Effects of shearing and supplemental level on intake of dry ewes grazing on barley stubble

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Received 1 October 1999; accepted 20 April 2000

Abstract

Twenty-eight Comisana dry ewes were utilised to evaluate the effect of shearing (14 shorn and 14 unshorn ewes) and supplemental level (100 and 300 g of concentrate) on intake of barley stubble. Shorn ewes showed a small increase in dry matter intake (at the end of August: 1.32 vs. 1.10 kg/day; p<0.01). Intake of barley stubble decreased as supplement level increased (mean: 1.18 vs. 1.29; p<0.01). On average, substitution effect was 0.63. Total lamb weight per ewe was greater in the group receiving 300 g of concentrate (7.38 vs. 5.85; p<0.05). Shearing induced a small, but not significant decrease in total lamb weight per ewe (6.18 vs. 7.05 kg/ewe). Results seem to indicate that unshorn ewes react better to environmental stress and that 300 g improve reproductive performance. © 2000 Elsevier Science B.V. All rights reserved.

Keywords: Stubble grazing; Shearing effect; Intake; Ewes

1. Introduction

Sheep grazing on cereal stubble represents one of the most widespread feeding practices during the summer season in the Mediterranean region. These agricultural residues have a very low nutritive value, but can be used as their availability coincides with the dry physiological phase of ewes.

The sheep production system in southern Italy involves shearing at the beginning of summer. Removal of the fleece in animals accustomed to grazing in the sun at the hottest times of day is considered a necessary practice by the shepherds, not only for hygienic reasons, but also to enable animals to better withstand exposure to high temperatures. In contrast with this traditional practice, it has been recognised that, for sheep, a means of defence against external factors is its woollen coat that helps create good thermal conditions to enable normal physiological, functional and, hence, productive processes (Eyal, 1963a, b; Siqueira et al., 1993). The aim of the current research was to assess effects of shearing and of feed supplement level on the feeding behaviour, body condition variations and lamb weight of dry ewes grazing barley stubble.

2. Materials and methods

2.1. Animals and experimental procedure

Four groups, each of seven Comisana dry ewes 3–5 years old were used. Ewes weighed 55.1±3.4 kg; were in the 2nd-to-3rd month of gestation and had an initial
body condition score (BCS) of 3.2±0.4. Fourteen ewes were shorn at the end of June, whereas the others were not shorn. The trial started on 10th August after a 10-day pre-experimental period, during which all the ewes grazed on an area of barley stubble adjacent to the experimental area. The sheep were held in individual pens where daily, on return from grazing, they received a concentrate supplement (15.3% CP, 17.9% NDF and 75.8 digestible organic matter as percentage of DM) consisting of 33% maize meal, 28% barley meal, 8% wheat bran, 8.5% carob meal, 10% soyabean meal, 8% brewers grain and 4.5% mineral and vitamin supplements. The experimental design was as follows: Group 1: shorn ewes — 100 g concentrate; Group 2: shorn ewes — 300 g concentrate; Group 3: unshorn ewes — 100 g concentrate; and Group 4: unshorn ewes — 300 g concentrate. Each morning the four experimental groups grazed for 5 h on barley stubble in a fenced area (18 m²/head/day). At the beginning of the experiment, before the animals were taken out to pasture, the available biomass was estimated: on 16 plots of 0.3 m×4 m (randomly placed within the fenced area), the stubble was cut at ground level. Moreover, the pasture was examined for the presence of grains and weeds.

2.2. Measurement and analysis

Body condition was recorded on days −1, 6, 13 and 20 of the trial on a 5-point scale (1=thin, to 5=obese) (Russel et al., 1969). Individual concentrate intake was recorded daily. Pasture intake (I), estimated according to the method reported by Le Du and Penning (1982), was measured twice a week; each animal was equipped with bags to collect faeces and urine during grazing. Also, absorbent material was placed in each bag to avoid loss of urine. The animals, with this equipment, were weighed before entering the pasture (W1) and after grazing (W2). Weight loss occurring during grazing (insensible weight losses, IWL) were estimated for three shorn and three unshorn ewes that were not included in the experiment, though similarly harnessed and muzzled to prevent grazing. The latter sheep were weighed (w1), left to pasture with the experimental groups and reweighed after 5 h (w2). No water was available during intake measurements. Pasture intake was estimated as follows: I=(W2+IWL)−W1 where: IWL=(w1−w2).

