SUPPLEMENTARY FEEDING OF GRAZING SHEEP — ITS EFFECT ON PASTURE INTAKE

By J. M. Holder*

Summary

In three experiments conducted with Merino sheep grazing unimproved native pasture, feeding a grain supplement significantly depressed grazing time and pasture intake. An “efficiency of supplementation” coefficient is developed to describe this substitution effect. If 100 per cent. efficiency indicates that the supplement does not act as a substitute for pasture, the highest efficiency of supplementation reached in these experiments was 43 per cent. The higher efficiency coefficients tended to occur when unsupplemented animals were losing weight on the pasture.

The effect on grazing time and pasture intake of mixing supplemented with unsupplemented sheep varied. Generally the trend was towards lower grazing times and pasture intake of unsupplemented animals, but in one experiment there was a significant increase in the grazing time of the supplemented sheep.

I. INTRODUCTION

At the 1st Biennial Conference of the Australian Society of Animal Production it was pointed out by McClymont (1956) that while “the feeding of supplements of conserved roughage or concentrates is widely recommended as a means of combating the effect of poor pasture on growth or milk production of stock . . . the responses have been most erratic and far less than would have been expected on the basis of feeding standards.”

Reports since then have tended to confirm this contention (Corbett 1958; Castle et al. 1960; Holder 1960). The data of these authors, all obtained with dairy cattle, suggest that the supplement fed acted as a substitute for pasture. Although intake data were not presented, in the latter report there was a significant decrease in the grazing time of the cows.

Tribe (1950) also has reported that Scottish Blackface ewes fed a meal supplement grazed for much shorter periods than did unsupplemented ewes. When the two groups were mixed as one flock, however, the grazing times were similar and approached that of the unsupplemented animals when they had grazed alone. That is, the presence of presumably hungry animals appeared to stimulate the supplemented ewes to graze for a longer daily period, an effect described as one of “social facilitation.” If Tribe’s report of social interactions in the sheep used in his study holds for other breeds, and if grazing time is a reflection of pasture intake, then his findings are of considerable significance in relation to design and interpretation of grazing experiments and may have application in husbandry of the grazing animal.

The present experiments were therefore designed to determine the social interactions, if any, between supplemented and unsupplemented Merino sheep as they might affect grazing time and pasture intake.

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The experiments were conducted on unimproved native pasture at Armidale, New South Wales. The total food intake of individual sheep was estimated by “indirect” techniques, with faecal output determined by the chromic oxide method (Raymond and Minson 1955), and the intake factor ‘(Lancaster 1954) from the relationship:

\[ F = 1.03 - 0.2438N - 0.1855N^2 \]

where \( F \) = intake factor (digestible organic matter) and \( N \) = faecal nitrogen percentage. This “local” regression was developed from analysis of digestibility experiments covering a wide range of pasture species, including those used in the present experiments (Lambourne, Reardon, and Holder, unpublished data).

Total food intake was measured over 10- or 12-day collection periods. The supplement fed in each experiment was oat grain derived from the one supply. Animals receiving the supplement were yarded each morning and fed individually so that the oats could be measured. The digestibility of organic matter in the oat grain was determined by standard methods, oat grain alone being fed to Merino wethers in metabolism crates. Pasture intake of the supplemented sheep was calculated by difference, total intake in grams of digestible organic matter (D.O.M.) minus D.O.M. intake in grams from the supplement.

Grazing times of individual sheep were obtained by direct observation over 24-hour periods, generally with two such periods in each collection ‘period of 10 or 12 days.

(i) Experiment 1. Winter 1959. Ten Merino wethers were offered 450 g grain once daily and were run as one group (S.A.), while another ten unsupplemented animals were run alone as one group (US.A.). A third mixed group consisted of ten supplemented (S.M.) and ten unsupplemented animals (US.M.). The stocking rate was 2 sheep per acre and the duration of the experiment was two consecutive 10-day collection periods.

(ii) Experiment 2. Spring 1960. Same treatments as for Experiment 1. The supplement offered was 340 g grain per day. Duration, two consecutive 12-day collection periods.

(iii) Experiment 3. Autumn 1961. Same treatments as for Experiments 1 and 2. The supplement offered was 340 g grain daily. Duration, one 12-day collection period.

The sheep used in Experiment 1 were not used again. The 60 sheep used in Experiment 2 were used again in Experiment 3 after spending the intervening period as one flock on native pasture without supplements. The animals were allocated at random to treatments. Ten similarly treated sheep were added to each of the “alone” groups so that numbers in these groups equalled those in the “mixed” group. Data were not collected for these sheep. In all experiments, the groups were rotationally grazed round the three paddocks used at three- or four-day intervals to overcome the confounding of paddock effects. In each experiment a period of at least 7 days elapsed between allocation to treatments and the commencement of the collection periods.
Fig. 1—Intake and grazing time of supplemented and unsupplemented sheep.
III. RESULTS

The mean digestibility of organic matter in the oat grain used was 76.5 per cent.

