EFFECT OF LUPIN FEEDING ON REPRODUCTION IN BEEF HEIFERS

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SUMMARY

Over two years, lactating 2-year-old heifers were fed either high (c. 19.4%) or medium (c. 11.8%) protein rations for 8 or 12 weeks before and during joining. The medium protein ration contained hay, wheat and oats, and lupins replaced oats in the high protein ration. Total amount fed per day was the same for both rations, and total energy values were only slightly less in the medium protein ration. Heifer gains were similar on both rations, and calf gains were higher when suckling heifers which were fed the high protein ration.

Feeding lupins before joining increased the number of heifers exhibiting oestrus, but this advantage was partly lost if green pasture was available during joining. More Angus heifers fed the high protein ration were in calf after 12 weeks joining than those fed the medium protein ration, but this effect was not observed in heavier Angus x Friesian heifers.

INTRODUCTION

A major problem in the beef industry is poor reproductive performance especially in heifers suckling their first calf, and there is a concept of critical body condition below which a heifer will not exhibit oestrus and conceive (Lamond 1970). In pastoral situations live weight is used as an indication of energy storage. At the time of joining in southern Australia, live weight is often depressed by poor feed conditions, and poor conception could be due to shortages of either protein or energy. In northern Australia, with marked season-al rains and shortage of protein in the dry winters, a number of workers have been successful in improving reproduction in beef cows by the addition of small amounts of protein supplements (e.g. Sparke and Lamond 1968; Little 1975). Siebert, Playne and Edye (1976) suggested that the short term use of small quantities of protein supplement may be more effective than other supplements in maintaining regular pregnancy.

Lupins (> 30% protein) are a readily available protein source in southern Australia, and have been fed to ewes (e.g. Knight, Oldham and Lindsay 1975) to increase numbers of ewes lambing and also the number of twin births. These increases have usually been associated with similar weight gains to control groups. This paper reports the effects of feeding lupins on the reproductive performance of 2-year-old heifers with their first calf at foot, at Ginninderra Experiment Station, Canberra.

MATERIALS AND METHODS

Experiment 1 - 1975 joining

Twenty-nine Angus (A) and 22 Angus x Friesian (AxF') a-year-old heifers calved in June-July, and were randomised on weight and calving day into two groups. Preliminary feeding commenced after calving to accustom animals to feeding, and experimental feeding commenced approximately 20 days post-calving in small paddocks that had previously been heavily grazed so that very little pasture was available. Stocking pressure was equivalent to 5.8 heifers/ha. Because of the spread in calving, feeding was in two periods:

Period A = 33 heifers from 15 July to 7 Oct. (84 days).
Period B = 18 heifers from 12 Aug. to 7 Oct. (56 days).

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The rations were calculated on a metabolisable energy basis to give weight gains of 1.0 kg/day in lactating heifers weighing 270 kg and to provide enough milk for calves to gain 0.7 kg/day (M.A.F.F. 1975). Treatments and rations are shown in Table 1. The medium protein ration consisted of hay, wheat and oats, and lupins (*Lupinus albus* and *L. angustifolius*) replaced oats in the high protein ration, (11.8% and 19.4% protein respectively). Grain was fed whole, and poor quality grass-clover hay was fed as approximately 25% of the ration.

### TABLE 1 Feed composition, and DM, ME (metabolisable energy) and protein fed/day

<table>
<thead>
<tr>
<th>Feed</th>
<th>DM</th>
<th><em>In vitro</em> digestib.</th>
<th>Ash</th>
<th>ME*</th>
<th>Protein</th>
<th>Rations fed/day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>MJ/kg</td>
<td>g/kg</td>
<td>High Protein</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Medium Protein</td>
</tr>
<tr>
<td>Lupins</td>
<td>92.7</td>
<td>86.2</td>
<td>3.4</td>
<td>12.5</td>
<td>30.9</td>
<td>2.8 35.0 0.9</td>
</tr>
<tr>
<td>Oats</td>
<td>92.7</td>
<td>82.2</td>
<td>4.8</td>
<td>11.7</td>
<td>85</td>
<td>3.8 49.4 0.6</td>
</tr>
<tr>
<td>Wheat</td>
<td>94.9</td>
<td>88.0</td>
<td>1.8</td>
<td>13.0</td>
<td>153</td>
<td>2.7 20.5 0.3</td>
</tr>
<tr>
<td>Hay</td>
<td>91.3</td>
<td>54.4</td>
<td>6.3</td>
<td>7.6</td>
<td>94</td>
<td>9.3 104.9 1.8</td>
</tr>
</tbody>
</table>

*ME* = 0.15 DOMD% (Equation 58, M.A.F.F. 1975).

DOMD% (Digestible organic matter in dry matter) = \( \frac{\text{In vitro OMD\% (100-Ash\%)}}{100} \) (Equation 55, M.A.F.F. 1975).