The selective behaviour of the grazing sheep was recorded each week. While grazing (5 h/day), every hour, using binoculars, we observed the parts of plants selected by each animal. Moreover, at the end of the trial we examined the residual biomass.

Once a week, on the basis of behavioural observations, three samples of pasture for each group were collected by hand, imitating the biting technique observed in the animals; the purpose was to gather representative samples of the diet selected. At the same time, we gathered three samples of available biomass by mowing at ground level. The samples of biomass and concentrate were analysed for fat, crude protein, ether extract and ash (Association of Official Analytical Chemists, 1984), for structural carbohydrates (Goering and van Soest, 1970) and for digestible organic matter using pepsin and cellulase from Trichoderma viride (Dowman and Collins, 1982).

After the trial, the sheep were kept indoors and fed with hay ad libitum until parturition. Data on parturition dates, number of lambs per ewe and lamb weights were collected.

2.3. Statistical analysis

The data were analysed using two-way least square analysis with shearing and supplement level as main effects and their interaction. Where no significant interaction (p<0.05) was found the data were reanalysed for main effects.

3. Results and discussion

3.1. Meteorological conditions

Fig. 1 illustrates the temperature and humidity trends during the experimental period. Maximum temperatures, on average equal to 31.7°C, with peaks at 37°C, could be considered rather high, taking into account the critical temperatures reported by Graham et al. (1959) (24 and 33°C, respectively, for high and medium feeding level). The mean relative humidity (RH) was 84.6%, reaching values as high as 92–95% on intake measurement days. These parameters portray a particularly stressing environment for the animals.
3.2. Pasture characteristics

The area dedicated to grazing was characterised by the presence of culm residues alone, up to about 15 cm. We did not detect any weed essences. Moreover, there was no trace of residual grains that are often present after harvesting, as reported by others (Coombe and Mulholland, 1983; Guessous et al., 1991; Caballero et al., 1992). The absence of grains in our experimental conditions can be explained by the starting date of the experiment, at least a month after harvest. It can be assumed that between the harvest and the start of our experiment, birds had removed all the grain from the field. The available biomass was equal to 1.46 t dry matter/ha, comparable to other authors’ findings in similar conditions on barley stubble (Treacher et al., 1996).

Table 1 reports the chemical composition of the stubble and the basal leaves of culm. Both morphological parts of the plant had a very poor nutritional value. Crude protein, slightly higher in the basal leaves, was nonetheless below 3.8% of DM. Values of NDF and lignin, negatively correlated with protein content, were very high and only slightly lower in basal leaves compared to culms. As a consequence, the digestible organic matter was, on average, low and slightly higher in the basal leaves.

3.3. Intake

Concentrate supplement was always completely consumed. All animals demonstrated a marked preference for basal leaves and basically left the residual stems untouched. Therefore, the chemical composition of the selected diet corresponded to that of the basal leaves. These leaves are characterised by a crude protein level only slightly higher than whole stubbles; this selective behaviour would seem to be determined by the lower resistance to bite of leaves than the culms, rather than by the nutritional value of the selected parts.

Table 2 reports DM intake at pasture. Mean daily intake of DM at pasture, equal to 1.23 kg/ewe, was rather high considering the poor quality of pasture and particularly stressful environmental conditions during the experimental period. Treacher et al. (1996) in a trial carried out in Syria on barley stubble observed a slightly lower intake despite the sheep were grazing for 10.25 h, i.e. 5 h more than in our experimental conditions. There were significant variations in intake on different days, probably in relation to climatic conditions. However, the temperature, which was constantly around 30–33°C on those days, does not seem to explain these variations, whereas humidity does seem to have played an important role. Indeed, maximum intake levels were recorded on the least humid day (26 August: 80% RH), and lowest DM intake was recorded on the day characterised by heat–
humidity conditions and rain (19 August: 90% RH and about 20 mm of rain).