A summary of the grazing times, total food intake, and intake of supplement where appropriate, is given for all four experiments in Fig. 1. Intakes are recorded in grams D.O.M., and grazing time in minutes.

In Experiment 2 two of the sheep allocated to the S.M. treatment group consistently refused to eat the supplement offered. In the same group one sheep was badly affected by pizzle rot over the experimental period. The data for these three sheep was excluded from calculations, so that the group mean was derived from seven sheep.

In an endeavour to describe in quantitative terms the substitution effect of the supplement noted in these experiments, a coefficient of “efficiency of supplementation” has been developed:

\[
\text{Efficiency of supplementation (per cent.)} = \frac{\left(\frac{\text{Intake of D.O.M. from supplement}}{\text{Intake of D.O.M. from supplement}}\right) - \left(\frac{\text{Difference in pasture D.O.M. intake of supplemented vs. unsupplemented animals}}{\text{Intake of D.O.M. from supplement}}\right)}{\times 100}
\]

Thus if supplementation were 100 per cent. efficient in this context it would be found that there was no difference in the pasture intakes of the supplemented and unsupplemented animals running alone. That is, the supplement could exert maximum productive effect without substituting for pasture.

The “efficiency coefficients” are recorded in Table 1, together with the liveweight and the mean change in weight, over the period of each experiment, of the supplemented and unsupplemented animals.

| Table 1 |
|---|---|---|---|
| Efficiency of Supplementation * S.A. compared with US.A. | Liveweight (kg) | Liveweight Change ‡ (g per day) |
| Experiment | | S.A. | US.A. | S.A. | US.A. |
| 1 | +43 | 38·6 | 38·6 | -63 | -68 |
| 2 | -25 | 36·6 | 36·5 | +127 | +104 |
| 3 | i-17 | 41·8 | 42·0 | -13 | +50 |

* Efficiency of Supplementation—see text.

‡ Liveweight change as measured over the experimental period divided by the number of days in the period.
Mean grazing times of the treatment groups followed the same pattern in each experiment with S.A. < S.M. < US.M. < US.A. The percentage increase in grazing time of each group over the previous group in the series is given in Table 2.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Increase in Grazing Time (%)</th>
<th>S.M. compared with S.A.</th>
<th>US.M. compared with S.M.</th>
<th>US.A. compared with US.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24.0 *</td>
<td>+12.5 *</td>
<td>+4.0 N.S.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>+2.5</td>
<td>+2.5</td>
<td>+12.0 *</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>+6.0</td>
<td>+8.0</td>
<td>+16.0 *</td>
<td></td>
</tr>
</tbody>
</table>

* Difference significant at P < 0.05.

IV. DISCUSSION

The use may well be questioned of a regression equation, to estimate “intake factor,” developed from digestibility experiments with pasture species and not including a grain similar to that used in these experiments. Unpublished data (Holder 1959), however, have shown that the addition of oat grain to a diet of natural pasture fed to penned sheep did not improve the digestibility of the pasture portion of the diet. That is, the digestibility of organic matter in the mixed diet (native pasture and grain to the proportion 1 to 1·5), viz. 65·0 per cent., was closer to that of oat grain (76·5 per cent.) than that of the pasture only (42·5 per cent.) in proportion to the grain fed. Although it may reasonably be argued that the inclusion of oat grain in the diet could lead to a higher faecal nitrogen percentage, particularly in the faeces of sheep grazing the winter pasture, this could only lead to the use of a higher “intake factor” in calculation of total intake than is actually warranted. Thus there may be an overestimate of the total intake of the supplemented animals, but this would not invalidate the conclusions drawn from these experiments.

In all three experiments the marked substitution effect of the grain supplement was recorded, differences in pasture intake of the two groups running alone being highly significant. Even in Experiment 1, when the supplement alone group was losing weight and when the time was apparently available to increase daily grazing activity, the efficiency of supplementation was only 43 per cent.

The depression of pasture intake by the S.A. groups was paralleled by the marked depression of the grazing time of this group when compared with the US.A. group in Experiments 1 to 3.

Social interactions appear to have played a most important, though variable, role in the grazing behaviour and pasture intake of the sheep used in the
experiments. While the effect reported by Tribe (1950) was recorded in Experiment 1, there being a significant increase in the grazing time of S.M. sheep compared with those in the S.A. group, the trend in these experiments generally appears to be toward a reduction in the grazing time of the US.M. sheep, that is, a “social inhibition” effect appeared to be at work.

It would appear, therefore, that it is only in special circumstances, under practical farming conditions, that any beneficial effect on pasture intake of supplemented sheep may be obtained by running “decoy” unsupplemented sheep with them.

However, it is felt that the data presented should serve at least as a warning to workers designing experiments dealing with supplementary feeding of grazing sheep. Due recognition must obviously be paid to the social interactions which may be at work in a mixed group of supplemented and unsupplemented animals, and which could well affect interpretation of the data gained.

V. ACKNOWLEDGEMENTS

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VI. REFERENCES


