SUMMARY

The experiment investigated the performance of yearling grazing steers and heifers supplemented once a week with whole oat and lupin grain (70:30) (approximately 3 kg/hd.day), or with hay fed to appetite either on the ground (Normal) or in a “Waste-Not” Hayfeeder. Animals were supplemented for 112 days and animals in the Normal “Waste-Not” and grain groups consumed about 350, 295 and 356 kg/hd and gained 38.4, 57.5 and 83.5 kg/hd respectively. The respective costs of gains were calculated to be 91, 51 and 47 c/kg liveweight. Grain feeding was more cost-effective and allowed more flexible management compared with feeding hay. The use of a “Waste-Not” Hayfeeder reduced hay usage as well as increased the performance of the supplemented animals.

Keywords: grain, hay, supplements, cattle.

INTRODUCTION

The Mediterranean environment of southern Australia is characterised by a wet winter and a dry summer and autumn which results in a decline in availability of standing pastures with reducing nutritive value towards the end of autumn. Production of yearling beef on pasture in the south-west of Western Australia (WA) is dependent on animals, usually weaned in December, grazing the dry, standing pasture in the summer/autumn period and finishing on spring pasture. During the dry summer/autumn period cattle will normally lose weight and condition and producers commonly feed hay in an attempt to maintain weight until there is sufficient pasture to allow weight gain. The wet conditions during hay-making generally preclude making good quality hay so animals may lose weight even when supplemented with hay.

Cereal grain offers a cost-effective alternative to hay as a source of energy and will allow for production feeding where liveweight gain is required, provided the problems encountered with acidosis are overcome. There is a high risk of cattle developing acidosis if cereal grain is fed to cattle unadapted to grain or if adapted cattle are without grain for a period. In the past this risk was controlled by a slow introduction of cereal grain into the diet which included daily feeding or milling and mixing a complete diet. These high risks and high labour inputs have generally restricted grain feeding to feedlots with limited use in grazing animals.

Barker and May (1988) developed a system of feeding grain with nitrogenous fertilisers to limit the intake of grain. Although the system does control the intake of grain and reduces the risk of acidosis, it still requires an introductory period to prevent urea toxicity, requires considerable labour and capital inputs, and still requires that grain is available at all times. Zorrilla-Rios et al. (1991) demonstrated that treating grain with the antibiotic virginiamycin (VM; Stafac 500, SmithKline Beecham Animal Health, Australia) allows grain to be fed to unadapted cattle with no introduction and without risk of acidosis. It has also been shown that restricted amounts of grain with VM can be fed on a weekly basis with minimal losses in production but major savings in labour inputs (Zorrilla-Rios et al, 1993). This system has the potential to allow more grain to be fed to grazing cattle to increase production in a simple and cost-effective manner.

The normal method of feeding hay is to spread the hay on the ground. This is generally very wasteful because of problems with trampling and spoiling. A feeder designed for round bales, the “Waste-Not” Hayfeeder (Terry Allen “Grovedale” Carisbrook Vic 3464), allows the cattle to eat the hay with less spoiling or trampling. This may provide a more effective method of supplementing with hay.

The experiment was conducted on a 1000 ha beef/sheep property 20 km south-west of Darkan in the Great Southern region of WA with an average annual rainfall of 550 mm. This experiment involved weaner steers and heifers grazing an improved pasture and supplemented with hay, either fed on the ground (Normal) or provided in a “Waste-Not” Hayfeeder, or grain.
MATERIALS & METHODS

In early January 1993, 68 Murray Grey steers and 31 heifers, weaned in December 1992 at approximately 9 months of age, were stratified based on sex and liveweight, then randomly allocated from within strata to 3 treatments each with 31-34 animals. These treatments were assigned to separate paddocks. Animals grazed the available dry pasture and were supplemented with: 1. ad libitum hay fed on the ground (Normal); 2. ad Zibitum hay fed in a ‘Waste-Not’ Hayfeeder; and 3. whole oats/lupin grain mix (70:30) fed 21 kg/ha on a weekly basis (equivalent to 3 kg/hd.day). Individual animal intake of hay was calculated as the difference between the amount of hay fed out and residue after visually estimating wastage or loss and dividing by the number of animals. Grain intake was calculated as the usage of grain divided by the number of animals. The costs of the supplements were based on market value although the supplements were produced on the property.

