Sheep Updates 2007 - part 4

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MANAGING CHANGE

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GRAZING

The impact of high dietary salt and its implications for the management of livestock grazing saline land

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ABSTRACT

Understanding the impact of high salt intake on ruminant health, physiology and performance, will help when estimating the production potential of revegetated saline land. The key findings from a series of experiments are as follows. (i) Feed intake is reduced markedly in sheep and cattle when dietary NaCl concentrations exceed 10%, with digestibility decreasing in sheep at 15% NaCl. (ii) When sheep are given a choice, they will select a high-salt diet (18.5% NaCl) over a low-salt alternative, if the latter diet provides insufficient protein and energy. However, in general, salt-tolerant plants are not high quality and supplementation with good quality feed is recommended. (iii) An extra 4 litres of fresh water is consumed for every 100 g salt ingested by sheep and cattle. (iv) Pregnant ewes can ingest high-salt diets without compromising pregnancy rates or lamb birth weight. (v) The offspring of ewes fed a high-salt diet (13% NaCl) during pregnancy have an altered response to salt ingestion. (vi) Poll Dorset (meat), Damara cross (arid) and Merino (wool) sheep do not differ markedly in their response to ingested salt. (vii) Cattle are able to perform at least as well as sheep on high salt diets. (viii) Production differences due to high salt intake are associated with hormonal changes and an altered rumen microbial population. Overall, the experiments have shown that different breeds of sheep and cattle can be productive under saltbush grazing systems, especially if an alternative low-salt feed and fresh water are made available.

BACKGROUND AND AIMS

Revegetation with saltbush (*Atriplex* sp.) is promoted in the management of dryland salinity in Australia (Barrett-Lennard *et al.* 2005), but to add economic value it needs to be integrated with the production system. For example, saltbush could be particularly beneficial during the summer/autumn feed gap as part of a feeding program for pregnant ewes, provided there are no detrimental effects on the ewes or their offspring. As salt-tolerant shrubs (e.g. saltbush and bluebush) can contain over 20% salt in their edible parts (Wilson 1975), it was necessary to determine how much salt could be tolerated by grazing livestock without compromising animal health and performance. The impact of salt on water requirements, feed intake and dietary preference was also of interest, to inform better grazing practices for revegetated land. Finally, an understanding of adaptation mechanisms in terms of rumen function and the physiological systems that control water balance, salt excretion and energy metabolism, was considered important to estimate the capacity of sheep to cope with high-salt diets.

METHODS

Several experiments were conducted to measure the impact of high salt intake on health, production and physiology, in cattle and various breeds of sheep. Young growing ruminants were offered either pellets containing various amounts of salt in the form of NaCl or KCl (up to 25%), a set amount of salt to mimic that of sheep consuming saltbush and interrow pasture (usually 20% NaCl), or a choice of a high-salt feed (20% NaCl) and various low-salt alternatives. Pregnant ewes were fed
a 13% NaCl diet either throughout pregnancy, or during the last 2 months, at energy and protein levels sufficient to maintain conceptus-free live weight. Pregnancy rates, lamb birth weight and lamb survival were used to assess their reproductive success. The offspring from these ewes were tested for their capacity to handle ingesting a large amount of salt. Blood samples were taken to measure hormones that control energy balance, such as insulin, from a number of these experiments. In some production experiments, samples of rumen fluid were analysed using a combination of biochemical, microbiological and molecular technologies.

RESULTS AND DISCUSSION

In both cattle and sheep, there was a marked and progressive decrease in intake when dietary NaCl concentrations exceeded 10%. This decline was more noticeable if the diet was highly digestible, and represents a salt intake threshold of between 120 g and 200 g NaCl/day for young wethers, and about 870 g NaCl/day for Angus steers above which intake decreases. There was no marked difference in response between Merino sheep, an arid cross-breed (Dorper x Damara), and a British meat breed (Dorset x Border Leicester). Organic matter digestibility was also depressed by up to 5% when sheep were fed more than 15% NaCl, but this did not occur in cattle. Both sheep and cattle drank an additional 4 litres of water per day, for every 100 g of salt ingested. Sheep offered a high-salt diet with a low-salt alternative actively selected a combination of the two to meet their nutritional needs. However, they ate little of the low salt alternative if the digestibility was below 52%. Liveweight gain reflected feed intake and digestibility changes, but the efficiency of wool growth actually increased with increased salt intakes.

