Short communication

The effect of degree of grass wilting prior to ensiling on performance and energy utilisation by lactating dairy cattle

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Abstract

Thirty lactating Holstein Friesian cows were used in a three treatment randomised block design experiment to investigate the influence of degree of grass wilting prior to ensiling on animal performance and energy utilisation. The three forage treatments were produced from perennial ryegrass swards either ensiled directly or mown, conditioned, spread and tedded to ensure rapid wilting, and ensiled following 30 or 52 h to achieve dry matter (DM) concentrations in the silages of 193, 286 and 437 g/kg respectively. All silages were offered in \textit{ad libitum} quantities for a 5-week period and in addition all cows received 10 kg/d of a concentrate containing 206 g CP/kg DM. Total diet digestibility data were recorded on four cows/treatment and methane outputs on two cows/treatment during the final week of the experiment. The daily intake of silage DM increased with increased wilting – 7.2, 7.3, and 8.4 (s.e.m. 0.44) kg DM – but milk yield was highest with the unwilted silage – 23.3, 20.5 and 21.7 (s.e.m. 0.80) kg/d – for the unwilted, medium and high levels of wilting respectively. Wilting had no effect on the yield of milk fat or protein but the nutrient utilisation studies suggested that the overall efficiency of metabolisable energy conversion to milk energy output was reduced with increasing degree of wilting.

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1. Introduction

The effects of wilting on dry matter (DM) intake and animal production, including the output of animal product/ha, have been the subject of considerable research, (see reviews by Marsh, 1979; Wilkins, 1984; Unsworth and Gordon, 1985; Gordon, 1989). While wilting generally increased DM intake it often marginally reduced milk output and resulted in considerable reductions in the output of beef and dairy product per unit area of land. However none of these studies have adopted the recently developed techniques for ensuring fast rates of crop drying in the field (Patterson, 1993) and which now offer opportunities to achieve much higher DM concentrations in silages. The present study was therefore established to examine the effect of a range of...
degrees of wilting, using enhanced in-field wilting techniques, on intake, performance and energy utili-
sation by dairy cattle.

2. Material and methods

The three silages used in the study were produced as the second annual harvest from perennial ryegrass swards (cv. Talbot) during mid-August. On day 1 the grass was mown with a mower conditioner (Taastrup Model 307). Within 30 min of mowing one third of the crop was lifted for ensiling and the remainder spread to maximise the rate of drying. Twenty six hours later the grass was tedded, to facilitate further drying, and then at 30 h post-cutting half of the remaining grass was ensiled. At 48 h after cutting the remaining grass was tedded and ensiled at 52 h post-cutting. The same precision chop harvester (Mengele Model SH40) was used throughout and all grass was ensiled in concrete walled bunker silos. An inoculant additive (‘Ecosyl’, Zeneca Bioproducts Ltd.) was applied at 3.0 kg/t fresh crop to all grass at ensiling. There was no rainfall throughout the 52 h wilting period.

Thirty lactating Holstein Friesian dairy cattle, 18 in their first and 12 in their second lactation, were used in a randomised block design feeding study. The cows were housed as a single group in cubicle accommodation with the forages offered in troughs fitted with automatic weighing equipment and an entry door which was activated by a transponder fitted to each cow. All concentrates, with the exception of 1 kg/d, were offered through an out-of-parlour feeding system on the basis of four equal feeds daily. The additional 1 kg concentrate was divided over two feedings and offered during milking at 07.00 and 16.30. Twelve of the cows were 36 (s.d. 19.6) days calved at the commencement of the study and the remainder entered the study directly on calving. Cows were blocked into groups of three according to calving date and parity and allocated at random within each block to the three silage feeding treatments.

Cows remained on the treatments for 5 weeks and were then transferred to a standard diet of ad libitum quantities of silage and 8 kg/d of a standard dairy concentrate for a further four week period. During the feeding experiment, which commenced after the forages had been 56 days ensiled, the three silages were offered in sufficient quantity to allow proportionally 0.05 in excess of intake. All cows were also offered 10 kg/d of a dairy concentrate. For those cows entering the experiment at calving concentrate intake increased linearly from 2 kg on day 1 to 10 kg on day 15 of lactation. The concentrate used, contained 250, 200, 167, 167, 141, 25, 25 and 25 g/kg of maize gluten, barley, sugar beet pulp, citrus pulp, soyabean meal, fish meal, protected fat (Megalac) and minerals, respectively.

A total of 12 cows, four blocks of three, were transferred to individual standings during week five of the experiment for a six day diet digestibility and N balance study. The equipment, procedures and analytical methods were as described by Gordon et al. (1995). At the end of this balance study six cows, two blocks of three cows, were transferred to indirect open-circuit respiration chambers for measurement of methane production. Cows remained in these chambers for three days with methane output recorded over the final 48 h. The equipment, procedures and analytical methods were as described by Gordon et al. (1995).

