LUPIN GRAIN AS A SUPPLEMENT FOR GRAZING OR PENNED STEERS

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SUMMARY

In three experiments, yearling steers fed 3.5 to 4.0 kg/day lupin grain gained less weight if grazing dry perennial pasture (695 g/day) than if pen-fed the same rate of lupin grain plus hay ad lib. (878 g/day). Unsupplemented grazing steers grew slower (123 g/day) than either pen-fed or supplemented steers. Lower rates of lupin grain supplement on pasture produced lower liveweight gains, but more efficient conversion of grain to live weight.

INTRODUCTION

As pasture herbage senesces, its digestibility declines (Allden 1968), and beef cattle lose weight or make only small gains for a period of several months during summer (Franklin 1956). Energy and nitrogen supplementation of beef cattle during summer can result in enhanced liveweight gains (Allden and Tudor 1976).

Lupin grain (Lupinus angustifolius) is high in both energy and protein (Gladstones 1970), and promotes high liveweight gains in pen-fed cattle (Hawthorne and Fromm 1977; 1978). This paper reports the use of lupin grain as a combined energy and protein supplement for beef cattle grazing summer pastures.

MATERIALS AND METHODS

The work was carried out between 1977 and 1979 at the Struan Research Centre Naracoorte, South Australia. Average rainfall is 549 mm with an effective growing season of 8½ months. Pastures and soils have been described by Hawthorne (1975). The cattle used in the experiments were yearling steers bred on the Research Centre, and the experimental periods commenced 2 to 3 months after weaning. Steers were ranked on an initial 24-hour fasted live weight, and randomly allocated to treatment from within similar weight categories. During the experimental period the steers were weighed at fortnightly intervals directly from pastures at 0900 hours.

Supplements of whole lupin grain, whole oat grain and hay were weighed and fed daily or three times weekly (Monday, Wednesday and Friday), depending on the experiment. Steers were fed as groups with the grains being fed in troughs and the hay from racks. Pens were 30 m x 80 m.

Pastures used in all experiments were composed of the sown species Phalaris (Phalaris aquatica L.), Perennial ryegrass (Lolium perenne L.), Demeter fescue (Festuca arundinacea Schreb.) and Strawberry clover (Trifolium fragiferum L.) plus volunteer annual Wimmera ryegrass (Lolium rigidum Gaud.). Hay used had been made from similar pastures to those grazed. Lupin grain (Lupinus angustifolius cv Uni-crop) and Oaten grain (Avena sativa cv Swan) had been grown on the Research Centre.

Estimates of herbage available above 1.5 cm height were made during the course of the experiments, and samples of pasture and supplements were taken for determinations of nitrogen and in vitro digestibility of dry matter.

Supplementation studies commenced with mature herbage, but concluded with green herbage when most animals were prime for slaughter.

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Liveweight gains were estimated from the mean of the slopes of the regressions of unfasted live weight with time for individual animals. Statistical analyses within each experiment were by analysis of variance of all treatments.

Experiment 1

Ninety yearling Hereford steers of fasted weight 227 kg were randomized into five groups of 18 steers. Two groups rotationally grazed between two 14.2 ha paddocks of pasture, and received daily supplements of nil or 3.5 kg per head per day of lupin grain. Feeding was for 110 days from 9 February 1977. The remaining three groups were pen-fed rations of 3.5 kg of lupin grain per head per day plus either hay ad lib., 1.25 kg hay plus oats ad lib., or oats ad lib. Steers initially fed lupins plus oats ad lib. and no hay began to scour badly, so 1.25 kg of hay per head per day was introduced 56 days after feeding commenced.

Values for percentage nitrogen content and in vitro digestibility of dry-matter were 4.54 and 83.9 for lupin grain, 1.57 and 71.3 for oat grain, 2.76 and 62.2 for pasture hay, 0.82 and 42.6 for pasture available at day 35 (1418 kg/ha of drymatter), and 0.91 and 31.6 for pasture available on day 99 (652 kg/ha).

Experiment 2

Fifty-four yearling Jersey x Hereford steers of fasted weight 238 kg were randomized into six treatment groups of nine steers. One group was pen-fed 4 kg per head per day lupin grain plus hay ad lib. from 28 February 1978. A second group grazed set-stocked on pasture without supplementation. The four remaining treatment groups grazed set-stocked on pasture, and received a supplement of 4 kg per head per day lupin grain. Two of these four groups were changed to 2 and 6 kg lupin grain per head per day on day 56, when green pasture was first available. The other two groups continued to receive 4 kg lupins, but one group remained set-stocked while the other rotationally grazed three areas within the paddock, a full cycle taking one week. Change-over treatments were selected to overcome the low liveweight gains seen in experiment 1 when the "false" and "true" breaks of the season produced short green pasture, Treatments continued until day 141. Replication of each treatment was achieved by six of the nine steers per group grazing a 2.8 ha paddock, and the remaining three steers grazing a second 2.8 ha paddock of lower feed availability and production. One steer in the 6 kg group died of bloat so a replacement was added, but not included in the results.

Values for percentage nitrogen content and in vitro digestibility of dry-matter were 4.82 and 83.9 for lupin grain, 1.86 and 67.8 for hay, and 1.12 and 47.2 for pasture available (705 kg/ha) on day 20. Pasture available on day 141 increased with the level of supplementation, ranging from 146 to 640 kg/ha, with a mean nitrogen content of 2.76 percent and digestibility of 51.0 percent.