Homeostasis was also disturbed by high intakes of NaCl. Specifically, circulating concentrations of both insulin and glucose were reduced, over and above any effect caused by reduced feed intake alone. Although these changes do not explain the reduced feed intake, they are consistent with the reduced fat in the carcasses of saltbush-fed sheep.

When fed high-salt diets both cattle and sheep had increased intra-ruminal salt concentrations and reduced pH, ammonia and volatile fatty acids concentrations. Overall, bacterial numbers were reduced in cattle, but not in sheep. Both species had bacterial populations that can tolerate 5% salt, with these populations becoming more abundant when sheep consumed a high-salt diet. Bacterial diversity was unchanged in cattle, but preliminary results indicate reduced diversity in sheep. This suggests that cattle and sheep may adapt to dietary salt differently, to achieve similar levels of performance. The different adaptive responses may have implications for how to best supplement the two different species when there are high levels of salt in their diet.

Pregnancy rate, lamb birth weight and lamb survival were not affected when ewes consumed the high-salt diet or saltbush. Pregnant ewes fed high-salt diets drank more, but maintained their water balance, suggesting that grazing high-salt forages does not compromise the health of ewes. Their offspring did not develop a preference for salt, and when fresh water was freely available, they had the same capacity to excrete salt as normal lambs. However, when fresh drinking water was limited, these lambs had a greater capacity to excrete ingested NaCl.

CONCLUSION

Diets that exceed 10% NaCl cause reduced feed intake and liveweight gain, and have a detrimental effect on rumen function, but no negative effect on reproduction. However, salt below 10% of dry matter does not affect health or production parameters significantly. Therefore, it should be possible to maintain animals on high-salt feeds, provided they are supplemented with some low-salt feed of medium to good quality. The increase in wool growth efficiency with increased salt intake may offer strategic options for specialist wool producers. We observed no clear advantage in any specific sheep breed, with respect to their tolerance for salty diets. Although our data are limited, they indicate that cattle cope with high-salt diets at least as well as sheep. In conclusion, grazing sheep or cattle on saltbush could improve the value of revegetated saltland, providing the animals’ level of salt intake is controlled, and fresh water is in good supply. Additional salt in the water will likely compromise production.
KEY WORDS
Reproduction, metabolism, rumen function

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REFERENCES

Sustainable Grazing on Saline Lands – outcomes from the WA1 research project

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ABSTRACT
Overall, the revegetation of saline land in the low to medium rainfall zone of south-western Australia offers benefits to producers in the form of economic returns from animal production systems and improved environmental health. The benefits were highest at the least saline of the two experimental sites where we have been able to support 3 to 4 times more grazing days/ha in summer/autumn from alleys of saltbush with salt-tolerant annual legumes than from unimproved saltland. The outcomes from this study are exciting as they suggest that profitability and positive environmental outcomes can be achieved concurrently and supports the use of multidisciplinary research approaches.

AIMS
Dryland salinity is a major threat to agriculture in southern Australia. Halophytic chenopods such as saltbushes (Atriplex species) are planted on an estimated 30 000 ha of saline and waterlogged soils in south-western Australia. Being both perennial and active in the summer and autumn, saltbushes have the potential to reduce the recharge of water tables in saline discharge zones and provide out-of-season feed for livestock. The aim of this research project was to develop options for livestock production from saline land that are profitable and reduce negative environmental and social impacts from saline land. The research team included producers, hydrologists, plant and animal scientists, ecologists and economists. We focussed on systems incorporating saltbushes in the low to medium rainfall zone. Specific objectives were to; (a) determine the feeding value for sheep and wool production of grazing saltbush and saltbush plus improved pastures in autumn; (b) determine the financial return from these systems; (c) understand the environmental impact of saline grazing systems on water balance and biodiversity at paddock scales.

METHOD
This project utilised two research sites in Tammin and Yealering from 2002 to 2007. Both sites had similar long-term average annual rainfall (342-362 mm) and the major difference between the sites was in soil salinity. The plots at Tammin were the saltiest with 178 to 256 kg/m² of salt in the top 1.5m of soil whereas the plots at Yealering ranged from 89 to 109 kg/m² of salt in the top 1.5m of soil. The experimental treatments that were explored at the sites included; large plots of mature saltbush and volunteer understorey, large plots of mature saltbush and sown (legume based) understorey, large plots of unimproved saltland pasture, large plots of new plantings of saltbush and sown understorey (to assess the establishment phase), and small scale pasture agronomy/demonstration plots of new and existing plant species. Adjacent remnant vegetation at Tammin was used for some biodiversity comparisons.

