Digestion of Medicago truncatula pasture by sheep

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 Reasons for low productivity of sheep grazing barrel medic (Medicago truncatula) were investigated based on studies of intake and digestion. Pasture analysis showed that barrel medic represented only 13 to 30% of the diet selected and this was similar to its proportion in the green feed on offer. The selected diets had relatively low ratios of DOM to CP and the high levels of rumen NH₃ and wastage of dietary protein in the stomach were predictable. The amounts of amino acids derived by sheep on these diets were much lower than the CP intake suggested and undoubtedly contributed to the relatively low levels of wool production.

Introduction

Barrel medic (Medicago truncatula) is a legume favoured in the 375 mm rainfall zone in the wheat belt of southern Australia, and dominates pasture growth from seed germination in about March until pasture senescence in late Spring. Although there appears to be ample feed for sheep during this time, wool production is relatively low. The present paper reports an investigation into the reasons for this low productivity based on studies of intake and digestion by grazing sheep of barrel medic during its vegetative growth stages.

Material and Methods

Eighteen medium wool Peppin Merino wethers, including four with oesophageal fistulae and six with rumen and abomasal fistulae, were used. They grazed in a 6 ha paddock selected as representative of medic-dominant pasture. Measurements of pasture composition, selected diet and digestion were made in the winter and spring of 1979 and early spring of 1980, referred to as Periods 1 to 3. Feed intake was estimated from data on the in vitro indigestibility of oesophageal extrusa plus faecal organic matter output, the same indigestibility being assumed for all sheep. The salivary content of extrusa was measured by tritiated water dilution (Luick et al., 1959) and flow of digesta from the stomach by reference to chromium and ruthenium markers (Denney et al., 1979) continuously infused into the rumen by portable pumps (Corbett et al., 1976). Amino acid absorption from the small intestine was calculated according to Lindsay et al. (1980). Digesta samples were collected at four six-hour intervals during a 96-h period to provide a sample for each hour from 08h00 to 20h00 and for each two hours for the remainder of the twenty four. Wool growth was measured each 28 days by dye-banding (Chapman & Wheeler, 1963).

Results

The pasture was sparse and drought-affected in Period 1, sparse and vegetative in Period 2 and dense and vegetative in Period 3, although the plants were only about 1 cm high. The total green feed on offer (kg dry matter/ha) for the respective periods was 342, 443 and 493 (Table 1). Barrel medic represented only 13 to 30% of the diet selected, but this did not differ greatly from its proportion in the green feed on offer.
Table 1 Pasture on offer and diet selected (minor components omitted) with barrel medic pasture

<table>
<thead>
<tr>
<th>Period</th>
<th>Pasture on offer (kg dry matter/ha)</th>
<th>Diet composition (% of DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Green grass</td>
<td>Green medic</td>
</tr>
<tr>
<td>1</td>
<td>190</td>
<td>152</td>
</tr>
<tr>
<td>2</td>
<td>330</td>
<td>113</td>
</tr>
<tr>
<td>3</td>
<td>299</td>
<td>194</td>
</tr>
</tbody>
</table>

* Mostly litter
b Droughted

Diets in the three periods contained 77%, 73% and 85% water respectively. Saliva contributed 39 to 59% of the water in the oesophageal extrusa but only 3 to 5% of the nitrogen. Forage dry matter contained 13, 14 and 26% ash; the high value for the third period reflecting extensive soil ingestion. The diets contained, on an organic matter basis, 3.07%, 3.9% and 5.23% nitrogen.

The pasture ranged in organic matter digestibility from 71 to 75% (Table 2). Hence the ratios of digestible organic matter to crude protein in the three periods were 3.72, 3.09 and 2.28. Protein digestion was marked by high levels of rumen ammonia, while the amounts of nitrogen leaving the stomach were equivalent to only 56 to 88% of intake. The calculated amount of amino acids absorbed from the small intestines ranged from 59 to 93 g/d. Wool growth (g/d clean dry) measured with the eight non-fistulated wethers for the three periods was 10.5, 10.8 and 12.9. As feed intake in the intact sheep was about 30% higher than in those with fistulae, the rate of wool growth was equivalent to about 10.2; 8.9 and 16.8 g/100 g absorbed amino acids.

Table 2 Parameters associated with the digestion of barrel medic pasture

<table>
<thead>
<tr>
<th>Period</th>
<th>Organic matter (OM) intake (kg/d)</th>
<th>OM digestibility (in vitro)</th>
<th>OM digestion in stomach (% of total)</th>
<th>Dietary crude protein (g/kg OM)</th>
<th>Nitrogen (N) intake (g/d)</th>
<th>Rumen ammonia (mg/l)</th>
<th>Nitrogen leaving stomach (g/kg N intake)</th>
<th>Amino acids absorbed (g/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.867</td>
<td>71.3</td>
<td>65.3</td>
<td>192</td>
<td>26.6</td>
<td>239</td>
<td>873</td>
<td>79</td>
</tr>
<tr>
<td>2</td>
<td>1.039</td>
<td>75.3</td>
<td>70.8</td>
<td>244</td>
<td>40.5</td>
<td>465</td>
<td>673</td>
<td>93</td>
</tr>
<tr>
<td>3</td>
<td>.592</td>
<td>74.4</td>
<td>56.9</td>
<td>327</td>
<td>31.0</td>
<td>830</td>
<td>555</td>
<td>59</td>
</tr>
</tbody>
</table>

Discussion

Although barrel medic appears to dominate the pasture in winter and early spring, pasture analysis indicates that this may not be so, and medic has a relatively small direct influence on sheep nutrition. The three selected diets had relatively low ratios of digestible organic matter to crude protein and the high levels of rumen ammonia and extensive wastage of dietary protein in the stomach were thus predictable (Hogan, 1981). The amounts of amino acids derived by sheep from these diets were much lower than the crude protein intake might have suggested, and undoubtedly contributed to the relatively low levels of wool production.

References