AVOPARCIN SUPPLEMENTS FOR WOOL GROWTH OF SHEEP FED ROUGHAGE DIETS.

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SUMMARY

Diets based on lucerne chaff consumed at 1.04 kg dry matter (DM)/d or 0.53 kg DM/d or chaffed pasture hay at 0.60 kg DM/d were supplemented with avoparcin at 0 or between 48-57 ppm. The in vivo organic matter digestibilities of these rations were 0.62, 0.66 and 0.63 at 0 ppm avoparcin and 0.60, 0.66 and 0.59 at 48-57 ppm. Growth rates of wool (g/d clean) were respectively 11.9, 6.2 and 5.2 at 0 ppm avoparcin and 11.0, 6.5 and 5.5 at 48-57 ppm. The differences in both digestibility and wool growth rate between rations were significant (P<0.01), those between levels of avoparcin were not significant (P>0.05). Changes in mean fibre diameter (pm) were respectively 1.19, -1.10, -2.25 at 0 ppm and 0.38, -2.13 and -2.23 at 48-57 ppm. These differences were significant between rations (P<0.01) and between 0 and 48-57 ppm avoparcin (P< 0.05).

Keywords: avoparcin, wool growth, fibre diameter

INTRODUCTION

Avoparcin is a growth promoting antibiotic widely used in the intensive livestock industries. In common with many other antibiotic growth promotants, avoparcin affects ruminal fermentation resulting in a shift towards propionate production (McGregor and Armstrong 1984a). Avoparcin has also been shown to increase the apparent absorption of amino acids in the small intestine of sheep (McGregor and Armstrong 1982), evidently associated with an increase in the efficiency of amino acid absorption (McGregor and Armstrong 1984b). Events in the rumen with respect to effects of avoparcin on protein degradability and rumen fermentation may also influence amino acid supply; Jouany and Thivend (1986) found that avoparcin decreased the rate of degradation of soluble feed proteins which is potentially advantageous, and decreased the efficiency of microbial protein synthesis which is potentially disadvantageous.

Production trials with cattle indicated an increased liveweight gain and feed conversion efficiency (McGregor 1983). In view of these responses and also possible effects of avoparcin on protein availability, we examined wool growth in sheep supplemented with avoparcin. Roughage based diets with a range in protein content were offered in quantities which were comparable to the nutritional regimes experienced by grazing sheep in southern Australia.

MATERIALS AND METHODS

Sixty, two year-old non pregnant Peppin Merino ewes were allocated on the basis of live weight and greasy fleece weight at last shearing to six treatments (ten ewes each) as follows:

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1. Lucerne chaff fed near ad lib. estimated 1200 g/d, 50 g barley, nil avoparcin.
2. Lucerne chaff fed near ad lib. estimated 1200 g/d, 50 g barley, 50 mg/d avoparcin.
3. Lucerne chaff fed at metabolisable energy (ME) equivalent to treatment 5 below, estimated 600 g/d, 50 g barley, nil avoparcin.
4. Lucerne chaff fed at ME equivalent to treatment 5 below, estimated 600 g/d, 30 g barley, 30 mg/d avoparcin.
5. Chaffed pasture hay fed near ad lib. estimated 700 g/d, 30 g barley, nil avoparcin.
6. Chaffed pasture hay fed near ad lib. estimated 700 g/d, 30 g barley, 30 mg/d avoparcin.

The avoparcin was offered in the form of a barley supplement containing 1 mg/g avoparcin (10 mg/g 'Avotan' Cyanamid Australia Pty. Limited) and 0.75% molasses.

The sheep were housed in individual stalls with slatted wooden floors in a shed with natural lighting. Each stall was fitted with a feed and water trough. During an initial period of 8 days, sheep were fed restricted quantities of chaffed pasture hay (<500 g/d) and trained to consume barley immediately after it was offered. Commencing on 21 August 1985, sheep were introduced to the treatments, reaching their assigned intake after two weeks. Feeding at this level was continued for a further six weeks. Five sheep from each treatment were then transferred to metabolism stalls and following a ten day adjustment period, digestibility was determined over a seven day balance period.

Wool growth was estimated on all sheep, using the dyebanding technique of Chapman and Wheeler (1963) following a seven day lag phase for fibre emergence at the beginning and end of the treatment period. Wool grown in this period was cut with scissors from dyebanded staples and together with shearing at the end of the experiment enabled determination of fleece growth rate. Mean fibre diameter and percentage yield was measured by the Australian Wool Testing Authority. The change in mean fibre diameter during the experimental period was determined by comparison with samples prior to the imposition of treatments.

RESULTS

One sheep in Treatment 2 which refused barley containing avoparcin, but consumed normal barley was given 50 mg avoparcin orally each day.