At the Yealering site, two paddocks (52 ha each) were hydrologically isolated using banks with flumes at the water exit points to compare water and salt export from two of the experimental treatments (unimproved saltland with newly revegetated saltbush alleys with an annual legume understorey). At both sites soil salinity, deep and shallow water tables and evapotranspiration were monitored. Plots at both sites were grazed each summer/autumn with weaner Merino sheep and liveweight and wool growth were measured. Plant biomass production and nutritive value was measured each summer prior to grazing and at peak biomass in spring. Biodiversity measurements included plant and invertebrate diversity, microbial respiration and ‘Landscape Functional Analysis’. Profitability of the systems was assessed using the Central Wheatbelt MIDAS economic model, which had been
modified to incorporate actual saltbush and understorey growth, nutritive value of all plants as well as some tools to predict diet selection and salt intake.

**RESULTS**

**Livestock Production**

There was a large difference between the research sites in the size of improvement that was achieved after planting saltbush and annual legumes. The Yealering site demonstrated the largest difference between a saltbush-based pasture and unimproved saltland (that was mostly barley grass). In summer/autumn 2006, the saltbush and sown understorey area contained more edible dry matter, provided 2.9 times more grazing days per ha and resulted in more clean wool growth/ha than unimproved saltland. In summer/autumn 2007, after a poor growing season, the saltbush and legume understorey had a higher relative value than the previous year with 4 times more grazing days per ha over the unimproved pasture. At Tammin, the more saline site, the differences between unimproved saltland and mature saltbush stands with volunteer understorey were small. Sheep in the saltbush and volunteer understorey plots at Tammin achieved an average of 3.50 grazing days/ha and grew 3.14 kg/ha of clean wool. The data from Tammin also suggest that the relative value of saltbush is highest following a poor growing season. Within-plot analysis at Tammin demonstrated that plant cover, feed on offer and legume content were negatively correlated to salinity and waterlogging. The most successful legumes at both sites were balansa clover, burr medic, woolly clover and barrel medic.

**Water use**

There is evidence that the saltbush at Yealering enhanced evapotranspiration within plots (particularly in summer), thus acting as ‘biological drains’. However due to a series of dry years and the immaturity of the saltbushes at the Yealering site, we are reluctant to draw firm conclusions at this stage. It also appears that the soil under the saltbush at Yealering may be starting to show increased drying and a decline in the shallow watertable. At Tammin there was no difference in evapotranspiration between unimproved and revegetated saline land.

**Biodiversity and landscape function**

Overall, the biodiversity data offer mixed messages regarding ecosystem function and diversity. For example, while we could not link increased plant diversity to revegetation of saline land, it is apparent that saline land in itself is inherently diverse. The site at Tammin supported more than 50 plant species of which almost half were native. Soil collected from the saltbush plots had the highest microbial respiration rate of all plots. Maintaining annual cover in saltbush plots was associated with positive impact on landscape function. The invertebrate data suggests that saltland can provide habitat to a large range of orders however differences associated with revegetation of saltland were small.

**Economic returns**

The productivity data from the less saline site at Yealering, when incorporated into MIDAS, showed an increased total farm profit by approximately $12 000 or $60.70 per ha of saltland. The model ‘grazed’ the saltland in October/November as well as May/June. Sites of moderate to high salinity such as Tammin yielded marginal economic returns and the cost of pasture establishment is critical. The MIDAS model ‘grazed’ the saltland in May and June. This economic analysis does not quantify environmental benefits and other benefits such as deferring annual pastures until after the break of season, protecting soils through feed lotting sheep on saltland or vitamin E.

**CONCLUSION**

Revegetation of saline land with saltbush alleys and salt-tolerant annual legumes can be profitable and improve the environment though reduction of water table recharge in the discharge zones. Site selection is very important as the returns from saltbushes and salt-tolerant annual legumes declined as the degree of salinisation increased. A range of activities are planned to explore new grazing systems, different classes of livestock, new and better plants and to continue hydrological monitoring of the Yealering site though the CRC for Future Farm Industries.

**KEY WORDS**
ACKNOWLEDGMENTS

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MEAT QUALITY

Development of intramuscular fat in prime lambs, young sheep and beef cattle

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ABSTRACT
Intramuscular fat (%) increases relatively slowly with carcase fatness (and weight) until a carcase fatness of about 35% is reached. This level of fatness is not compatible with profitable production systems for prime lambs and so there is no point in over conditioning lambs (beyond the minimum desirable fat score 2) in an effort to achieve eating quality benefits. Premiums paid for marbled beef in some markets allow production systems with fatter cattle to be profitable. Finally genetic selection for intramuscular fat can powerfully shift fat distribution toward the intramuscular site.