Experiment 3

Forty yearling Hereford and Jersey x Hereford steers of fasted weight 224 kg were randomized into five groups of eight steers. Four of the groups were fed three times per week a supplement of 0, 1, 2 and 3.5 kg of lupins per head per day on pasture for 94 days from 30 January 1979. The fifth group was fed daily in pens 3.5 kg lupins plus hay ad lib. Steers in each grazing group were set-stocked on 3.5 ha paddocks for 42 days, and then changed to similar freshpaddocks for the remaining 52 days. One steer in the nil supplement group died of oster-tagiasis, and the replacement was not used in the results. All steers were drenched with fenbendazole after this death.

Values for percentage nitrogen content and in vitro digestibility of dry-matter were 5.84 and 87.5 for lupin grain, 2.68 and 63.9 for hay, 1.15 and 44.2 for pasture available (739 kg/ha) on day 30, and 0.87 and 39.2 for pasture
animal production in australia

available (204 kg/ha) on day 101.

results

experiment 1

the liveweight gains of steers fed nil supplement or 3.5 kg lupins either in
pens with hay ad lib. or on pasture are shown in table 1. steers on pasture fed
lupins had two periods of poor liveweight gain, both corresponding to the avail-
ability of short green pasture following the "false" and "true" breaks of the
season.

liveweight gains of steers in pens fed 3.5 kg lupins were significantly
higher where the remainder of the ration comprised either hay ad lib. (953 d/day)
or 1.25 kg hay plus oats ad lib. (872 g/day), rather than initially oats ad lib.
(671 g/day).

experiment 2

liveweight gains of steers fed nil supplement or 4 kg lupins either in pens
or set-stocked on pasture are shown in table 1. liveweight gains of steers fed
different rates of lupins from day 56 to day 141 while pastures were green are
shown in table 2. note that nil supplement steers had a lower live weight on day
56 since they had received no lupins when supplemented steers were being fed 4 kg
per head per day of lupin until the change-over on day 56.

steers supplemented on pasture had no period of pronounced low liveweight
gain as occurred in experiment 1, but gains were higher before the break of the
season (891 g/day) than after (518 g/day) for the steers continuously set-stocked
and receiving 4 kg lupins. rotational grazing did not increase liveweight gain
(466 g/day) over set stocking (518 g/day). the efficiencies of conversion of
grain to additional live weight over the nil supplement was 8.44, 10.36 and 20.98
kg grain per kg liveweight gain for set-stocked steers supplemented with 2, 4 and
6 kg lupins per day respectively.

experiment 3

liveweight gains of steers fed nil supplement or 3.5 kg lupins either in
pens or on pasture are shown in table 1, and liveweight gains of steers fed differ-
ent rates of lupin grain while grazing dry pastures are shown in table 2. the
efficiencies of conversion of grain to additional live weight over the nil supple-
ment were 3.95, 4.95 and 5.58 kg grain per kg liveweight gain for steers fed 1,
2 and 3.5 kg lupins per day respectively.

table 1 liveweight gains (g/day) of steers fed nil or 3.5 to 4.0 kg lupin
grain

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Experiment 1</th>
<th>Experiment 2</th>
<th>Experiment 3</th>
<th>Mean</th>
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<tr>
<td>Lupins in pens</td>
<td>951 ±</td>
<td>888 ±</td>
<td>878 ±</td>
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<tr>
<td>Lupins on pasture</td>
<td>683 ±</td>
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<td>695 ±</td>
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<td>Nil supplement on pasture</td>
<td>993 ±</td>
<td>135 ±</td>
<td>127 ±</td>
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*Figures in columns with different subscripts differ (P < 0.05)
TABLE 2 Liveweight gains (g/day) of yearling steers supplemented with different rates of lupin grain on pasture

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<th>Experiment</th>
<th>0</th>
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<td>388x</td>
<td>539y</td>
<td>762a</td>
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</tbody>
</table>

†Days 56 to 141 on green pasture. †Lower liveweight day 56 as no lupins fed previously. §Figures in rows with different subscripts differ (P < 0.05)

DISCUSSION

Supplementing grazing steers with 3.5 to 4.0 kg lupin grain was a practical alternative to pen feeding since liveweight gains were reduced by only 21 percent (Table 1), and no hay feeding or special facilities were required. However, the reduction in liveweight gain varied from 14 to 28 percent, with possible contributing factors being pasture availability, pasture and feedstuff quality, and the frequency of feeding.

By reducing the amount of lupin grain fed to steers on pasture, liveweight gains were lower (Table 2) but conversion of grain to extra liveweight gain over the control was more efficient (experiments 2 and 3).

By comparing liveweight gains before and after day 56 in experiment 2, and by comparing the results of experiments 2 and 3, it appears that supplementing steers on predominantly dry pasture may produce better liveweight gains and feed conversions than supplementing on green pasture. The exact reason is unclear, but may be because of reduced pasture intake due to the lower availability of green pasture, a greater substitution of grain for green pasture, or the elimination of the necessity for a protein supplement because of the higher protein content in green pasture.

Regardless of reason, it appears that a practical rate of lupin grain to feed on pasture will depend on the liveweight gain required for fattening, the desirability of reducing feed costs, and whether supplementation is on dry or green pastures.

ACKNOWLEDGEMENTS

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REFERENCES


292