The lucerne chaff, pasture hay chaff and barley contained respectively (% DM basis) 18.4, 8.4 and 9.0 crude protein, and 30.5, 41.2 and 8.0 acid detergent fibre. The initial live weight of sheep at allocation was 37 kg; mean fibre diameter prior to treatment was 20.2 μm. The intake, digestibility, live weight change and wool growth data are shown in Table 1. There were no feed residues for treatments 3 and 4, inconsequential residues for treatments 1 and 2 (<1%) and small residues (3.2% and 6.7%) for treatments 5 and 6 respectively. The concentration of avoparcin in dry matter intake for the higher and lower levels of lucerne chaff and pasture hay chaff were respectively 48, 57 and 51 ppm.

Avoparcin had no significant effect on apparent digestibility of organic matter, liveweight change and wool growth rate. Avoparcin
lowered mean fibre diameter in both the lucerne treatments (P<0.01), whereas there was no comparable effect with pasture chaff, however the interaction between ration and avoparcin was not significant (P>0.05).

Digestibility of lucerne was higher (P<0.01) at the lower level of feeding and higher (P<0.01) than pasture chaff at the comparable level of feeding.

Table 1. The effect of avoparcin supplementation of roughage diets on digestibility, liveweight change and wool growth of sheep.

<table>
<thead>
<tr>
<th>Diet</th>
<th>LUCERNE CHAFF</th>
<th>PASTURE CHAFF</th>
<th>Significance of effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoparcin</td>
<td></td>
<td></td>
<td>Ration Avoparcin</td>
</tr>
<tr>
<td>dose</td>
<td>High level+</td>
<td>Low level#</td>
<td></td>
</tr>
<tr>
<td>Feed consumed (weeks 3-8) (g DM/d) (10)*</td>
<td>1043 1036</td>
<td>530 530</td>
<td>610 588</td>
</tr>
<tr>
<td>Apparent digestibility of organic matter (g)</td>
<td>0.62 0.60</td>
<td>0.66 0.66</td>
<td>0.63 0.59</td>
</tr>
<tr>
<td>Liveweight change (g/d) (weeks 1-8) (10)</td>
<td>112 110</td>
<td>-6 -8</td>
<td>0 -28</td>
</tr>
<tr>
<td>Wool growth (g/d) (10)</td>
<td>11.9 11.0</td>
<td>6.2 6.5</td>
<td>5.2 5.5</td>
</tr>
<tr>
<td>Change in fibre diameter (µm) (10)</td>
<td>1.91 0.38</td>
<td>-1.10 -2.13</td>
<td>-2.25 -2.23</td>
</tr>
</tbody>
</table>

* # : including 50 and 30g whole barley, respectively.
* : number in treatment

DISCUSSION

The rations imposed were comparable to the nutritional regimes experienced by grazing sheep in southern Australia. The higher nutritive value of lucerne chaff compared to pasture chaff was confirmed by the results for chemical composition and digestibility. The responses in liveweight and wool growth to the rations are explicable in terms of differences in nutritive value and intake. Digestible organic matter intake of the lower level of lucerne chaff (317 g/d) closely approximated that on the pasture chaff treatments (mean 315 g/d), and changes in live weight were similar. However, in spite of comparable metabolisable energy intakes, wool growth was 19% higher on the lucerne ration probably reflecting a higher protein availability related to the higher nitrogen intake (100 g/d) compared with the pasture chaff ration (53 g/d).

Under a range of nutritional regimes these adult wool growing sheep did not respond to avoparcin with respect to digestibility, liveweight
change or wool growth rate. Although McGregor and Armstrong (1982) found a higher apparent digestibility of organic matter on a pelleted dried grass-barley diet containing avoparcin (45 ppm), these data on roughage based diets indicate a depression in digestibility \( (P=0.055) \). The absence of wool growth response to avoparcin at maintenance levels of feeding in this experiment confirms the results of Aitchison et al. (1987), who also found no response to avoparcin supplementation between 0 and 75 ppm in both low and high protein diets.

The decrease in mean fibre diameter on the restricted rations in association with the lower wool growth rate was to be expected. However, the lower fibre diameter in sheep receiving avoparcin on lucerne diets was unexpected in view of the similar wool growth rates; generally nutritional effects on wool growth result in proportional changes in both fibre length (L) and fibre diameter (D). While there is no direct evidence that L/D ratio changed in this experiment, the effect on D in the absence of effects on wool growth indicates that L/D might have been altered. Increases in L/D ratio have been experimentally induced with amino acid imbalance (Allden 1979). It is feasible that alteration in rates of absorption of individual amino acids are related to a possible thinning of the wall of the small intestine associated with the administration of avoparcin (Armstrong 1986).

Avoparcin has been shown to be successful in reducing lactic acidosis in sheep challenged with rumen overload of cracked wheat (McDonald et al. 1987). If avoparcin is to be used to facilitate adaptation of sheep to grain based rations whether as a supplement or in droughts, it would be important to determine its effects on fibre diameter and tensile strength. A decrease in fibre diameter with maintenance of tensile strength may be of interest to sections of the wool industry but in the absence of substantial responses in wool growth, a significant role for avoparcin with grazing sheep is unlikely.

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REFERENCES