Lupins were included in the grain mix to increase protein content of the grain supplement. Oats were not cracked prior to feeding as May et al. (1988) showed no difference in utilisation of cracked or whole oat grain. The oats were treated with a solution of VM at 20 g/t which was applied by spraying the oats in an auger as it was moved from the silo to a feed bin on the tractor. The VM was extracted from Stafac 500 with 70% methylated spirits and adjusted to pH 6.9 with hydrochloric acid. To remove some of the effects of variation between paddocks the animals were rotated at monthly intervals through the 3 paddocks, each approximately 35 ha.

The animals were weighed fortnightly and feed on offer (FOO) was assessed monthly. The FOO was estimated by cutting at least 10 quadrats of pasture estimated to be representative of the paddock. Where there were distinct differences within a paddock, quadrats were cut from the different areas and averaged to calculate FOO/ha. Representative samples of pasture were collected as grab samples each month and analysed for in vitro digestibility (Aufrere and Michalet-Doreau 1988) and crude protein concentration (Kjeldahl N x 6.25).

Initial liveweights were compared using analysis of variance. April and June liveweights and liveweight changes were compared using analysis of variance with initial liveweight as the covariate. Growth rates were calculated by linear regression of individual liveweights against time from April to June. Growth rates were compared using analysis of variance with the April liveweight as the covariate. Liveweight change was calculated as the difference between the initial liveweight in February before supplementary feeding began and final liveweight 127 days later in June after supplementary feeding finished.

RESULTS

The FOO to all treatments was above 1200 kg/ha at all times. As FOO in excess of 1000 kg/ha is considered non-limiting to animal growth (W.J. Ryan pers. comm.) it was considered that FOO was non-limiting in this experiment. Quality of FOO was poor at the start of the trial with a digestibility of 50.1 ± 1.32% (mean ± s.e.) and crude protein content of 6.4 ± 0.23%. After the opening rains in mid-March, the digestibility increased to 74.3 ± 1.28% and crude protein content to 24.2 ± 1.11% in April. When supplements were stopped in June the digestibility was 78.2 ± 1.11% and crude protein was 23.5 ± 0.79%. Wastage of grain was negligible but wastage of hay was visually estimated to be 15% and 5% when fed on the ground or in a “Waste-Not” Hayfeeder respectively.

Initial mean liveweight of steers (254.1 ± 3.03 kg) was significantly (P < 0.001) greater than that of the heifers (223.5 ± 4.43 kg). Subsequent liveweights were significantly (P < 0.001) affected by initial liveweight but not by sex. As sex did not significantly (P > 0.05) affect liveweight change or growth rate, heifer and steer data were combined for further analyses.

The liveweight changes between February 11 and June 18, supplements fed and costs of supplements are presented in Table 1. From April to June growth rates were relatively constant and over this period the average growth rates of the animals were 0.61, 0.84 and 1.03 kg/day for the hay treatments (Normal and “Waste-Not”) and grain (Figure 1). The cattle supplemented with hay on the ground (Normal) lost more weight between February and April compared with the cattle supplemented with hay using the “Waste-Not” feeder. Cattle fed grain supplements lost weight only for a short period while they adapted to the grain before starting to gain weight. The amount of hay fed out using the “Waste-Not” Hayfeeder was 16% less than that provided using the practice of unrolling round bales on the ground. Taking into account the numbers in each treatment and the 10% difference in wastage we estimate that the “Waste-Not” treatment consumed 6% less hay than the Normal treatment.
Table 1. The initial, mid and final liveweights, and liveweight changes of steers and heifers grazing annual pasture and supplemented with hay or grain

