems (Figure 1). The difference in response between years is largely a reflection of moisture stress. In 1966-67, a period of moisture stress occurred in December. It had little effect on the summer calving cows, but the spring calving cows suffered a check in their lactation. 1967-68 was a dry year; the total precipitation was 1240 mm (mean rainfall 1650 mm), though rainfall in spring

TABLE 1

Butterfat and milk production from the three systems in 1966/67 and 1967/68 at Wollongbar

		PRODUCTION PER COW				PRODUCTION PER HA*	
YEAR	TREATMENT	BUTTERFAT (kg)	S.E.†	FAT CORRECTED MILK (kg)	S.E.	BUTTERFAT (kg)	FAT CORRECTED MILK (kg)
1966–67	Unimproved	86	6.0	2054	135	89	1996
	Improved	90	9.0	2117	214	166	3916
	Improved + supplement	129		2961		238	5478
1967–68	Unimproved	100	6.0	2300	139	103	2236
	Improved	79	8.7	1864	204	147	3448
	Improved + supplement	107		2437		198	4508

*Production per cow × stocking rate.

†Standard error of mean.

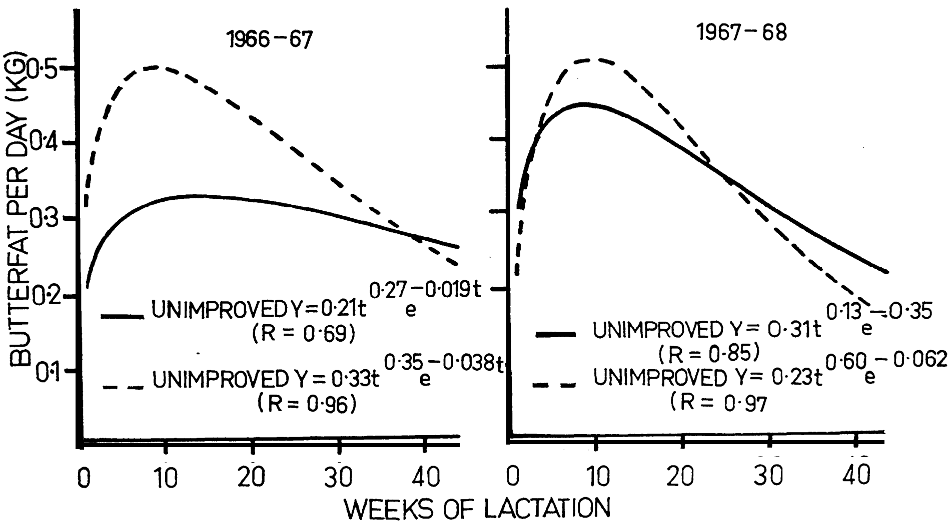

Fig. 1.—Production curves of cows on the unimproved and improved systems for the two years of the experiment. The curves were calculated using mean weekly data obtained from at least 8 cows.

and summer was fairly normal. However, a moisture stress occurred in April which affected the summer calving cows' lactations — this was reflected in a mean decrease in lactation length from 282 to 240 days. Cows on the unimproved system had a mean decrease of 2 days over the same period. The persistency factor (Wood 1967) of the production curves of cows on the unimproved system decreased from 156 to 80 from 1966-67 to 1967-68, whereas cows on the improved system showed an increase in persistency from 82 to 87 over the same period of time.

The amount of concentrate required to increase butterfat production by 1 kg was 19.0 and 15.6 kg for 1966-67 and 1967-68 respectively. In 1966-67, the average price of butterfat was $1 .0 1 /kg, thus the concentrate would have to be purchased at a cost of less than 5.3 cents/kg before any gross profit could be realised; in 1967-68, the limiting price would be 6.5 cents/kg concentrate. The average price for bulk oats during 1967-68 was 5.3 cents/kg, so returns for supplement feeding were small.

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