AIMS
Intramuscular fat is associated with juiciness and flavour of meat and so is one determinant of eating quality. The aims of this work were to (i) understand the maturity pattern of intramuscular fat deposition and (ii) compare intramuscular fat deposition in prime lambs, beef cattle and pigs.

METHOD
The data sets that were analysed to produce the results have been obtained from published serial slaughter experiments where defined groups of animals have been grown from light to heavy weights. The primary sources of data were obtained from: Australian Angus cattle (Pugh et al. 2005), Japanese Black x Holstein cattle (Aoki et al. 2001), Australian prime lambs/hoggets (Hopkins et al. 2007) and Australian modern pig genotypes (D’Souza et al. 2004). All data sets had measures of intramuscular fat (%) in the loin muscle and estimates of total carcase fatness based on either dissection or DXA scanning technology.

RESULTS

| Figure 1. Relationship between loin fat (g) and total carcase fat (as a proportion of maturity) in lambs and young sheep. | Figure 2. Relationship between carcase fat (%) and intramuscular fat (%) in the loin of Angus and Japanese × Holstein (JB × Hol) beef cattle, lambs/sheep and the modern pig. |
The development of intramuscular fat as a depot in the loin of lambs/sheep is clearly early maturing in relation to total carcase fatness as a proportion of maturity (Figure 1). However the expression of intramuscular fat (%) is late maturing in selected cattle breeds (Figure 2). In the Australian cattle, sheep and pig breeds, intramuscular fat increases relatively slowly as carcase fatness (and also carcase weight) increases until about 35% carcase fatness. The Japanese Black cross cattle show an increase in intramuscular fat at all levels of carcase fatness compared to all other species/breeds. Pigs show the lowest levels of intramuscular fat at all levels of carcase fatness.

**CONCLUSION**

A common conclusion from previous animal development studies is that intramuscular fat is late developing compared to other carcase depots. This is clearly not correct in lambs/sheep (Figure 1) or in cattle (Pugh et al. 2005) when results are expressed as the weight of fat in muscle relative to weight of fat in the carcase. Of course the final trait, intramuscular fat (%), is late maturing since it is the result of continued fat synthesis and declining muscle accretion. Despite the heterogenetic nature of the experiments, variations in methodologies and that only carcase fatness has been reported, there is a compelling case that intramuscular fat (%) is related to total adiposity (and by difference muscularity). Excluding the Japanese Black cross cattle, it is clear that intramuscular fat (%) increases relatively slowly as animals fatten until a carcase fatness of about 30-35% is reached. At least for prime lambs and pigs, such levels of fatness are well beyond the limits that are compatible for profitable production systems and also consumer expectations for low level of salvage fat surrounding retail meat cuts. In the case of prime lambs there is virtually no eating quality gain associated with over fattening lambs and the minimum desirable fat score of 2 is enough. Premiums paid for marbled beef in some markets allow production systems with fatter cattle to be profitable. Clearly the Japanese Black cross cattle stand out as being very different since they develop intramuscular fat more strongly at lower levels of carcase fatness and this is the only breed in the data set to have undergone prolonged genetic selection for increased intramuscular fat.
An interesting observation in the study of Hopkins et al. 2007 was the higher IMF levels due to the influence of Border Leicester genes, but the practical differences were small. These results emphasize the potential for genetic manipulation to shift the emphasis of fat deposition from one depot to another.

KEY WORDS
Beef, Lamb, Pork, Intramuscular Fat, Marbling

ACKNOWLEDGMENTS
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Referred by David Hopkins

REFERENCES


Importance of drinking water temperature for managing heat stress in sheep

Savage DB, Nolan JV, Godwin IR, Aoepah A, Nguyen T, Baillie N and Lawler C
University of New England, Armidale, NSW, Australia

ABSTRACT

Australian sheep are transported to the Middle East where excessive temperatures (>45°C) can cause heat stress and inappetence, compromising the welfare of animals in the post-discharge phase of an industry worth $1.8 billion annually (Hassall and Associates 2006). There is little published research on the importance of drinking water temperature in managing heat stress in sheep. There are also no recommendations. Recommended water temperatures for cattle in hot climates are 16 to 18°C (EA Systems 2004). This study found that as drinking water was increased from 20°C to 40°C water intake increased and that sheep prefer to drink water of 30°C rather than 20°C in hot climates. These are new findings with important implications for the industry.