<table>
<thead>
<tr>
<th></th>
<th>Hay (Normal)</th>
<th>&quot;Waste-Not&quot; feeder</th>
<th>Grain</th>
<th>RMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number(^a)</td>
<td>34</td>
<td>31</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Initial liveweight (kg) (February)</td>
<td>244.2(^a)</td>
<td>245.2(^a)</td>
<td>245.1(^a)</td>
<td>781.30</td>
</tr>
<tr>
<td>Mid liveweight (kg) (April)</td>
<td>235.6(^b)</td>
<td>239.2(^b)</td>
<td>256.2(^\ast)</td>
<td>58.01</td>
</tr>
<tr>
<td>Final liveweight (kg) (June)</td>
<td>282.9(^\ast)</td>
<td>300.0(^b)</td>
<td>328.5(^\ast)</td>
<td>223.20</td>
</tr>
<tr>
<td>Growth rate(^b) (kg/lad/day) (April-June)</td>
<td>0.61(^a)</td>
<td>0.84(^b)</td>
<td>1.03(^\ast)</td>
<td>0.04</td>
</tr>
<tr>
<td>Liveweight change (kg) (Feb-June)</td>
<td>38.5(^a)</td>
<td>57.4(^b)</td>
<td>83.5(^\ast)</td>
<td>223.20</td>
</tr>
<tr>
<td>Supplement (kg/hd)</td>
<td>350</td>
<td>295</td>
<td>356</td>
<td>na</td>
</tr>
<tr>
<td>Supplement cost(^c) ($/hd)</td>
<td>35.00</td>
<td>29.50</td>
<td>38.93</td>
<td>na</td>
</tr>
<tr>
<td>Cost/gain (c/kg LW gain)</td>
<td>91</td>
<td>51</td>
<td>47</td>
<td>na</td>
</tr>
</tbody>
</table>

\(^a\) Steers and heifers.
\(^b\) Growth rate was calculated by linear regression between April and June when growth rate was relatively constant.
\(^c\) Hay $100/t; Oats $85/t; Lupins $180/t and VM approximately $5/t grain.
na - not statistically analysed.
Means in the same row with different superscripts are significantly different at P < 0.001.

DISCUSSION

There were no observed digestive problems in the cattle fed grain, and after initial slow intakes during the first 2 weeks, the animals consumed their weekly allocation on average 3 days before the next feed. The extra energy and protein obtained with the grain mix resulted in 46 and 119% improvements in performance over the "Waste-Not" and Normal hay feeding (Table 1).

![Figure 1. The average liveweight change of grazing steers and heifers supplemented with hay (Normal-circles, "Waste-Not" - triangles) or grain (squares)](image)

The results show the animals fed hay lost weight till April then started to gain weight (Figure 1). The animals fed hay using the "Waste-Not" Hayfeeder were marginally heavier than those animals fed hay in the Normal method. However the animals on the "Waste-Not" Hayfeeder achieved these heavier weights...
with 16% less hay (Table 1). This may have resulted from reduced refusals of hay due to less contamination with soil, faeces and urine compared with feeding hay on the ground. In the last month of the trial, animals in the “Waste-Not” treatment gained more weight than animals in the Normal treatment (Figure 1). Rain over this period (40 mm) resulted in the hay fed on the ground getting wet with fairly extensive spoilage from trampling which probably resulted in less hay being consumed. As there was less spoilage of the hay in the “Waste-Not” Hayfeeder the animals continued to eat the hay.

These results were obtained in a year when opening rains were earlier than expected. As a result there was sufficient high quality pasture in April to allow growth of animals receiving the hay supplements. If opening rains had been later the benefits of grain supplementation over hay supplementation may have been greater. Slaughter of animals began soon after supplementation finished but it appeared that after supplementation stopped there may have been some compensatory growth by the animals which had been supplemented with hay rather than grain. This agrees with the results of another “on-farm” trial conducted at Esperance, where animals supplemented with hay showed compensatory growth in relation to the animals supplemented with grain when they were subsequently finished in a feedlot. This indicates that if the animals are to be supplemented with grain then to maximise the benefits of the extra liveweight gained when supplementing with grain it would be preferable to ensure that animals are ready to be slaughtered at the end of the grain feeding period. Levels of grain supplementation may need to be higher to achieve this goal.

Using Grazfeed it was estimated that unsupplemented cattle on the pastures available during the trial would have gained approximately 20 kg. Therefore, the feed conversion ratio for cattle supplemented with grain was 5.6 kg grain/kg liveweight gain. Total cost of supplement was highest for the animals fed grain. However, grain feeding was the most cost-effective supplement on a liveweight gain basis followed by feeding hay in the “Waste-Not” Hayfeeder. The cost of each kilogram gain using the “Waste-Not” Hayfeeder was about 56% of the cost of the Normal system with grain feeding about 52% of the Normal system (Table 1).

These costs depend greatly on the price of hay and grain, but no account has been taken of any benefits as a result of more flexible marketing and higher carrying capacity due to earlier selling allowed by the grain feeding system. There are also benefits in ease of storage and sale of surplus grain compared with hay. It is obvious that this grain feeding system is simple, practical and provides a cost-effective method of achieving levels of production in grazing cattle which are not achievable by supplementing with hay.

ACKNOWLEDGMENTS

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REFERENCES