PERFORMANCE OF WEANER STEERS GRAZING STUBBLES OF NARROW-LEAFED LUPIN AND WHEAT STUBBLES

P.J. MAY*, D.J. BARKER* and W.J. FERGUSON**

SUMMARY

Young steers grazed stubbles of narrow-leafed lupin and wheat, that were free of green plant material, for 90 days at three rates of stubble availability. The cattle grazing the lupin stubble initially gained live weight while those grazing wheat stubble only maintained live weight. On lupins and wheat respectively the period of gain or maintenance increased as the availability of stubble increased. It is suggested that stubbles could be usefully described in terms of the weight of crop residue required to support one day of liveweight gain or maintenance.

INTRODUCTION

Cereal and legume crop stubbles are alternatives to dry annual pasture as summer/autumn feeds for grazing stock in regions with a Mediterranean climate. A characteristic of these crop residues is the variation in the nutritive value of the various components, from high value for the grain to very low for the stems. Mulholland et al. (1977) have shown that cattle grazing stubbles can select a diet of better quality than the average on offer. May and Barker (1984) also showed this with unsupplemented yearling cattle which gained 0.6 kg/d for 58 days, while grazing a barley stubble of predominantly poor quality leaf and stem. This suggested that unsupplemented crop residues merited further assessment as summer feeds for cattle.

In the south west of Western Australia narrow-leafed lupins (Lupinus angustifolius) and wheat (Triticum aestivum) are those requiring most investigation. Two thirds of the stubble available is wheaten, while residues of lupin crops could be expected to be superior to cereal stubbles as a summer feed, although lupinosis is a potential problem. There are few reports from similar environments of the performance of cattle grazing unsupplemented stubbles of either lupins or wheat free of green plant material. Carbon et al. (1972) reported a moderate liveweight gain for cattle grazing lupin stubble but performance on wheat stubble has been variable. Round et al. (1978) and Coombe and Mulholland (1988) recorded low liveweight gains and Fromm (1976) reported a liveweight loss.

In this experiment unsupplemented stubbles of narrow-leafed lupin and wheat were evaluated as summer feed for young cattle, Both stubbles were assessed at three levels of herbage availability to provide opportunity for diet selection.

MATERIALS AND METHODS

Two types of stubble (narrow-leafed lupin, Lupinus angustifolius, cv. Unicrop and wheat, Triticum aestivum, cv. Madden) were grazed by cattle at three rates of estimated availability (1200, 1800, and 3600 kg of air dry stubble per head at the start of the experiment) with two replicates.

The research was carried out at Chapman Research Station, 400 km north of Perth, Western Australia. The mean annual rainfall is 460 mm, 89% of which falls between April and October. The crops were harvested in mid-November and no rain fell between harvest and the start of the experiment on January 2. A

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chemical weed control program had left the stubbles free of other plant species.

The weight of air dry material available was estimated immediately after harvest by cutting fifty 0.25 metre square quadrats to ground level and again after 81 days of grazing by cutting 20 quadrats in each paddock. Yields per hectare of the crops immediately after harvest were estimated to be:

Lupins: 880 kg grain harvested + 5875 kg stubble (including 655 kg split grain)
Wheat: 2100 kg grain harvested + 5700 kg stubble

At both cuttings, samples of the lupin stubble were separated into leaf, stem, pod and wheat stubble into leaf and stem. Components were analysed for crude protein and in vitro digestibility (Tilly and Terry 1963). Samples of lupin stem were collected from each paddock at the start and assessed for the level of infestation with *Phomopsis leptostromiformis*, the fungus which can cause lupinosis in sheep and cattle.

Seventy two steers aged 259 ± s.d. 35 days and weighing 251 ± s.d. 24 kg were randomly allocated from within breed and liveweight strata to 12 groups each of six animals. They were drenched with the anthelmintic thiabendazole at the start and 14 days later and weighed unfasted at intervals of 10 to 14 days. At the end of the experiment samples of liver were taken by biopsy from a subsample of the cattle for histopathological examination.

Live weight and stubble availability data were analysed by analysis of variance with type and availability of stubble as main effects.

RESULTS

The quality and availabilities of the stubbles immediately after harvest and after 81 days are given in Tables 1 and 2 respectively. The dry matter content of both stubbles at both sampling times was 92%.

