SUPPLEMENTING GRAZING STEERS WITH GRAIN LEGUMES

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SUMMARY

In two experiments, yearling steers were fed various grain supplements whilst grazing perennial pasture in summer and autumn.

In both experiments, a supplement of 2.88kg/head/day whole oat grain plus 1.0kg/head/day whole narrow-leafed lupins produced liveweight gains (0.53 and 0.50kg/head/day respectively) similar to those produced by 4.0kg/head/day whole oats (0.56 and 0.43kg/head/day respectively). Unsupplemented steers grew significantly slower than all other treatments in both experiments (0.06 and 0.03kg/head/day respectively).

In the first experiment there were no significant differences in liveweight gains of steers fed a supplement of either 4.0kg/head/day whole oats or 2.88kg/head/day whole oats plus 1.0kg/head/day whole grains of either narrow-leafed lupin, white lupin, field pea or field bean (0.53; 0.59, 0.49, 0.58kg/head/day respectively).

In the second experiment, supplements of 3.5kg/head/day of whole grains of either narrow-leafed lupin or field bean produced significantly lower liveweight gains (0.36kg and 0.28kg/head/day respectively) than 1.0kg/head/day of those same grain legumes fed with 2.88kg/head/day whole oats (0.50; 0.41kg/head/day respectively).

INTRODUCTION

The feeding of an energy plus protein supplement during summer and autumn can enhance the liveweight gains of grazing steers (Allden and Tudor 1976; Hawthorne 1980; 1982). A supplement of narrow-leafed lupin grain plus oat grain can achieve this effect, but the protein supplied by the lupins may not always be essential to maximise liveweight gains (Hawthorne 1982). As well, other grain legumes can replace the lupins without reducing liveweight gains (Hawthorne 1982), but it is not known if this would apply when the inclusion of the grain legume was beneficial compared with the feeding of oats alone. This paper reports two grazing experiments in which a supplement of oats and narrow-leafed lupin grain was compared with either narrow-leafed lupins, field beans, oats, or a mixture of oats plus either field beans, peas or white lupins.

MATERIALS AND METHODS

The work was carried out in 1982 and 1983 at the Struan Research Centre, Naracoorte, South Australia. Average rainfall at the Centre is 549mm with an effective growing season of 8½ months. The cattle used were yearling steers bred at the Research Centre, and both experiments commenced two to three months after the steers were weaned at eight months of age. Steers were ranked on an initial 24 hour fasted liveweight, and randomly allocated to treatments from within similar weight categories to ensure that initial weights were the same for each treatment. The steers were weighed directly off pasture at 0900 hours each fortnight, and at the conclusion of each experiment, were fasted for 24 hours and re-weighed.

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Whole grain supplements of narrow-leafed lupins, white lupins, field peas, field beans and oats were weighed and fed three times weekly (Monday, Wednesday and Friday). Steer groups were fed their grains in troughs.

Pastures in both experiments were composed of the sown species phalaris (Phalaris aquatica), Perennial ryegrass (Lolium perenne), Demeter fescue (Festuca arundinacea) and Strawberry clover (Trifolium fragiferum) plus volunteer annual Wimmera ryegrass (Lolium rigidum). Narrow-leafed lupin grain (Lupinus angustifolius cv Illyarrie), oat grain (Avena sativa cv Swan) and field bean grain (Vicia faba cv Fiord) were grown on the Research Centre. Field beans (Vicia faba line 41), peas (Pisum sativum cv Early Dun) and white lupins (Lupinus albus cv Hamburg) were purchased. Where oats were substituted for the grain legumes, quantities were adjusted to supply the equivalent energy intake.

Estimates of herbage available above 1.5cm height were made when sufficient pasture was present. Samples of pasture and supplements were taken for determinations of nitrogen and in vitro digestibility of dry matter.

Supplementation studies commenced with steers in store condition grazing short, mature herbage, and concluded on short, green herbage with most animals being prime for slaughter.

Liveweight gains were calculated from the increase in fasted weight during the experiment. Carcase weights were determined from the hot carcasses after kidney fat and tails had been removed, less three percent shrinkage factor. Data within each experiment were statistically analysed by two-way classification analysis of variance.

