WINTER-SPRING FORAGE CROPS AS SUPPLEMENTS FOR DAIRY COWS GRAZING KIKUYU PASTURE

A.J.E. ROYAL* and R.M. HUGHES*

Summary

Five alternative forages were compared as supplements for lactating dairy cows grazing kikuyu pasture during winter and early spring. The forages were: sugar cane, autumn-saved kikuyu, oats, ryegrass and yellow lupins. Cows produced significantly more milk when supplemented with oats, ryegrass or lupins than cows on autumn-saved kikuyu which in turn produced more than the cows supplemented with cane. Results are discussed in relation to nutritive value, costs and some practical aspects of production.

I. INTRODUCTION

A major problem in sub-tropical areas is the provision of feed of adequate quantity and quality for dairy cattle during winter and spring when warm climate species are dormant. There are a number of alternative techniques for providing feed including the autumn-saving of tropical pastures, the growth of summer crops and the sowing of temperate forage species. Although the value of temperate legumes has been demonstrated (Holder, Swain and Colman 1963), there are no comparisons between these forages, the temperate grasses, autumn-saved tropical grasses and the tropical crop, sugar cane (Saccharum officinarum).

This paper reports a comparison between a temperate legume, two temperate grasses, an autumn-saved tropical grass and sugar cane when used as supplements for dairy cows grazing tropical pasture.

II. MATERIALS AND METHODS

The experiment was conducted at the Wollongbar Agricultural Research Centre. Wollongbar, situated on the North Coast of New South Wales, experiences a humid sub-tropical climate, with a predominantly summer rainfall. Average annual precipitation is 1660 mm.

The experiment was conducted from 29th July to 4th September, 1974 and compared five forage supplements. Two of these were tropical species; sugar cane and kikuyu grass (Pennisetum clandestinum), and three were temperate forages; oats (Avena sativa cv. Camella), ryegrass (Lolium multiflorum cv. Tetila) and yellow lupins (Lupinus luteus cv. Weiko 171). A completely randomised design was employed with treatments replicated three times except for lupins which was replicated twice.

The three annual species were sown in mid-April. Ryegrass and oats were sown into cultivated seedbeds while lupins were sod-seeded into pasture that had been sprayed two weeks previously with Paraquat (0.28 g active ingredient ha-1). The oats were grazed at the end of May to ensure the crop remained in a vegetative stage for the trial period; both oats and ryegrass were topdressed with 60 kg ha-1 of nitrogen in mid-June. Following a heavy grazing in mid-April, the kikuyu was topdressed with nitrogen (100 kg N ha-1) and stock withdrawn until the commencement of the experiment. The cane was planted in 1971 and the material harvested was approximately ten months old.

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All cows were standardised on a ration of 5 kg lucerne chaff cow\(^{-1}\) day\(^{-1}\) plus ad libitum kikuyu pasture for three weeks immediately prior to the commencement of the experimental period which was run over 33 weeks, one week being allowed for adjustment, and 2\(\frac{1}{2}\) weeks for measurement. Forty-two Guernsey cows were divided into 14 groups allocated to treatment replicates at random.

The forages were offered at 7 kg dry matter (DM) cow\(^{-1}\) day\(^{-1}\) with the exception of kikuyu which was offered at 7 kg dry green leaf (DGL) cow\(^{-1}\) day\(^{-1}\) above a level of 600 kg DGL ha\(^{-1}\). The sugar cane was green chopped and fed in troughs while the other forages were strip grazed, the area to be grazed each day being allocated according to the assessments of yield. Between evening and morning milkings all cows grazed a common nitrogen fertilized kikuyu pasture and were rotated around a number of paddocks so that the yield of pasture on offer never dropped below 600 kg DGL ha\(^{-1}\).

Milk yield was recorded daily during both the standardisation and experimental periods. Proportional milk samples were collected on two days each week. These were bulked, on a weekly basis, prior to analysis for butterfat and protein. Four per cent fat corrected milk (4\% FCM) production was calculated according to the method of Overman and Gaines (1948).

Yields of kikuyu, oats, ryegrass and lupins were estimated prior to the commencement of the experiment and each week before and after grazing. Oats, ryegrass and lupin DM yields were estimated by cutting ten random quadrats (0.64 m\(^2\)) per grazing area. The kikuyu DGL were estimated using a combination of cut and visually estimated quadrats and hand sorting of pasture samples. Harvested material was dried for 24 hours at 75\(^\circ\)C in a forced draught oven before weighing.

Random grab samples of the sugar cane, random leaf pluck samples of the kikuyu and subsamples of the cut quadrats of the oats, ryegrass and lupins were taken weekly. They were dried at 75\(^\circ\)C, ground through a 1 mm screen and subsamples analysed for total Kjeldahl nitrogen (N) and in vitro digestibility (IVD).

The milk production and composition data for each cow were subjected to an analysis of covariance adjusted for standardisation period production.

III. RESULTS

The quality of the temperate forages, as measured by both IVD\(\%\) and N\% was appreciably higher than that of the kikuyu and cane (Table 1). The N\% of the sugar cane was low. The quality and composition of the forages did not change significantly during the course of the experiment.

There were significant milk yield differences (P < 0.05) between the cows supplemented with temperate crops and those supplemented with the tropical forages (Table 1). Butterfat percentages were generally inversely proportional to yield. The levels of protein in the milk of the cows on ryegrass and lupins was significantly (P < 0.05) higher than for the other three treatments. There was a strong positive relationship (r\(^2\)=0.86) between IVD\(\%\) of forage and milk production cow\(^{-1}\).