AIMS

In the post-discharge phase of the live-export trade of sheep to the Middle East region, stock drinking water temperatures exceeding 40°C have been observed during the summer months. The aims of this study were to test two hypotheses:

Hypothesis 1: Merino sheep will have higher intake of cool water than hot water in hot conditions.

Hypothesis 2: Merino sheep will prefer to drink cooler water (20°C) rather than warm water (30°C) in hot conditions.

METHOD

An experiment was carried out at the University of New England, Armidale with eight Merino wethers (47.01 ± 3.5 kg) randomly allocated to four individual metabolism crates in each of two rooms (cool room: 20°C continuously; hot room: 40°C daytime and 30°C nighttime). The four sheep in each room were allocated to four drinking water treatments (20°C, 30°C, 40°C and a choice of 20°C or 30°C) in a 4x4 Latin Square design (4 treatments x 4 periods). Sheep were rotated within each climate room at the conclusion of each period (4 sheep x 4 treatments).

Sheep were offered lucerne chaff and drinking water ad libitum in individual troughs. Room temperature and humidity and sheep rectal temperature and respiration rate were measured continuously (10 records/sec) with computer data logging equipment. Feed intake and water intake was measured four times daily for each animal. Faecal and urine production was measured daily for each animal. Sheep were weighed at the commencement of the experiment, at the conclusion of the adaptation period and at the end of each of the four periods (total = 6 liveweights).

Data were analysed for the main effects of ambient temperature, temperature of drinking water and the interaction effect of the two factors. The statistical analyses were undertaken using Genstat. The General Linear Model (GLM) was used with Analyses of Variance (Anova) for further analyses to compare the difference among treatments.

RESULTS

Mean respiration rate of sheep in the hot room (206 breaths/min) was higher (P<0.05) than for sheep in the cool room (149 breaths/min). Mean rectal temperature of sheep across the experimental period in the hot room (40.7°C) was higher (P<0.05) than for sheep in the cool room (40.0°C).

Mean daily dry matter intake of sheep was higher (P<0.05) in the cool room (1578 g) than in the hot room (1136 g). Dry matter intake expressed as a percentage of sheep liveweight was higher (P<0.05) for sheep in the cool room (3.0%) than in the hot room (2.4%). There was no difference in liveweight change of sheep between the hot room and the cool room (Table 1).
Total daily water intake of sheep was higher (P<0.05) in the hot room (8275 g) than in the cool room (5826 g). Total daily faecal production (dry matter basis) of sheep was higher (P<0.05) in the cool room (598 g) than in the hot room (443 g). Total daily urine production of sheep was higher (P<0.05) in the hot room (4588 g) than in the cool room (2248 g). Neither mean daily dry matter intake nor mean daily dry matter intake, expressed as a percentage of liveweight, were affected by water temperature. Faecal production was not affected by water temperature. Dry matter digestibility and organic matter digestibility were not affected by water temperature.

Table 1 Comparison of mean liveweight change, daily dry matter intake (DMI), water intake and faecal and urine production for sheep housed in a cool room (20°C) or a hot room (40°C daytime; 30°C nighttime).

<table>
<thead>
<tr>
<th>Livewt chg (kg)</th>
<th>DMI (g/d)</th>
<th>DMI (% livewt)</th>
<th>WI (ml/d)</th>
<th>Faeces (g DM/d)</th>
<th>Urine (g/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool room</td>
<td>-1.1</td>
<td>1578&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5826&lt;sup&gt;a&lt;/sup&gt;</td>
<td>598&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Hot room</td>
<td>-0.5</td>
<td>1136&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8275&lt;sup&gt;b&lt;/sup&gt;</td>
<td>443&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>ab</sup> Means within columns are different (P<0.05)

Within the cool room, drinking water temperature did not affect water intake. However, in the hot room, total daily water intake tended (P<0.06) to increase as water temperature increased (Figure 1). Analyses of the water preference data revealed that in the hot room, sheep drank more (P<0.05) 30°C water (6708 g/d) than 20°C water (1185 g/d). In the cool room, water intake was higher (P<0.05) from the 20°C water (4024 g/d) than from the 30°C water (2646 g/d) (Figure 2).

**CONCLUSION**

This study has rejected both hypotheses. Sheep tended to drink more from the troughs with hotter water. It seems that sheep prefer to drink water at temperatures close to ambient temperature in the hot climatic conditions typical of the summer months in the Middle East region. This is a new finding that establishes the need to determine whether the preference for hot water in hot climates has a positive or negative impact on the heat load of sheep.

