SELENIUM STATUS AND WOOL PRODUCTION OF UNTREATED AND SELENIUM TREATED WEANER SHEEP WITH DIFFERENT GROWTH PATTERNS DUE TO STOCKING RATE

D W PETER*, D J BUSCALL, and P J REIS

SUMMARY

Weaner sheep, with an initially high selenium (Se) status, exhibited different patterns of body growth when grazed from late spring onwards for 329 days at a high (HSR) compared to a low (LSR) stocking rate on pasture with a low Se content. There were no marked differences in the concentration of Se in whole blood or plasma during the course of the experiment, due to difference in stocking rate. Further there were no body growth responses to selenium supplementation.

Wool production per head was significantly reduced and the incidence of tender plus cotted fleeces found by a normal wool classing procedure, tended to be higher at the HSR. Maintenance of the initially high Se status by treatment with intraruminal Se pellets did not influence wool production although it appeared to lower the incidence of tender/cotted fleeces. Subsequent more detailed visual and microscopic examination of a range of wool samples revealed various degrees of loss of staple strength, cotting and fibre shedding in most fleeces irrespective of SR and classing classification. Se treatment again appeared to reduce the occurrence and severity of these adverse features in fleeces.

INTRODUCTION

Hunter et al. (1982) suggested that the failure to observe an effect of selenium (Se) supplementation on the body growth and wool production of weaner sheep, with an "inadequate" Se status at weaning, during the summer/autumn period in south-western Western Australia may have been due to a general restriction on growth imposed by the poor quality of the pasture. They postulated further that in a minimal or negative growth situation dietary Se concentrations normally considered as inadequate may be sufficient to meet such animals' requirements and became inadequate only if positive growth occurred.

The present study was undertaken to investigate these proposals by examining whether differences in body growth resulting from differences in stocking rate and pasture availability/quality influenced the pattern of changes and levels of Se in plasma and whole blood of Se-supplemented and unsupplemented weaner sheep grazing low Se pastures. An examination of the effects of different growth rates and Se status on wool quality and quantity was also included in this study. Sheep with an initially high Se status were chosen for experimentation on the basis that any differences in the pattern of changes or levels of Se caused by different growth rates would be more readily observed.

MATERIALS AND METHODS

In early November, 1980, 100 recently weaned and shorn Merino wethers, from a large commercial flock (of high Se status) at Tammin, W.A., were transferred to the CSIRO research station at Bakers Hill. After weighing 20 animals, chosen at random, were introduced to each of four plots, designated P1, P2, P3 and P4.

* CSIRO, Division of Animal Production, P.O., Wembley, W.A. 6014.
** CSIRO, Division of Animal Production, P.O. Box 239, Blacktown N.S.W. 2148.
The remaining 20 weaners plus adult wethers were distributed throughout the plots to produce low (LSR) and high (HSR) stocking rates of 6.25 (plot P1 and P3) and 11.75 sheep/ha (P2 and P4) respectively. The HSR was subsequently reduced to 8.75 sheep/ha in mid-January, 1981.

Twenty nine days after the weaners were introduced to the plots they were reweighed, and treated with a cobalt pellet ('Permaco', ICI Pty Ltd). Ten animals in each plot were given a Se pellet (Webster & Son Pty Ltd) and the remaining 10 received a steel grinder. Live weights were monitored throughout the proceeding 300 days and in mid-October all sheep were shorn. Greasy fleece weights were recorded, the fleeces classified by a professional wool classer and a mid-side sample collected for measurements of yield and fibre diameter by the Australian Wool Testing Authority. Twenty samples, ten classed as tender and/or cotted and ten classed as normal (AAAM), were subjected to more detailed visual and microscopic examination.

Blood samples were collected from 3 untreated and 3 Se treated sheep from each plot prior to Se treatment and at several weighing times thereafter. Whole blood and plasma, together with pasture samples collected in November, March and August, were analysed for Se using a semi-automated procedure (Watkinson 1979).

RESULTS

Immediately prior to the beginning of the experiment, while the pasture was still partly vegetative, estimates of pasture availability in the four plots were as follows: 1710, 1390, 1800 and 1420 kg dry matter/ha for P1, P2, P3 and P4 respectively. The LSR plots contained a higher proportion of clover and a lower proportion of capeweed than the HSR plots. Pasture Se concentrations were lower in all plots in November, 1980, than in August, 1981, with the mean values for LSR and HSR plots respectively of 0.021 and 0.018 ppm in November and 0.032 and 0.031 ppm in August.