During the adjustment period, and the first week of the experimental period we observed that the cows were somewhat reluctant to graze the lupins. However, during the last two weeks they readily consumed their daily allocation. Senescence of the top 7-15 cm of the kikuyu canopy occurred in July as a result of frosting.
IV. DISCUSSION

The large differences in milk production cow⁻¹ between the cows supplemented with the temperate crops and those on the tropical forages would appear to be mainly an effect of forage quality, given that all crops were offered at the same rate of DM. The observed relationship between forage digestibility and milk production supports the contention of Stobbs (1971) that tropical forages impose limits on milk production through low intakes of digestible nutrients.

The low milk production from the cows on sugar cane relative to those on kikuyu could have been due to the low levels of crude protein (CP = N x 6.25) in the cane. Lupins was the only forage to which the cows had not previously been exposed, and thus we feel that the initial lack of acceptance of the lupins by the cows was probably due to unfamiliarity rather than any inherent property of the species. This may explain, in part, the lower milk production of the cows on lupins relative to those grazing the oats.

Factors to be considered in selecting a forage supplement not only include digestibility, chemical composition, acceptability and accessibility but also yield, costs and management requirements. Yields, cost per kg of total DM and some agronomic attributes are shown in Table 2.

### TABLE 1

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sugar Cane</th>
<th>Kikuyu</th>
<th>Oats</th>
<th>Ryegrass</th>
<th>Lupins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forage quality N% (DM)</td>
<td>0.62ᵃ</td>
<td>1.70ᵇ</td>
<td>2.50ᶜ</td>
<td>2.62ᶜ</td>
<td>3.13ᵈ</td>
</tr>
<tr>
<td>¹¹²% (DM)</td>
<td>22ᵃ</td>
<td>50ᵇ</td>
<td>76ᵇ</td>
<td>72ᵇ</td>
<td>77ᵇ</td>
</tr>
</tbody>
</table>

Milk production/composition

| 4% FCM (kg cow⁻¹ day⁻¹) | 6.3ᵃ         | 7.2ᵇ   | 9.7ᵈ  | 9.6ᵈ     | 9.1ᶜ   |
| Butterfat %             | 4.90ᵃ        | 4.82ᵈ  | 4.56ᵃ  | 4.67ᵇ    | 4.41ᵃ  |
| Protein %                | 3.58ᵃ        | 3.56ᵃ  | 3.57ᵇ  | 3.83ᵇ    | 3.80ᵇ  |

a, b, c, d: Figures in the same row with different superscripts are significantly different (P < 0.05).

### TABLE 2

Yields, costs kg⁻¹ DM, periods of availability and number of harvests of the forage supplement*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sugar Cane</th>
<th>Kikuyu</th>
<th>Oats</th>
<th>Ryegrass</th>
<th>Lupins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total DM available</td>
<td>20-40,000</td>
<td>3-5,000</td>
<td>3-5,000</td>
<td>3-5,000</td>
<td>4-6,000</td>
</tr>
<tr>
<td>June-Nov (kg ha⁻¹)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost (cents kg⁻¹ total DM)</td>
<td>0.8-1.6</td>
<td>0.6-1.1</td>
<td>2.2-3.7</td>
<td>1.8-3.0</td>
<td>0.6-0.9</td>
</tr>
<tr>
<td>Period available</td>
<td>Jul-Dec</td>
<td>June-Aug</td>
<td>June-Sep</td>
<td>Jul-Oct</td>
<td>Jul-Sep</td>
</tr>
<tr>
<td>Number of harvests</td>
<td>1</td>
<td>1-2</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

* Data from experiments at Wollongbar.
Although milk production from cows supplemented with tropical species is lower than with temperates, both costs and risks associated with the *tropicals* tend to be lower. Cane has a further advantage in that growth occurs during summer and the material produced remains *in situ* irrespective of rainfall during autumn, winter or spring. However, forage harvesting of cane can be time-consuming and may be impossible during periods of high rainfall. Autumn-saved kikuyu is a very simple technique posing few management problems, although loss of DM and a lowering of quality will occur if kikuyu is frosted. This can be avoided by the selection of frost free sites. Spasmodic outbreaks of sod webworm (*Herpetogramma licarsalis*) do occur on nitrogen fertilized pastures but occurrence is infrequent.

The major reason for the high cost of oats and ryegrass is their seedbed requirement, either cultivated or chemical (Murtagh 1971). However, they will grow at relatively low temperatures and can be grazed every six to eight weeks during winter providing moisture is not limiting. Costs can be reduced if these crops are grown in a rotation with a summer legume such as Dolichos (*Lablab purpureus*).

Lupins can be *sod-seeded* without the use of herbicides (Hughes unpub. data). Consequently the base pasture is left intact and, following grazing of the lupins, can respond to any nitrogen fixed by the legume. Drawbacks associated with lupins are the period during which land is not in use (3–4 months) and that they *may* only be grazed once.

In sub-tropical dairying areas, supplementation of tropical pastures during winter and spring may be required for up to five months of the year. Recognising that differences exist not only between the alternative supplements, but also in the physical attributes of farms and between managers, in terms of attitudes and requirements for quality and quantity supplements, we suggest that the most economic method of providing feed may involve a number of alternatives rather than reliance on only one.

V. ACKNOWLEDGEMENTS

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VI. REFERENCES