**KEY WORDS**

Heat stress, Merino wethers, drinking water temperature

**REFERENCES**
EWE MANAGEMENT TOOLS

E-sheep Management of Pregnant Merino Ewes and their Finishing Lambs

Ken Geenty\textsuperscript{A}, John Smith\textsuperscript{A}, Darryl Smith\textsuperscript{B}, Tim Dyall\textsuperscript{A} and Grant Uphill\textsuperscript{A}

\textsuperscript{A} Sheep CRC and CSIRO Livestock Industries, Chiswick, NSW
\textsuperscript{B} Turretfield Research Station, SARDI, Roseworthy, SA

ABSTRACT

Development of a semi automated e-sheep system for precision management of pregnant Merino ewes and their finishing wether lambs is outlined. The system used radio frequency eartags and fixed weighing for automatic tag reading and data capture. It incorporated an algorithm for prediction of pregnant ewe maternal body weights and determination of auto-draft instructions for targeted feeding of lupins to ewes as required. Predicted turnoff date for a pre-determined proportion of wether lambs was done using Lamb Growth Predictor software. Predicted ewe maternal body weights showed 5.7 kg and 3.6 kg less decline during pregnancy days 40-120, at Chiswick and Turretfield respectively, compared with controls. Wether lamb growth rates to eight months of age determined that 72\% of the 173 lambs would reach the target turnoff slaughter weight of 48 kg by 10 months of age. This semi automated e-sheep system allowed targeted feeding of ewes and predicted turnoff date for their finishing lambs according to live weight targets and is considered a forerunner for fully automated e-sheep systems.

AIMS

The goal was to develop management systems using e-sheep principles for cost effective and targeted feeding of pregnant Merino ewes and their finishing lambs. This project aimed to develop semi-automated data capture and auto-drafting as a forerunner to fully automated systems with minimal labour input.

METHOD

The project was replicated at CSIRO Chiswick and SARDI Turretfield.

Animals and treatments

A total of around 380 Merino ewes pregnant to AI were used at each site. They were allocated by restricted randomization after pregnancy diagnosis to precision management and control groups run together as one mob. All ewes were fitted with radio frequency eartags and live weights were monitored twice weekly using fixed weighing. Body condition scores were assessed monthly by palpating the loin area. From around days 50 to 120 of pregnancy precision managed ewes were auto-drafted to lupin grain supplement, as determined using a prediction algorithm outlined below, while the remainder including the control group grazed a base pasture maintenance diet. Following weaning the wether lambs were fitted with radio frequency eartags and live weights were monitored by weekly (Chiswick) or fortnightly (Turretfield) fixed weighing.

Ewe and lamb live weight targets

Maternal ewe body weights were estimated as actual live weight less the sum of the predicted weights of conceptus and greasy fleece. The decision to draft individual ewes in the precision managed group to lupin supplement was based on her maternal weight/condition score relative to the target condition score. The algorithm was written in Excel and adapted from Program 1.5.3 within the Sheep CRC and is based on procedures used in GrazFeed and GrassGro (Freret al., 1997). It consisted of five steps detailed by Geenty et al. (2007).

A lamb live weight target of 48kg was set for slaughter turnoff at 8-10 months of age at both sites. The Lamb Growth Predictor, developed by Jess Richards and Kevin Atkins in the Sheep CRC, was used...
to predict various slaughter turnoff times for different proportions of lambs from previous weight changes.

*Equipment and layout*

The yard layout included two holding pens for up to 400 ewes with fixed and walk over weighing platforms in parallel for entry to the second yard which also contained a watering point. A third smaller yard adjacent contained the lupin grain feeders and a water trough. Spear gates allowed animal access back out to the main paddock from the second and third holding pens. This layout was a continuous loop. Ewes could voluntarily pass over the walk over weighing platform, for access to water and/or lupin grain when the drafting instruction allowed, then return to the paddock and base pasture ration. The fixed weighing simply used the same loop twice weekly. More detail on this layout is given by Geenty et al. (2007).

**RESULTS**

*Ewe live weight changes*

Ewe live weight changes, including weight of conceptus and fleece, and predicted maternal body weights, are shown for precision and control groups at Chiswick in Fig. 1.