Experiment 1

Sixty Hereford yearling steers with a mean fasted weight of 255±16 kg were randomized into six groups of 10 steers. Four of the groups were fed a supplement of 2.88kg/head/day of Swan Oats plus 1.0kg/head/day of either Illyarrie lupins (SO/IL), Hamburg lupins (SO/HL), Early Dun peas (SO/EDP) or line 41 field beans (SO/B). The remaining two groups received either no supplement (NIL) or 4.0 kg/head/day Swan oats (SO). The groups were rotationally grazed at fortnightly intervals so that each group grazed all six of the 7.0ha paddocks at least once in the 108 days from February 23, 1982. All supplements were progressively introduced over 14 days.

Percentage nitrogen content and in vitro digestibility of dry matter were: 4.84 and 74.7 for Illyarrie lupins; 5.87 and 70.8 for Hamburg lupins; 3.95 and 74.7 for Early Dun peas; 4.87 and 73.3 for line 41 beans; 1.44 and 65.2 for Swan oats; and 0.85 and 47.7 for pasture available (257 kg/ha) on day 17.

Experiment 2

Forty two yearling Hereford steers and 18 Hereford X (Jersey x Hereford) steers with a mean fasted weight of 274±16 kg were randomized within breeds into six treatment groups of 10 steers. Four groups received either no supplement (NIL), 3.5kg/head/day Illyarrie lupins (IL), 3.5kg/head/day Fiord beans (FB) or 4.0kg/head/day Swan Oats (SO). The remaining two groups received a supplement of 2.88kg/head/day Swan Oats plus 1.0kg/head/day of either Illyarrie lupins (SO/IL) or Fiord beans (SO/FB). The groups rotationally grazed the six 7.0ha paddocks at fortnightly intervals from January 11, 1983.

† Standard deviation from the mean
Percentage nitrogen content and in vitro digestibility of dry matter were: 5.31 and 75.5 for Illyarrie lupins; 4.78 and 73.7 for Fiord beans; and 2.08 and 65.2 for Swan Oats. There was too little pasture available (less than 1.5 cm height) to warrant measuring.

RESULTS

Experiment 1

The mean liveweight gains, carcass weights and fat thicknesses of the steers in experiment 1 are shown in Table 1. The NIL treatment produced significantly (p<0.05) lower liveweight gain, carcass weight and fat thickness than all other treatments. Of the supplemented treatments, the oat plus pea supplement (SO/EDP) produced the lowest liveweight gains, and along with oats alone (SO), also produced the lowest carcass weights. Steers in the SO/EDP and SO/IL treatments had been without drinking water for up to four days prior to day 64. A growth check of about 12 kg was observed in those treatments during the fortnightly weighings between days 53 and 67, despite 28.0 mm of rain having fallen during those four days. Growth patterns subsequent to day 67 were similar for all supplemented treatments.

TABLE 1 Liveweight gain, carcass weight and fat thickness between the 10-11 rib of steers fed various supplements in experiment 1 (n=10 in each group)

<table>
<thead>
<tr>
<th>Supplement</th>
<th>NIL</th>
<th>SO</th>
<th>SO/IL</th>
<th>SO/HL</th>
<th>SO/EDP</th>
<th>SO/B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain (kg/head/day)</td>
<td>0.06±</td>
<td>0.56ab</td>
<td>0.53ab</td>
<td>0.59a</td>
<td>0.49b</td>
<td>0.58ab</td>
</tr>
<tr>
<td></td>
<td>(0.06)‡</td>
<td>(0.10)</td>
<td>(0.14)</td>
<td>(0.09)</td>
<td>(0.16)</td>
<td>(0.13)</td>
</tr>
<tr>
<td>Carcass weight (kg)</td>
<td>133c</td>
<td>160b</td>
<td>165ab</td>
<td>170a</td>
<td>160b</td>
<td>171a</td>
</tr>
<tr>
<td></td>
<td>(10)</td>
<td>(13)</td>
<td>(11)</td>
<td>(12)</td>
<td>(11)</td>
<td>(12)</td>
</tr>
<tr>
<td>Fat thickness (mm)</td>
<td>1.0b</td>
<td>3.6a</td>
<td>3.9a</td>
<td>4.0a</td>
<td>3.3a</td>
<td>4.4a</td>
</tr>
<tr>
<td></td>
<td>(1.1)</td>
<td>(1.0)</td>
<td>(1.8)</td>
<td>(0.9)</td>
<td>(1.4)</td>
<td>(2.0)</td>
</tr>
</tbody>
</table>

