ENERGY AND PROTEIN SUPPLEMENTS FOR DAIRY COWS GRÄZING TROPICAL PASTURE

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Summary

The effects of supplementing the diets of eight cows, grazing kikuyu dominant pasture during winter, with crushed maize and soyabean meal, fed both singly and in combination, were measured in a 4 x 4 balanced latin square change-over design experiment. The experiment was conducted at the Agricultural Research Station, Wollongbar, which is situated in a humid sub-tropical environment on the far north coast of N.S.W.

Differences in milk production and composition were found between the diets. A significant linear correlation between dry matter intake of supplement and milk production was observed, indicating that energy rather than protein was limiting milk production.

I. INTRODUCTION

Milk production from cows grazing tropical pastures is generally lower than that obtained in temperate regions (Glover and Dougall 1961; Hardison 1966; Dale and Holder 1968). This has been attributed to low intakes of digestible nutrients (Glover and Dougall 1961; Dale and Holder 1968; Hamilton et al. 1970). Digestible nutrient intake can be increased by supplementation with concentrates (Holmes and Jones 1964); however, the milk production response, particularly on tropical pastures, has not been well defined. While a production response can generally be obtained by supplementing tropical pasture with energy rich concentrates, it is only at certain times of the year that chemical analyses point to possible limitations to milk production imposed by a digestible protein deficiency (Glover and Dougall 1961; Hardison 1966).

Supplements can be fed either strategically to avoid large production declines during periods of feed shortage, or for production above that level attainable on pasture alone. Studies at the Agricultural Research Station, Wollongbar, have suggested that the latter system may be only marginally profitable on the Far North Coast of N.S.W. (Jeffery et al. 1970). On the other hand, strategic feeding is most likely to be employed by those farmers seeking to produce milk throughout the year, especially during winter and spring, when pasture growth rates can be very low.

In this experiment, the effects on milk production and composition when energy rich and protein rich concentrate supplements were fed to dairy cows grazing kikuyu pasture in winter have been examined.

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II. MATERIALS AND METHODS

This experiment was carried out over eight weeks between June 17 and August 12, 1970, with dairy cows grazing *kikuyu* (*Pennisetum clandestinum*) dominant pasture. Two replicates of a 4 x 4 balanced latin square change-over design incorporating 14 day periods were used. In each period 6 days were allowed for adjustment, and collections were made during the following 8 days.

Eight Jersey cows, 4 to 7 months into lactation, were blocked on their persistency of lactation, as recommended by Lucas (1957), and the four treatments were allocated to them according to the latin square design. The treatments adopted were as follows:

- **P** — Pasture alone (Control)
- **S** — Pasture plus 1.1 kg/day Soyabean meal
- **M** — Pasture plus 2.67 kg/day crushed maize
- **MS** — Pasture plus 3.77 kg/day Soyabean meal maize mixture (1.1:2.67)

The soyabean meal provided approximately 45 per cent of the cows digestible crude protein requirements, while the maize supplied an estimated 33 per cent of the requirements for digestible energy (Agricultural Research Council, 1965).

The supplement rations were fed after each milking in the ratio of 3:4 (a.m.:p.m.). Cows were divided into two separate grazing groups according to the supplement treatment currently allocated them, in order to reduce possible commensal effects on grazing behaviour and pasture intakes which may have been brought about by widely differing levels of supplementation. Ten paddocks (4 x 0.45 ha and 6 x 0.57 ha) were, after balancing for area, randomly divided into two groups of 5. Cows receiving the highest levels of supplementation (MS and M) were rotated amongst one group of 5 paddocks while the other group provided grazing for the cows on treatments P and S. Rotation followed a 2 to 3 day cycle according to paddock size, the cows being transferred to the paddock which, of the four available to each group, carried the most dry matter, according to visual estimation. The average stocking rate throughout the experiment was 1.75 cows/ha.

Ten 0.405m² quadrat cuts were taken from each paddock for dry matter estimation of the pasture at the beginning, middle and end of the experiment.

Milk from each cow was collected and weighed from both the morning and afternoon milkings on days 1, 3, 6 and 8 of the 8 day collection period, and samples (100 ml a.m. and 75 ml p.m.) were bulked and stored in bottles to which four drops of formalin had been added. Milk fat percentages were measured using a “Milko Tester Mk. II” (A/S N Foss Electric), protein percentages with a “Pro Milk Mk. II” (A/S N Foss Electric) and milk solids not fat (SNF) were measured using a British standard density hydrometer (size No. 1). Four per cent fat corrected milk (FCM) was calculated by the formula of Overman and Gaines (1948).

Statistical analysis followed the method of Patterson and Lucas (1962). Statistically significant differences were determined using L.S.D. comparisons.
III. RESULTS

Cows yielded significantly ($P < 0.01$) greater amounts of milk when fed the concentrate supplements than when grazing pasture alone (Table 1). As the milk production increased with increasing levels of supplementation, the yields of protein, SNF and FCM ($P < 0.01$) and butterfat ($P < 0.05$) also rose significantly. However, the concentrations of the various milk constituents, with the exception of protein per cent, were not significantly ($P < 0.05$) effected by the supplement treatments. Although the mean production of milk and its constituents were generally higher when the cows were fed maize (M), only in terms of SNF production was a significant difference derived between treatments M and S.

There was a significant ($P < 0.05$) linear relationship between dry matter fed as supplement in kg/cow/day ($X$) and milk production in kg/cow/day ($Y$) described by $Y = 0.458X + 7.68$ ($r = 0.972$, d.f. 2). An equally significant relationship ($r = 0.962$) was observed between milk production and digestible energy fed as supplement using mean values from feed composition tables (National Research Council 1964). Non-significant curvatures were associated with these relationships.

Pasture dry matter (DM) yields decreased throughout the experiment; mean DM available to the cows, assessed from quadrat cuts being 112 1 ± 10 1 kg/ha (15.6.70), 695 ± 109 kg/ha (15.7.70), and 662 ± 81 kg/ha (12.8.70).

IV. DISCUSSION

The high correlation found between supplementary DM fed and milk production supports the contention of Hamilton et al. (1970) that response in terms of milk production is mainly due to increased digestible nutrient intake. If a response specifically to protein were to occur, then a relationship between milk production and supplemental protein provided could be expected. There was no evidence of such a relationship, and the lack of curvature in the relationships between milk production and supplemental DM and digestible energy consumed indicate that the response was mainly attributable to greater energy intake.
In this experiment, the only notable compositional change in the milk was that the protein content tended to increase with increasing supplementation. The highest level of concentrate produced a significant (P < 0.05) response compared with the control (Table 1). This is in line with work conducted on temperate species by Holmes et al. (1956) which indicated a response to increased digestible energy intake.

The relationship between the amount of pasture dry matter available and animal production has been described by Mott (1960). From Mott’s studies, it could be expected that as the DM yields of our pasture decreased with time, so animal production (milk yield) would decline at a rate greater than that normally observed in dairy cows. However, the decrease observed in our experiment was only 2 per cent per week, which is within the expected range for animals on unlimited pasture. Thus it seems unlikely that DM yield affected the observed response.

In conclusion, these results support the suggestions of past work, that the major factor limiting production from cows in subtropical and tropical areas is a lack of digestible energy in their diets. Protein levels in the available pasture would appear to be non-limiting under the reported system of management and at the reported levels of production.

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VI. REFERENCES