![Fig. 1: Ewe live weight and maternal body weight changes from conception and during the treatment period from days 40 to 120 of pregnancy.](image)

The difference between ewe live weight and predicted maternal body weight at day 120 of pregnancy was similar in both precision and control groups being 5.3 kg at Chiswick and 8.5 kg at Turretfield.

At both sites the difference in maternal body weight between precision managed and control ewes was minimal during early pregnancy but by day 120 of pregnancy precision managed ewes were 5.7 kg heavier than control ewes at Chiswick (P<0.01) and 3.6 kg heavier at Turretfield (P<0.05). Following parturition body weight differences between precision managed and control groups declined at lamb marking at 4-5 weeks at both sites to around 2.00 kg and to 0.7 kg at weaning at 10-12 weeks as the ewes gained weight.

*Lamb live weight changes*

Mean live weight changes of wether lambs at Chiswick, offered pasture and lupin grain *ad lib.*, are given in Table 1.

**Table 1:** Progressive lamb live weight means and maximum (Max) and minimum (Min) values (kg) for Chiswick wethers to 8 months of age
<table>
<thead>
<tr>
<th>Weigh date</th>
<th>30/4/07</th>
<th>9/5/07</th>
<th>15/5/07</th>
<th>21/5/07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of lambs</td>
<td>173</td>
<td>173</td>
<td>173</td>
<td>173</td>
</tr>
<tr>
<td>Min</td>
<td>27.0</td>
<td>28.8</td>
<td>27.2</td>
<td>30.8</td>
</tr>
<tr>
<td>Max</td>
<td>45.6</td>
<td>49.4</td>
<td>51.0</td>
<td>52.8</td>
</tr>
<tr>
<td>Mean</td>
<td>35.0</td>
<td>38.4</td>
<td>37.8</td>
<td>40.3</td>
</tr>
</tbody>
</table>

Based on the above live weight gains the Lamb Growth Predictor estimated 124 lambs, or 72% of the total, would reach average turnoff weight of 48 kg by 15 July 2007 at around 10 months of age.

**CONCLUSION**

The e-sheep system developed has allowed semi automated data capture and management to maintain maternal body weight of pregnant ewes and prediction of turnoff date for a given proportion of their wether lambs. This allows precision management with more effective targeted feeding and is a forerunner to fully automated e-sheep systems with reduced labour input.

**KEY WORDS**

e-sheep, precision management, pregnant ewes, lamb finishing

**ACKNOWLEDGMENTS**

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**REFERENCES**


Is it important to manage ewes to CS targets?

John Young, Farming Systems Analysis Service, Kojonup, WA

ABSTRACT

The Lifetimewool project is a flagship project for AWI with aims to determine the optimal allocation of feed resources and develop profitable ewe management guidelines for woolgrowers across Australia. The project has developed relationships between the condition score profile of the ewes and the survival and production of their progeny. This information has been used in the economic component of the project to develop CS targets for ewes. MIDAS was selected as the modelling tool for the economic component of the project because it represents the whole flock and it includes a powerful feed budgeting module that optimises animal and pasture management across the whole farm.

For a spring lambing flock including the production relationships alters the outcome about the most profitable nutrition strategy for ewes. The targets are to join in CS 3, allow slow loss of condition to day 90 and regain the condition back to CS 3 by lambing. The targets for an autumn lambing flock are not affected by including the production relationships and the targets are to join ewes in CS 3, allow ewes to lose 0.4CS up to day 90 and regain the condition after lambing.

AIMS

The Lifetimewool project has developed relationships between the condition score (CS) of ewes at critical times of the year and the survival and productivity of their progeny. Ewes that are in better condition at joining will have progeny that cut more wool and are heavier at birth. Gaining (losing) condition between joining and day 90 of pregnancy and between day 90 and lambing results in progeny that are heavier (lighter) at birth and cut more (less) wool that is finer (broader) (See Table 1 for the magnitude of the changes measured). Twin born progeny that are heavier at birth have a higher survival in the first 48hrs after birth.

<table>
<thead>
<tr>
<th></th>
<th>CFW (kgs)</th>
<th>FD (μ)</th>
<th>Birth Weight (kgs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ewe CS at Joining</strong></td>
<td>0.10</td>
<td>0.0</td>
<td>0.27</td>
</tr>
<tr>
<td><strong>Ewe CS change</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 0-90</td>
<td>0.19</td>
<td>-0.31</td>
<td>0.33</td>
</tr>
<tr>
<td>Day 90-lambing</td>
<td>0.19</td>
<td>-0.36</td>
<td>0.45</td>
</tr>
</tbody>
</table>

The aim of the economic component of the project was to utilise this information and determine the optimum CS targets for ewes lambing in spring and ewes lambing in autumn.