### Table 1

<table>
<thead>
<tr>
<th></th>
<th>Lupins</th>
<th>Wheat</th>
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<tbody>
<tr>
<td></td>
<td>% CP</td>
<td>% IVD</td>
</tr>
<tr>
<td>Leaf</td>
<td>19.6</td>
<td>32.9</td>
</tr>
<tr>
<td>stem</td>
<td>3.7</td>
<td>35.2</td>
</tr>
<tr>
<td>Seed</td>
<td>33.2</td>
<td>87.7</td>
</tr>
<tr>
<td>Pods</td>
<td>3.1</td>
<td>57.4</td>
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</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th></th>
<th>Lupins</th>
<th>Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total-feed at start</td>
<td>1200</td>
<td>2100</td>
</tr>
<tr>
<td>Seed at start</td>
<td>134</td>
<td>201</td>
</tr>
<tr>
<td>Total feed after 81 days</td>
<td>442</td>
<td>925</td>
</tr>
<tr>
<td>Seed after 81 days</td>
<td>75</td>
<td>143</td>
</tr>
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</table>
The amount of stubble that disappeared increased with the initial availability, suggesting that the cattle with greater allocations of stubble ate more. However, the trend was not statistically significant ($P>0.05$). On lupin stubble, the proportion of seed in the feed that disappeared was similar for all rates of availability (7.8, 6.6 and 7.3% for 1200, 1800 and 3600 kg/head respectively).

Liveweight changes of the cattle and rainfall during the experiment are shown in Fig. 1. The cattle grazing lupin stubble performed better than those on wheat stubble from day 28 onwards ($P<0.001$). Stubble availability significantly affected performance from day 42 onwards. On days 42, 69 and 90 there was a significant interaction between type of stubble and availability ($P<0.05$) with increasing availability having a greater effect on the cattle grazing lupin stubble than on those grazing wheat stubble.

Rainfall up to and including day 57 was immediately followed by fine and hot weather and no germination occurred. Rainfall after day 76 resulted in green feed becoming available by day 90 and the experiment was terminated. The lupin stubble was visually assessed to be heavily infected with the fungus *Phomopsis leptostromiformis*. The cattle were clinically normal throughout and microscopic examination of samples of liver detected no pathological changes.

**Fig. 1.** Rainfall and liveweight change of young steers grazing stubbles of lupin and wheat at three levels of herbage allowance

The liveweight changes recorded in this experiment can be divided into four consecutive phases, namely (i) adaptation to the new feed, (ii) gain, (iii) maintenance and (iv) loss. As there was over 2000 kg/ha of stubble remaining after 81 days this pattern of liveweight change suggests that the cattle selectively grazed the stubbles and progressively exhausted the more digestible fractions, to be left eventually with only very low quality material. As the proportion of seed in the lupin stubble that disappeared was similar for the three levels of availability the better performance of the cattle offered more lupin stubble was very likely a consequence of higher intakes rather than selection of a diet containing a higher proportion of seed. The better performance of the steers on lupins could suggest that they had eaten more of...
the residues than those on wheat stubble. However, the apparent daily rates of disappearance of both stubbles ranged from about 3 to 6% of live weight and were similar to the rates reported by Carbon et al. (1972), Round et al. (1976) and Coombe and Mulholland (1988). As feed eaten would have accounted for a maximum of only half the material that disappeared, any differences in intake between the stubble types would have been extremely difficult to detect.

Differences in nutritive value of the components of the two stubbles (Table 2) would explain the differences in performance between the cattle on the two stubble types. The steers grazing lupin stubble, by initially selecting a diet containing a significant proportion of the higher quality fractions (seed and pod), were able to gain weight. In contrast, maintenance of liveweight was the best that the cattle on wheat stubble were able to achieve. Given the crude protein content and digestibility of the major portion of the wheat stubble on offer (leaf and stem) the animals would have had to select a diet of considerably better quality than the average on offer to achieve maintenance.

The period of liveweight gain on lupin stubble was about one day for every 50 kg of material available, which was similar to the one day per 40 kg of stubble reported by Carbon et al. (1972). For wheat stubble the length of the maintenance period was about one day for every 30 kg of stubble that was initially available while in the experiments of Round et al. (1976) and Coombe and Mulholland (1988) 75 and 60 kg of wheat stubble were required respectively to support liveweight gain for one day. These relationships suggest that the value of stubbles as cattle feed could be usefully described in terms of the weight of crop residue required to support a day of gain or maintenance.

The liveweight gains of 0.2 to 0.3 kg/d that we recorded on lupin stubble are less than the 0.5 kg/d that Carbon et al. (1972) reported, but the cape-weed, grass and clover that were present in their stubble might have contributed to their better liveweight gains. Round et al. (1978) and Coombe and Mulholland (1988) reported digestibilities of wheat stubble at least 10 percentage units higher than the leaf fraction in our investigation and recorded better performance than we did. Fromm (1976) also reported stubble digestibilities much greater than ours, had a low allowance of stubble and his animals lost weight. He provided only 3.3 kg stubble per kilogram of initial liveweight in contrast to the 8 kg in the experiments of both Round et al. (1978) and Coombe and Mulholland (1988) and 4.8, 7.2 and 14.4 kg in our experiment.

The hot and dry conditions following rain up to day 57 were not conducive to production of the toxin causes lupinosis in lupin stubble. Consequently the disease would not have been anticipated.