‡Figures in rows with different subscripts differ significantly (p<0.05)

‡Figures in brackets are standard deviation from the mean

Experiment 2

The mean liveweight gains, carcass weights and fat thicknesses of the steers in experiment 2 are shown in Table 2. Liveweight gains of the steers fed the grain legumes alone (IL and FB) were significantly (p<0.05) lower than those of steers with oats in the supplement (SO/IL and SO/FB). There were, however, no significant (p<0.05) differences in carcass weight or fat thickness between any of the treatment groups fed a supplement. The NIL treatment produced significantly (p<0.05) lower liveweight gain, carcass weight and fat thickness than any of the supplemented groups.

DISCUSSION

In experiment 1, the use of a grain legume to replace some of the oats fed as a supplement did not improve steer liveweight gain, although carcass weights were increased if beans or Hamburg lupins were used (SO/B and SO/HL). In experiment 2, neither liveweight gains nor carcass characteristics were improved by including a grain legume. Both experiments confirm that the inclusion of a grain legume with an oat supplement does not always improve liveweight gains or carcass.
TABLE 2  Liveweight gain, carcase weight and fat thickness between the 10-11 rib of steers fed various supplements in experiment 2 (n=10 in each group)

<table>
<thead>
<tr>
<th>Supplement</th>
<th>NIL</th>
<th>SO</th>
<th>IL</th>
<th>FB</th>
<th>SO/IL</th>
<th>SO/TF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain (kg/head/day)</td>
<td>0.03d+ (0.09)#</td>
<td>0.43ab (0.11)</td>
<td>0.36bc (0.10)</td>
<td>0.28c (0.14)</td>
<td>0.50a (0.14)</td>
<td>0.41ab (0.11)</td>
</tr>
<tr>
<td>Carcase weight (kg)</td>
<td>142b (9)</td>
<td>168a (11)</td>
<td>166a (10)</td>
<td>165a (1b)</td>
<td>172a (1b)</td>
<td>167a (12)</td>
</tr>
<tr>
<td>Fat thickness (mm)</td>
<td>3.4b (2.5)</td>
<td>4.8a (1.8)</td>
<td>3.9ab (1.3)</td>
<td>4.8a (2.0)</td>
<td>4.8a (1.7)</td>
<td>4.8a (1.7)</td>
</tr>
</tbody>
</table>

*Figures in rows with different subscripts differ significantly (p<0.05)
#Figures in brackets are standard deviation from the mean

characteristics (Hawthorne 1982). The reason for such inconsistency needs to be found. The protein content of the oats could be involved, since if it exceeds 12.3 percent, then the inclusion of a grain legume with oats is not justified for lambs (Suiter and Croker 1980). In experiment 2, the oat protein content was 13.0 percent, but in experiment 1 and those of Hawthorne (1982), the oat protein contents were between 9 and 10 percent. The protein requirements of the steers must have been met by the pasture consumed, despite the scarcity of pasture.

In both experiments there were no real differences between the grain legumes when fed alone or with oats. The decision as to which grain legume to feed is therefore less important than to know the conditions under which you need a grain legume at all.

In experiment 2, the growth rates of steers fed Fiord beans or Illyarrie lupins alone were lower than when they were fed the grain legumes with oats. Steers supplemented with whole lupins alone had previously grown only slightly, but not significantly (p<0.05), more slowly than those fed whole oats plus whole lupins (Hawthorne 1982). In experiment 2, liveweight gains were lower than those of Hawthorne (1982) because the steers were heavier at commencement, and less pasture was available throughout.

In conclusion, when supplementing grazing steers the most consistent animal performances will be produced by feeding a mixture of oaten grain and a grain legume. Relative grain prices will determine the proportion of each grain to feed and which grain legume to use. The conditions which allow either one or the other component to be eliminated without loss of animal performance are still unclear.

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REFERENCES


