THE EFFECT OF FRESH LEUCAENA LEUCOCEPHALA AS A SUPPLEMENT ON THE UTILIZATION OF PASTURE HAY BY GOATS

A. BANUALIM*, S. STACHIW**, R.J. JONES*** and R.M. MURRAY*

SUMMARY

Six goats were used to evaluate the value of fresh Leucaena leucocephala as a supplement to low quality spear grass hay. The OM intake of spear grass alone (SG) was 154 g/d (21 g/kg BW\(^{0.75}\)); spear grass + urea (SG+U): 175 g (23 g/kg BW\(^{0.75}\)); and spear grass + leucaena (SG+L): 275 g/d (38 g/kg BW\(^{0.75}\)). The higher OM digestibility values of SG+L and SG+U enhanced digestible OM intake compared to the control treatment (SG), with values of: 153, 96 and 73 g/d respectively. The non-ammonia nitrogen (NAN) flowing from stomach in SG+L was 4.9 g/d twice that with of SG (2.4 g/d), due to more microbial-N and dietary-N (about 34% of leucaena protein). It is suggested that using leucaena to supplement low quality roughage would improve animal-performance.

INTRODUCTION

The potential of Leucaena leucocephala (leucaena) for improving the nutrition of grazing animals in tropical countries has been described by Jones (1979). In many developing countries such as in South-east Asia, leucaena has long been widely used in a "cut and carry" system. In Australia, the possible use in conjunction with tropical native pastures is being intensively studied. The following experiment was undertaken to provide information on the effects on some aspects of intake and rumen function of fresh leucaena leaf as a supplement to goats fed mature spear grass (Heteropogon contortus) hay. The effects were compared with the use of urea as a supplement.

MATERIALS AND METHODS

Six Saanen x Angora weaner goats (<1 year old) with average weight of 15 kg, fitted with rumen and abomasal fistulae were used. The animals were placed in metabolism cages and fed ad libitum one of three diets in a two 3x3 latin square design (Cochran and Cox 1957) for a 7-day preliminary and 7-day collection period. The diets were as follows: spear grass alone (SG); spear grass + urea (SG+U); and spear grass + leucaena (SG+L). The urea in aqueous solution to supply additional nitrogen at 1.4% of dry matter was mixed thoroughly with the daily ration, as was a mineral mixture containing Na\(_2\)S to provide an N:S ratio 10:1. The leucaena was fed at 30% of the individual ad libitum intake of spear grass measured prior to the experiment. The rations were offered in equal portions twice daily during the preliminary period, while during the collection period one twelfth of each ration was offered at 2 hour intervals between 6.00 am and 6.00 pm, the remainder being fed after 6.00 pm.

Flows of digesta through the rumen and abomasum were measured using infusion of \(^{51}\)Cr-EDTA and \(^{153}\)Ru-P as described by Hogan (1981). Microbial protein reaching the abomasum was calculated by reference to the \(^{15}\)N concentration in microbes and
abomasal digesta following intraruminal infusion of $^{15}$NH$_4$Cl (Nolan et al. 1976). Feed offered and refused, abomasal digesta and faeces were analysed for organic matter (OM), cell wall constituents (CWC; Van Soest 1967) and total N, while ammonia-N was determined in rumen liquid and abomasal digesta.

RESULTS

The low OM intakes of 21, 23 and 38 g/kg BW$^{0.75}$ for SG, SG+U and SG+L treatments respectively was reflected in a slow decline in body weight with two animals dying following periods on spear grass alone. Although both urea and leucaena supplementation improved the OM digestibility slightly, the increase was not significant. Mean retention time (MRT) for rumen liquid was decreased from 34 h for SG to 27 and 22 h for SG+U and SG+L respectively ($P<0.05$). Nitrogen

TABLE 1 Organic matter (OM) intake, digestibility of OM and cell wall constituents (CWC), rumen ammonia and values relating to nitrogen (N) intake and digestion by goats fed a basal diet (SG), SG plus urea (SG+U) and SG plus leucaena (SG+L)