From 7 Oct. heifers were grazed on good pasture to gain weight. Animals were weighed fortnightly throughout the feeding and joining periods. Vasectomised bulls (fitted with chin-ball harness) were run with the heifers from calving to record oestrus. Joining with entire bulls was from 11 Sept. for 12 weeks.

### EXPERIMENT 2 - 1976 JOINING

Forty-five 2-year old heifers (11A, 10F and 24 AxF) that calved in June-July were randomized into two groups and were individually fed in concrete pens. Feeding was in three periods from 5 Aug., 19 Aug. and 1 Sept. (approximately 35 days post-calving) for 58 days. Rations, management and recording of oestrus were similar to the previous year, and calves were fed hay in calf creeps within each pen.

### RESULTS AND DISCUSSION

#### Live weight and liveweight gains

In both years, all heifers lost weight in the two weeks immediately following calving, but during the feeding periods gains were 0.5 and 0.3 kg/head/day for 1975 and 1976 respectively, and were similar for both breeds and treatment groups. These gains were low considering their low post-calving weights, and were less than expected on the rations being fed. This was probably because grains were fed whole, whereas performance was predicted from *in vitro* digestibilities based on ground materials. Liveweight gains on pasture were 0.7 kg/head/day in both years. Mean live weights at the start of joining were 273 and 298 kg respectively for A and AxF heifers in 1975, and 248, 270 and 290 kg respectively for A, AxF and F heifers in 1976.
Calf weight gains were analysed as a year x breed x treatment non-orthogonal analysis of variance. The only significant (P < 0.05) effect was that calves suckling lupin-fed heifers gained more than those suckling heifers fed the medium protein diet (0.69 vs 0.61 kg/head/day).

Cows in early oestrus before the start of joining

In Period A in 1975, the number of heifers on the high protein diet showing oestrus before joining was significantly higher (P < 0.05) than that on the medium protein diet (Table 2). This difference was not maintained through joining (particularly in heavier AxF heifers) after heifers were moved to good pasture. Generally, if green pasture is available, protein level should be sufficient for good reproductive activity (Siebert, Playne and Edye 1976). However, if pasture is scarce, energy as well as protein may be limiting. None of the heifers in Period B in 1975, or in 1976 (when feeding commenced later), had shown oestrus by the start of joining. Mean days from calving to 1st oestrus of all heifers were 78 and 86 in 1975, and 89 and 103 in 1976 for high and medium protein diets respectively.

**TABLE 2** 1975. Number and percent of heifers showing oestrus before joining+

<table>
<thead>
<tr>
<th>Breed</th>
<th>Feeding</th>
<th>No.</th>
<th>No. in oestrus</th>
<th>% oestrus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aqw (A)</td>
<td>High protein</td>
<td>9</td>
<td>4</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Medium protein</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>AXF</td>
<td>High protein</td>
<td>7</td>
<td>5</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>Medium protein</td>
<td>9</td>
<td>4</td>
<td>44</td>
</tr>
</tbody>
</table>

+ Period A only. These heifers had been fed for 58 days to start of joining.

Within each year x breed x treatment group, the data were analysed as the number of heifers conceiving after 3, 6, 9 and 12 weeks joining. The conception rate can be calculated as the number of heifers conceiving in each interval divided by the number not conceived at the beginning of the interval. These rates are treated as independent binomial values. The effects of treatments were assessed by fitting a generalized linear model to the complementary log log of the rates (See Bartlett 1978).

Conception was significantly higher (0.9 and 0.7 respectively after 12 weeks joining, P < 0.001) in 1975 than in 1976 when heifers were lighter and had lower gains during the feeding period. With years combined, there was a significant breed x treatment interaction (P < 0.001) as A cows fed lupins had higher conception rates than those on the medium protein diet, but AXF heifers did not show this effect (Fig. 1). It appears that the medium protein level was adequate for reproduction, but the higher protein level increased the likelihood of early oestrus. It was suggested by Lindsay (1976) that other high protein supplements would have the same effect on reproduction as lupins. F cows were not included in the analysis but conception rates were very low (0.4 and 0.2 for high and medium protein rations respectively) despite their higher live weights. This is often so with high milk-producing breeds of this age while suckling a calf (Morgan, Cummins and Saul 1974).

As well as more A heifers in calf, conception was advanced by some 10 days
Animal production in Australia

over the two years in all heifers fed the high protein ration than those fed the medium protein ration (96 vs 106 days post-partum). This gives some advantage in that earlier calves have a slightly longer growth period to weaning. In commercial practice, if heifers are in very poor condition post-calving (e.g., during drought), conception may be increased by feeding a high protein supplement. However, it is likely that feeding higher rates of cheaper energy supplements to increase live weight would prove more economic (Lamond 1970).

Fig. 1. Estimated probability of conception for breed x treatment, averaged over years. ● - ● Angus - high protein ○-----○ Angus - medium protein ○---- ○ AxF - high protein ○----- ○ AxF - medium protein

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REFERENCES