Silage was sampled daily throughout the feeding period. Milk yields were recorded daily and milk samples taken on days 5, 6 and 7 of the 5th week of the experiment, and the 4th week of the post experiment standardisation period. Live weights were recorded weekly during the experiment, and on week four of the post experiment standardisation period. The methods of forage, concentrate and milk sampling and analysis were as described by Gordon et al. (1995).

All cow production and feed digestibility data were statistically analysed as a randomised block using milk production data recorded on week four of the post-experimental period and liveweight at the beginning of the study as covariates.

3. Results

The three silages were well preserved, and their mean compositions over the five week experimental period are given in Table 1, along with feed intake and animal performance data recorded during the
Table 1
Effect of extent of wilting on silage composition, feed intake, cow performance and nutrient utilisation (intake and performance data relate to 10 cows/treatment, digestibility to four cows/treatment and energy utilisation to the mean of 10 cows/treatment using ME concentrations derived from the digestion studies)\(^a\)

<table>
<thead>
<tr>
<th>Silage composition</th>
<th>S.E.M.</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Med</td>
<td>High</td>
</tr>
<tr>
<td>Silage DM concentration</td>
<td>193(^a)</td>
<td>286(^b)</td>
</tr>
<tr>
<td>Dry matter (g/kg)</td>
<td>Crude protein (g/kg DM)</td>
<td>PH</td>
</tr>
<tr>
<td></td>
<td>123</td>
<td>123</td>
</tr>
<tr>
<td></td>
<td>127</td>
<td>127</td>
</tr>
<tr>
<td></td>
<td>123</td>
<td>123</td>
</tr>
<tr>
<td></td>
<td>2.1</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Milk energy based on \(E(MJ/d) = 0.0384[B] + 0.0223[P] + 0.0199 [La] 0.108 (Tyrrell and Reid, 1965). ME concentration derived from energy digestibility determined from four cows/treatment and CH\(_4\) energy losses (proportion of gross energy intake) from two cows/treatment. Means with different subscripts within rows are significantly different at 5% level.

The data on digestibility of the diets are also presented in Table 1. There were no significant differences between treatments in terms of DM or N digestibility but the digestibility of energy was higher with high than the medium degree of wilt \((P < 0.05)\).

4. Discussion

The crop drying rates achieved in the present study were considerably faster than those recorded during the major proportion of previous wilting studies at this Institute and hence provided data relevant to the higher rates of wilting which can now be achieved in practice.

The data in the present study showed wilting to
286 g DM/kg to increase DM intake by 1.4% a response which is close to the overall mean of 0% reported from a review of 39 studies by Wilkins (1984) following moderate degrees of wilting. However at the highest DM concentration (437 g DM/kg) in the present study the response in intake at 16.6% was much greater. Other research, in which a range of DM concentrations have been produced, has also shown similar trends with increasing responses in intake as DM concentration increased up to approximately 400 g/kg (O’Kiely et al., 1988). The present data would therefore support the hypothesis that provided wilting is being achieved rapidly the response in intake will increase with degree of wilting, up to at least 450 g DM/kg.

In the present study wilting resulted in a mean reduction in milk yield of 9%, this depression tending to be the greatest with the medium DM material. However because of the trend towards higher butterfat concentration with both wilted materials, the outputs of fat plus protein were not significantly influenced by wilting; the mean effect of wilting was to reduce the outputs of milk fat plus protein by 3.8%. This mean effect of wilting on the output of milk components was relatively similar to the 3% reduction reported by Gordon (1989) as a mean of eight similar studies at this Institute but contrasts with recent work by Patterson et al. (1996) where significant positive responses were obtained from wilting over three harvests.

Unsworth and Gordon (1985) summarised data from four previous studies and reported either no or only marginal effects of wilting on the digestibility of energy in mixed diets with dairy cattle. This was in line with the present study. However these effects on mixed diets are often masked by the inclusion of supplementary feeds and numerous authors have shown considerable depressions in the digestibility of energy in silage only diets following wilting (Unsworth and Gordon, 1985). Linking the data from the digestion and production elements of the present study would provide support for the view that wilting reduces the efficiency of ME conversion to milk energy output – an effect which appears to increase with degree of wilting. This could arise through either effects on maintenance energy requirements, or efficiency of energy utilisation for milk production ($k_i$), or greater partitioning of ME intake towards body tissue gain. The present study does not provide adequate data to enable these possible mechanisms to be disentangled.

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**References**


