HEAT STRESS MANAGEMENT OF MERINO SHEEP: RESPONSES TO DRINKING WATER TEMPERATURE AND A YEAST-BASED FEED ADDITIVE

by

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Declaration

I certify that the work presented in this thesis is, to the best of my knowledge and belief, original, except as acknowledged in the text.

I certify that the material has not been submitted, either in whole or in part, for a degree at this or any other university.

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Abstract

Conditions in the hot room in the climate-controlled housing used in this study were intended to simulate those experienced by Australian sheep in the post-discharge phase of the live export trade to the Middle East, i.e. 40°C and 60 % relative humidity between 0900 h and 1800 h and 30°C over night. Hot climatic conditions can lower an animal's production by altering physiological characteristics (body temperature, respiration rate, packed cell volume), behaviour (feed and water intake) and thereby affect feed digestibility, total excreta output and live-weight gain.

The use of a yeast-based feed additive reputed to reduce the effects of heat stress was investigated in 16 Merino sheep in Expt. 1. A 2 x 2 factorial design was used with 1 group of 8 sheep in a hot room and the other group in a cool room; 4 sheep in each room were offered lucerne pellets containing the yeast-based feed additive and the other 4 were offered only lucerne pellets. Outer body temperatures (wool, skin and ear) and also mean respiration rates were higher ($P<0.05$) for sheep in the hot room than those in the cool room. Dry matter intake of sheep was higher ($P<0.05$) in the cool room but only during the hottest hours (0900 to 1700 h). Water intake and urine production were higher ($P<0.05$) in the hot room whereas feed intake and faecal output tended ($P=0.07$) to be higher in the cool room.

The use of the yeast-based feed additive was beneficial, increasing growth rate of sheep ($P<0.05$). Respiration rate and other measurements were not influenced ($P>0.05$) by the use of the yeast-based feed additive.

In Expt. 2, the effects of providing drinking water at different temperatures was studied in Merino sheep offered lucerne chaff *ad libitum* in hot or cool conditions. Using a 4 x 4 Latin square design, 4 Merino wethers in each room were offered free access to drinking water at 20°C, 30°C or 40°C from single troughs or a choice of 20°C or 30°C from two separate troughs in each of 4 periods. Mean rectal temperatures and respiration rates of sheep during the hottest hours of the day were higher ($P<0.05$) in the hot room, but daily dry matter intake, DMI as % live weight, organic matter digestibility, microbial N flow to

the small intestine and N balance were lower ($P<0.05$) in the hot room; as a consequence, total faecal dry matter output in the hot room was higher ($P<0.05$) than that in the cool room. The efficiency of microbial synthesis did not differ ($P>0.05$) in sheep in hot or cold conditions; however, efficiency was higher ($P<0.05$) in animals drinking water 40°C than in those drinking cooler water. Total daily water intake and urine output were also higher ($P<0.05$) in the hot room.

In the hot room, total daily intake of drinking water at 40°C, 30°C and 20°C was 9.97 L/d, 8.78 L/d and 6.66 L/d, respectively; the values are different ($P<0.05$). Hot-room sheep prefer to drink hot drinking water at 30°C (6.71 L/d) than to drink cool drinking water at 20°C (1.18 L/d), $P<0.05$. The higher intake of hot water was surprising as hot drinking water could be expected to increase heat-load in sheep held in hot conditions. Other measurements were not affected by drinking water temperature. In the cool room, intake of 20°C water was higher ($P<0.05$) than of 30°C water (4.02 L/d vs. 2.65 L/d).

In Expt. 2, packed cell volume was not affected ($P>0.05$) by either ambient temperature or drinking water temperature.

The interaction between the inclusion of the yeast-based feed additive in the diet of heat-stressed Merino sheep and different drinking water temperatures should now be investigated.