<table>
<thead>
<tr>
<th></th>
<th>SG</th>
<th>SG+U</th>
<th>SG+L</th>
</tr>
</thead>
<tbody>
<tr>
<td>OM intake, g/d</td>
<td>154$^a$</td>
<td>175$^a$</td>
<td>275$^{b+}$</td>
</tr>
<tr>
<td>OM digestibility, %</td>
<td>47.3</td>
<td>53.2</td>
<td>55.5</td>
</tr>
<tr>
<td>Digestible OM intake, g/d</td>
<td>73$^a$</td>
<td>96$^a$</td>
<td>153$^b$</td>
</tr>
<tr>
<td>CWC digestibility, %</td>
<td>48</td>
<td>53</td>
<td>49</td>
</tr>
<tr>
<td>Rumen ammonia, mg N/l</td>
<td>52$^a$</td>
<td>227$^c$</td>
<td>88$^b$</td>
</tr>
<tr>
<td>Rumen liquid MRT, h</td>
<td>33.8$^a$</td>
<td>27$^{ab}$</td>
<td>22.4$^b$</td>
</tr>
<tr>
<td>Nitrogen intake, g/d</td>
<td>0.7$^a$</td>
<td>4.6$^b$</td>
<td>3.5$^b$</td>
</tr>
<tr>
<td>Flow from stomach, g/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-ammonia N (NAN)</td>
<td>2.4$^a$</td>
<td>2.8$^a$</td>
<td>4.9$^b$</td>
</tr>
<tr>
<td>Microbial N</td>
<td>1.6$^a$</td>
<td>1.8$^a$</td>
<td>2.9$^b$</td>
</tr>
<tr>
<td>g MP/100 g OMDR **</td>
<td>19.6</td>
<td>18.0</td>
<td>17.7</td>
</tr>
<tr>
<td>g DCPi/100 g DOM intake +++</td>
<td>11.0</td>
<td>11.8</td>
<td>13.1</td>
</tr>
</tbody>
</table>

$^a$ Within rows, figures with different superscripts differ significantly ($P<0.05$)

intake was improved markedly by the supplementation treatments as were rumen ammonia-N levels, but only the leucaena increased non-ammonia-N and microbial-N from the stomach (Table 1).

Approximately 34% (0.8gN/Day) of the leucaena protein was calculated to have escaped rumen degradation assuming that the proportion of non-microbial-N leaving the stomach with the basal diet was not altered by the presence of leucaena (Zinn et al. 1981). As shown in Table 1 crude protein digested in intestines (DCPi = apparently digested N x 6.25) per 100 g digestible OM (DOM) intake slightly increased with leucaena supplementation.
DISCUSSION

Higher intake of the spear grass plus urea (SG+U) diet compared to spear grass alone (SG), is in agreement with results from most studies in which low quality roughage supplemented with urea was fed to cattle or sheep (Romero et al. 1976; Lindsay and Loxton 1981; Stephenson et al. 1981). However, only moderate increases in intake are often achieved by the use of urea (Leng 1982) and in this study the increase was not significant. This higher intake (SG+U>SG), emphasizes the need for ammonia supply in the rumen to increase feed intake presumably through an increased rate of fermentation. For higher animal responses, it is necessary to supplement such diets with by-pass protein (Lindsay and Loxton 1981). In this experiment, significantly greater OM intake was recorded when the spear grass was supplemented with fresh leucaena leaf (SG+L). Leucaena supplied additional rumen ammonia and supplied more NAN into the intestines both from microbial-N and from dietary-N (about 34% of leucaena protein intake). NAN flow from the fore-stomach in SG+L diet (4.9 g/d) was double that of animals fed spear grass alone (2.4 g/d), and higher than SG+U diet (2.8 g/d).

In the present experiment, OM digestibility of spear grass (SG) by the goats although low (47%) compared to SG+U (53%) and SG+L (56%), was higher than the digestibility of spear grass reported for sheep (39% OMD, Freire et al. 1980; 34% DMD, Siebert and Kennedy 1972). While this may have been due to a higher quality hay being used in our experiment it could also have been associated with a greater ability by goats than sheep to digest fibre as suggested by Devendra (1978). In this study the digestibility of CWC was 48%, compared to CWC digestibility for sheep fed a similar spear grass hay of 38% reported by Freire (1981). The longer mean retention time of rumen liquid measured for the goats in this study (34 h) compared to that for sheep (18 h) reported by Freire et al. (1980) could in part help to explain the higher CWC digestibility by goats.

The enhanced digestibility observed when leucaena was included, increased the digestible OM intake (153 g/d) twofold compared with the basal diet alone (73 g/d) confirming the value of leucaena as a supplement to low quality or dry season roughage. It would provide supplementary protein and energy when used in conjunction with native pastures during the dry season, and could provide a useful solution to low feed availability in some tropical countries where available grazing lands are limited due to pressure from other forms of agriculture. In Australia, greater acceptance of leucaena as feed for ruminants would be expected if the toxicity of mimosine or its derivative 3-hydroxy-4(1E)-pyridone (DHP) could be overcome (Zones 1979).

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REFERENCES


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