On average, DM intake (Table 2) was not significantly affected by shearing. However, a tendency of increased pasture intake was observed in shorn ewes, as confirmed by intake data recorded at the end of August. In this regard, Hawker et al. (1985) did not observe significant differences in intake caused by the absence of fleece in a trial performed in spring, that is, in milder climatic conditions. As the wool coat has been demonstrated to act as an insulator against the effects of solar radiation (Siqueira et al., 1993), the increase in intake found in our experimental conditions could be the result of an increased energy requirements linked to higher heat stress resulting from shearing. In this regard, it has been reported that a hot environment increases maintenance requirements (Silanikove, 1992).

The effect of feed supplement levels on intake was statistically significant. On average, sheep that received the higher level of concentrate reduced mean DM intake at pasture \( p < 0.01 \). Substitution effect, on average equal to 0.63 in terms of DM, varied greatly on different days of observation. On some days it was particularly low, even reaching negative values, whereas on other days values were well over 1. This wide variation in the substitution rate, which was very difficult to explain and on the whole not attributable to experimental variables, led us to recalculate this parameter in terms of net energy rather than dry matter. As the two food sources, barley stubble and concentrate, were obviously very different in terms of nutritional value, a minimal variation in pasture intake would modify the substitution effect excessively. Calculation in terms of energy substantially confirmed the results although the differences were less marked.

3.4. Energy balance

Total energy intake for all experimental groups was greater than maintenance requirements indicated by the Institut National de Recherches Agronomique (Bocquier et al., 1988). Net energy balance was therefore positive (mean: +676 kcal/day). Nonetheless, from the start to the end of the trial, no BCS increase was detected. On the contrary, there was a slight reduction of this parameter in all groups (Table 3). These results would seem to suggest that the extra energy consumed, not justified by gestation requirements, considering that the ewes were still at the 2nd–3rd month of gestation, was probably linked to an increase of maintenance requirements due to environmental stress.

3.5. Reproductive performance

Of the 28 sheep in the trial, 26 gave birth between October and November, whereas two ewes, one in the 100 g shorn group, the other in the 100 g unshorn group, did not complete pregnancy.

Mean number of lambs per ewe (Table 3) was higher \( p < 0.01 \) in the groups that received 300 g of concentrate, whereas it was not influenced by shearing effect. Total lambs weight per ewe (Table 3) was higher in the 300 g groups \( p < 0.05 \), but was not statistically affected by shearing. However, shorn ewes tended to give birth to lighter litters (6.2 vs. 7.0 kg/ewe). This slight tendency could be associated with the environmental stress caused by the absence of the fleece. As Alexander and Williams (1971) suggested, pregnant sheep exposed to heat stress produce lambs of low birth-weight probably due to a restriction in placental growth.

4. Conclusions

In conclusion, our results suggest that sheep delivering between August and September, as generally occurs in the south of Italy, could retain their fleece in the summer season to better withstand heat stress, and they could be shorn after delivery. Hence, in the 2 months that follow, and these are usually mild, the wool would have enough time to grow adequately to

<table>
<thead>
<tr>
<th>Days of measurement</th>
<th>Shorn</th>
<th>No</th>
<th>Supplement (g)</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCS changes</td>
<td>–0.25</td>
<td>–0.15</td>
<td>–0.25</td>
<td>–0.15</td>
</tr>
<tr>
<td>No. of lambs/ewe</td>
<td>1.2</td>
<td>1.3</td>
<td>0.9**</td>
<td>1.6**</td>
</tr>
<tr>
<td>Total lamb weight/ewe</td>
<td>6.18</td>
<td>7.05</td>
<td>5.85*</td>
<td>7.38*</td>
</tr>
</tbody>
</table>

* \( p < 0.05 \); ** \( p < 0.01 \).
protect the animals against the cold, thus avoiding stress from low temperature.

References


