PHYSICAL AND CHEMICAL CHARACTERISTICS OF FORAGES AS PREDICTORS OF RATE OF FEED INTAKE BY SHEEP

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Chemical and physical characteristics of forages are important in determining the rate at which they can be consumed and their preference by sheep (Kenney and Black 1984). Biomechanical properties of forages (eg shear strength) have been reported to be negatively correlated with the rate of feed intake by sheep (Mackinnon et al. 1988), and may therefore be an appropriate factor upon which to base predictions of rate of feed intake. The objective of this work was to evaluate the impact of a number of chemical and physical characteristics, in particular intrinsic shear strength, on the prediction of rate of feed intake.

Five cultivars of Phalaris aquatica (cvv Australian, Holdfast, Perla, Sirosa, Uneta) were grown in the field, and tillers were harvested from (a) vegetative plants (October 1992), (b) plants at ear emergence (November 1992), and (c) plants at anthesis (February 1993). At each harvest, 4 of the cultivars were selected on the basis that they differed in intrinsic shear strength (Henry et al. 1996), and were fed to 8 cross-bred (Merino x Border Leicester) ewes housed indoors in individual metabolism crates.

The rate of intake (g/minute) of each forage was determined at each harvest. Forage was harvested fresh from the field, chopped to 25 mm lengths, and 500 - 600 g offered to each sheep in a 4 x 4 Latin square design (2 sheep per forage per day). The sheep were allowed to eat for 10 minutes after which the remaining forage was removed. This procedure was repeated 3 times a day at hourly intervals. Over a 4-day test period, the forages were rotated between sheep so that the rate of intake of each cultivar was determined for each sheep.

Rate of feed intake decreased markedly as the plant material matured from 37.1 (+ 0.81) g FW/minute in October to 16.7 (+ 1.16) g FW/minute in February. Rate of feed intake was significantly correlated (n = 4 forages*3 harvests = 12) with each of a number of forage characteristics (Table 1).

Table 1. Coefficients of determination relating forage characteristics to rate of feed intake

<table>
<thead>
<tr>
<th>Characteristic of forage</th>
<th>r² value *</th>
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<th>r² value *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of leaf</td>
<td>0.62</td>
<td>Cellulose content</td>
<td>0.56</td>
</tr>
<tr>
<td>NDF content</td>
<td>0.61</td>
<td>Grinding energy</td>
<td>0.56</td>
</tr>
<tr>
<td>IVOMD</td>
<td>0.60</td>
<td>Nitrogen content</td>
<td>0.55</td>
</tr>
<tr>
<td>Intrinsic shear strength</td>
<td>0.58</td>
<td>Lignin content</td>
<td>0.53</td>
</tr>
</tbody>
</table>

* Asterisk (*) represents a significant coefficient of determination, P<0.05.

Each forage characteristic was fitted as a term in a linear regression model in combination with each other characteristic, but in different orders, to determine the proportion of variation explained by each characteristic. Based on the proportion of sum of squares attributed to each characteristic, the proportion of leaf in the forages appeared to be the major determinant of rate of intake (explaining 62% of the variation in intake), and this masked the effect of any other forage characteristic. As a consequence, correlations between rate of intake and other forage characteristics (eg NDF, IVOMD) were probably associated with differences in the proportion of leaf, including the effect of intrinsic shear strength on rate of intake. In previous studies that have reported a negative relationship between strength and intake, there were other covariates (eg differences in proportions of leaf and stem; differences in leaf length and linear density, Inoue et al. 1994) which influenced intake. This indicates that the effect of intrinsic shear strength on intake has not been fully resolved.