EFFECTS OF SUPPLEMENTS ON WOOL GROWTH RESPONSES OF MERINO, ROMNEY AND TUKIDALE SHEEP

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SUMMARY

During winter, the fleece production of carpet wool producing Tukidale ewes fed a grain-based ration was significantly greater than the growth by either Merinos (P < 0.01) or Romneys (P < 0.05). The response to the grain-based ration by Tukidales was also greater (P < 0.01) than their response to a protein-rich pellet ration. The Merinos consuming the pellet ration produced more wool per unit area than those consuming the grain or chaff rations. The Romneys were intermediate in their overall level of fleece production and their response to both the grain-based and protein pellet rations.

Keywords: carpet wool, wool growth, supplements.

INTRODUCTION

Wool production varies considerably throughout the year for most sheep breeds, due to factors such as nutrition, climate, physiological state, or a rhythm inherent to the breed (Doney 1966). A seasonal rhythm due to changes in photoperiod is absent in Merinos (Doney 1966) but has a substantial impact on Romneys (Hawker and Crosbie 1985; Woods and Orwin 1988) and their derivatives, the specialized carpet wool breeds (Reid 1981; Williams 1981; Sumner 1983).

During winter the photoperiod effect, possibly combined with a restriction on nutrition, causes a marked decline in the rate of fleece production by carpet wool sheep which is of concern to commercial producers (S. Keen pers. comm.). As carpet wool sheep are largely confined to the higher rainfall areas of south-eastern Australia, winter pasture is more likely to be restricted in quantity rather than lacking in quality. However, studies with Merino sheep indicated that increases in wool growth were only likely to occur when nitrogen supplements were offered (Reis 1969), particularly when the proteins or amino acids were reasonably well protected against microbial degradation in the reticulorumen (Ferguson 1972; Leng et al. 1984). Thus, this study sought to determine if the wool growth of carpet wool sheep would respond during mid-winter to feeding with rations containing relatively high levels of crude protein and available energy.

MATERIALS AND METHODS

The experiment was conducted on the University of New South Wales (NSW) field station at Hay in south-western NSW between 4 May and 30 August 1992. Sub-groups of 9 sheep were housed in 12 x 18 m pens, each of which contained shelter, a feeder and a water trough.

Animals

The experiment involved 27 Merino, Romney and Tukidale ewes which were drawn at random from groups of 34, 29 and 31. Initially the Merinos and Tukidales were 18 months old and the Romneys 30 months old, and had mean liveweights of 42.2, 46.1 and 51.1 kg, respectively.

Experimental design

The sheep were allocated by stratified randomization based on liveweight to one of 3 rations: oaten chaff (base ration), commercial sheep nuts of about 19% crude protein (pellet ration), and a mixture of 80% wheat grain and 20% oaten chaff (grain-chaff ration). There were 9 experimental groups: 3 each of Merino (base, pellet and grain-chaff), Romney (base, pellet and grain-chaff) and Tukidale (base, pellet and grain-chaff). On the basis of estimated metabolizable energy (ME) values for the rations, and the mean liveweight of the sheep assigned to each treatment group, the rations were offered at levels estimated to maintain constant liveweight (Clark 1977).

A week after the sheep were introduced to the bare yards, the experimental rations progressively replaced grass hay over 7 days. A program of feeding every third day was established over the next 7 days to encourage uniform intake between sheep.

Measurements

Three weeks after the intermittent feeding was established, a mid-side patch (c. 10 x 10 cm) was clipped on 5 randomly chosen animals in each of the 9 treatment groups. The patch was again clipped
and measured 4, 8 and 12 weeks later at the end of 3 experimental periods. Liveweights of all sheep were recorded after a 16-18 hour fast at monthly intervals throughout the experiment. All sheep were shorn and fleece weights recorded 2 days after the final clipping. Mid-side fleece samples were scoured and daily clean wool growth was estimated by dividing individual clean fleece weights in proportion to the average weights of clean wool clipped from the mid-side patches of sheep in the corresponding breed/ration group. Fibre diameter was measured by FFDA.

Statistical analyses

The data were analysed by split-plot analyses of variance using Harvey’s program (Harvey 1990), with breed and ration as main effects.

RESULTS

Samples of the experimental rations were estimated to have average crude protein percentages and ME (MJ/kg DM) values of 3.4 and 8.0 for the oat-ten chaff, 17.8 and 12.9 for the pellets, and 10.8 and 13.7 for the grain/chaff mix. As there were no feed refusals throughout the experimental periods, the overall loss of weight of sheep offered the base ration indicates an overestimation of ME value for the chaff, and the gain of liveweight of the sheep offered the grain-chaff ration indicates an underestimation of the ME value of the grain-chaff mixture.

Initial analyses of wool data showed a significant difference between period 1 and periods 2 and 3, indicating that wool growth had not fully adjusted to the experimental rations within the first 6 weeks. Thus, the results analysed and presented here are for periods 2 and 3.