Differences in growth rate between stocking rate groups resulted in significant differences in live weight \((P<0.05)\) by mid-February (\(d\) 84), differences which were maintained until mid-August (\(d\) 278). Compensatory growth in the July to October period resulted in no significant differences in live weights in October (Fig. 1). The liveweights of neither HSR nor LSR groups were influenced at any time by Se supplementation.

As expected the concentrations of Se in whole blood and plasma were higher in Se-supplemented animals, but changes in values with time were similar within treatment groups at both stocking rates (Fig. 2). During the summer/autumn period there was a significant difference \((P<0.05)\) in blood Se levels at \(d\) 84 between the HSR and LSR, nil Se groups. Differences in plasma Se levels between SR groups occurred in spring in the nil-Se group at \(d\) 278 \((P<0.05)\) and in the Se-treated group at \(d\) 329 \((P<0.05)\).

Sheep at the HSR had significantly lower greasy fleece weights (GFW) \((P<0.05)\), lower clean fleece weights (CFW) \((P<0.1)\) and, according to normal classing procedure, a higher, though non-significant, incidence of tender and cotted fleeces. Yield and fibre diameter were not affected by SR. GFW, CFW, yield and fibre diameter were not affected by Se treatment though the incidence of tender and cotted fleeces tended to be lower (not significant) in the Se-treated sheep. The more detailed visual and microscopic examination of the 20 samples classed as normal (AAAM) or tender and cotted revealed a variable degree of loss of staple strength in the upper one third of the staple in 19 samples and likewise variable degrees of fibre shedding in 16 samples. The degree of loss of staple strength and fibre shedding appeared to be lower in Se treated sheep.
Table 1. Changes in mean (± SD) for various parameters of treatment.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treatment 1</th>
<th>Treatment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma Se Concentration</td>
<td>(μg/kg)</td>
<td>(μg/kg)</td>
</tr>
<tr>
<td>Whole Blood Se Concentration</td>
<td>(mg/mL)</td>
<td>(mg/mL)</td>
</tr>
</tbody>
</table>

Fig. 1. Changes in mean (± SD) for various parameters of treatment.

---

NS = non-significant; * = low; ** = high; *** = very high; **** = extremely high; ( ) = treatment effect; ( * ) = significant interaction between treatment and time point.
Despite the significant differences in the patterns of body growth the differences in plasma and whole blood Se concentrations between SR groups were not large though they were at times significant. Recent animal house studies, however, indicate that the response to changes in feed intake, and hence Se intake, and growth varies between tissues, with plasma and liver being the least responsive tissue (D. Peter, unpublished observations). The present results therefore do not preclude the possibility that differences in feed intake and/or quality may cause more significant changes in other tissues such as muscle, thereby resulting in effects of growth on the occurrence of Se-responsive conditions. Furthermore the differences in body growth observed in this experiment were presumably largely the result of differences in feed availability and hence intake. The effects of differences in growth rate due specifically to variations in pasture quality on Se metabolism and hence the adequacy of Se in tissues requires closer examination.

The failure to detect small alterations in staple strength, cotting and fibre shedding using a normal wool classing procedure or even by quantitative measurement such as fibre diameter is of potential economic importance. Likewise, the possible effects of Se status on staple strength, cotting and fibre shedding is potentially important, particularly since the Se status of unsupplemented sheep, except during the latter two months was considered to be "adequate". Furthermore the loss of staple strength and fibre shedding occurred in LSR and HSR sheep during a period when liveweight was being maintained or liveweight loss was minimal, respectively. These findings suggest that the immediate supply of energy or protein was not involved in the adverse effects on wool fibres in these animals and that some specific dietary components, not necessarily Se, may have been limiting. A more detailed investigation is therefore in progress to identify the exact time at which reductions in fibre strength commence in relation to diet quality and composition and live weight change and to examine further the effects of Se status on wool quality.

ACKNOWLEDGEMENTS

The authors wish to thank Messrs M. Palmer and R. Litchfield for assistance with statistical analysis, Mr. P. Young for Se analyses, Miss Susan Munro for detailed examination of wool samples and Mr. W. Thompson for assistance in the provision of experimental sheep.

REFERENCES