Sheep consuming the grain-chaff and pellet rations grew significantly (P < 0.01) more wool per unit area of skin than those consuming the base ration. Of those consuming the grain-chaff ration the Tukidales grew more wool per unit area than the Merinos (P < 0.01) and the Romneys (P < 0.05). Within Merino and Romney groups, those consuming the pellet ration grew more wool per unit area (P < 0.01) than those consuming the base ration. Within Tukidales those consuming the grain-chaff ration grew more wool per unit area (P < 0.01) than those consuming either pellets or the base-ration, and the contrast of this with the higher production of Merinos consuming pellets resulted in a significant interaction.

Analysis of daily clean wool production per sheep did not show any significant differences due to either breed or ration as a result of the large variation between the 9 sheep in each group.

Tukidales produced significantly coarser wool than Romneys, which produced significantly coarser wool than Merinos, and both the grain-chaff and pellet rations supported coarser wool production than the base ration. Fibre diameter in the pellet-fed group of Merinos was greater (P < 0.01) than for the base group, with the grain-chaff-fed group intermediate (Figure 2). The grain-chaff-fed Romneys had the coarsest fleeces although the difference between the grain-chaff and pellet-fed groups was not significant. The grain-chaff ration produced the coarsest fibre in the Tukidales, being significantly coarser than both the base (P < 0.001) and pellet-fed (P < 0.05) groups. The significant (P < 0.05) breed x ration interaction arises from the large response to the g-am-chaff ration by Tukidales relative to the fibre diameter response by Merinos and Romneys.
Figure 2. Left: Fibre diameter (µm) of wool grown; Right: Liveweight change (g/hd.day); by Merino, Romney and Tukidale ewes fed oaten chaff (hatched bars), pellets (black bars) or a mixture of grain and chaff (white bars). The standard error of the LS mean is indicated in brackets above the bars.

Sheep fed the base ration had the lowest mean liveweights in all breeds, while the grain-chaff-fed sheep had the highest liveweights. The difference between sheep fed grain-chaff and the basic chaff rations was significant in the Merinos (P < 0.01) and Tukidales (P < 0.05). There were significant differences between the liveweights of all the basic chaff-fed groups (P < 0.01), and within ration comparisons all proved significant (P < 0.05) except for the comparison between the grain-chaff-fed Romneys and Tukidales. The period x ration interaction was significant (P < 0.05) due to changing liveweights during the course of the experiment and the marked variations in liveweight changes within groups, indicating large differences in individual intakes between the group-fed sheep.

When rations were considered as main effects, the grain-chaff ration produced greater liveweight increases than the base (P < 0.01) and pellet (P < 0.05) rations. The grain-chaff-fed Tukidales gained more liveweight than the basic (P < 0.01) and pellet-fed (P < 0.05) Tukidales (Figure 2).

DISCUSSION

While the feeding levels of each ration were intended to maintain constant liveweight for each group of sheep, the pre-experimental estimates of ME values obviously underestimated the true value for the wheat grain and overestimated the value for the oaten chaff. Thus, groups consuming the base chaff ration lost a small amount of liveweight, one pellet-fed group gained liveweight and the grain-chaff fed groups all gained liveweight.

Considered on a wool per unit area basis, Tukidales grew significantly more wool when fed the grain-chaff ration than when they were fed the other 2 rations. While the same group also grew the most wool in terms of g/hd.day, the complicating effects of liveweight, small group numbers and large within-group variation due to group feeding meant the result was not significant.

The large wool growth response by Tukidales to a grain-chaff ration was not expected in view of the considerable literature on wool growth responses in Merinos which makes clear the overwhelming importance of protein in the ration, or more specifically amino acids absorbed from the small intestine (Reis 1969; Ferguson 1972; Leng et al. 1984). It must be noted that both the grain based ration and the high protein commercial pellets had a relatively high ME value, and the proportion and nature of the grain in the pellets is not known. It was noted that the Tukidale response to the grain ration occurred while the Merinos were making their expected response in wool growth to the high protein pellets. In contrast, nitrogen in the high protein pellets may have been largely in the form of urea and its utilisation in the rumen may have been relatively inefficient.

The intermediate response of the Romneys to both rations is in keeping with reported wool growth
responses in Romneys. For example, although protected protein has been found to increase wool production in Romneys (Barry 1972), casein infusions into the abomasum do not appear to have the same effect as in Merinos (McClelland et al. 1986).

Increased fibre diameter and wool production, as a result of supplementary feeding are desirable responses in the carpet wool industry, where harshness is an important quality parameter, and the wool component of producer income is determined largely on fleece weight. As 80-90% of carpet wool fibre processed in Australia is imported, the indication that low levels of winter production may be increased substantially by adequate feeding, deserves further investigation.

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REFERENCES


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