METHOD

The calculations were done using the Great Southern version of the MIDAS model (1). The features of MIDAS that make it suited to this task are that the model includes the value of production of the whole flock and it also includes a powerful feed budgeting module that optimises animal and pasture management across the whole farm.

The model represents a ‘typical’ 1000ha farm in the Great Southern region of Western Australia. The analysis is based on a self replacing merino wool producing flock utilising a medium wool genotype and running 6500 ewes. Surplus ewes and all wethers are sold as hoggets off shears at 1.5 years old. Cast-for-age ewes are sold at 5.5 years. The pasture production is based on a mixed sub-clover, annual grasses and herbs pasture typical of farms in the region.
RESULTS

Including the biology that has been quantified as part of the Lifetimewool project in the economic analyses alters the outcome about the most profitable CS targets for July/Aug lambing ewes. The optimum targets are allowing slow loss of condition during early pregnancy and then regaining the lost condition on green feed prior to lambing. Achieving these CS targets for ewes at day 90 and lambing increases profit by up to $46 000/farm (Figure 1). Achieving the lambing target ($28 000) is relatively more important than achieving the day 90 target ($14 000 - $16 000) so if the condition cannot be regained on green feed after day 90 then it is better to maintain condition between joining and day 90.

![Figure 1: Change in profit if CS targets aren’t achieved (July/Aug lambing).](image)

The target at joining (not shown in Fig 1) is less important for profit than both the day 90 target and the lambing target with a value less than $6 000 per farm. However, allowing ewes to be light at joining results in the minimum CS of the ewes at day 90 being lower with resultant higher death rates of ewes and lambs. This effect would be magnified in a poor year and therefore aiming for CS 3 at joining has a lower risk than aiming lower. If higher CS is volunteered in a good season this will increase profit.

The optimum profile for autumn lambing flocks (join ewes in CS 3, allow ewes to lose 0.4CS up to day 90 and regain the condition after lambing) is unchanged by inclusion of the Lifetimewool effects. This is because there are only limited opportunities to adjust the ewe profiles other than by using grain feeding and this is more costly than the benefits received from improved survival and production.

CONCLUSION

The optimum targets for a spring lambing flock are to join in CS 3, allow slow loss of condition to day 90 and regain the condition prior to lambing. This profile has a high profitability and the survival of ewes and progeny is high. The optimum targets for an autumn lambing flock is to join in CS 3 or higher, allow slow loss of condition to day 90 and then maintain to lambing. The difference in profit between profiles for the autumn lambing flock is smaller than for spring, so the targets are less critical.

Decision support tools are currently being developed that will allow the profitability of achieving CS targets for individual flocks to be calculated.

KEY WORDS

Ewe nutrition, MIDAS, economics

ACKNOWLEDGMENTS

This work was funded by the Lifetimewool project. Lifetimewool is a national project, supported by Australian Wool Innovation, Dept. of Primary Industries Victoria, Dept. of Agriculture and Food WA, SA Research & Development Institute, NSW Dept. Of Primary Industries, Tas Dept of Primary Industries,
Austral Park; Coleraine, Billandri Poll Merino Stud, Kendenup and over 120 producers across southern Australia.

Paper reviewed by: Andrew Thompson (Department of Agriculture & Food WA)

REFERENCES
MULESING

Mulesing Accreditation – Vital for Wool’s Future
Dr Michael Paton, Department of Agriculture and Food WA, Perth.

ABSTRACT
Many sheep managers, wishing to carry out mulesing before 2010, may wonder why they should expend the time and expense of becoming accredited, as they will only continue to mules lambs until 2010 at the latest. The Australian wool industry has made commitments to our trading partners and to clothing retailers that mulesing operators will be accredited by the end of 2008 and will comply with new mulesing standards. It is likely that the markets will require some audited evidence that mulesing operators have been accredited as required. Failure to meet these targets may have significant negative effects on retailers already sensitised by adverse publicity on mulesing.

HISTORY
On 8 November 2004, the Australian wool industry announced its intention to phase out mulesing by 2010.

Primary Industries Ministerial Council (PIMC) requested the Animal Welfare Working Group to urgently review the Model Code of Practice for the Welfare of Animals — The Sheep, to incorporate new standards for mulesing ahead of the phase-out in 2010.

PIMC endorsed the new mulesing standards in an appendix to the Model Code of Practice for the Welfare of Animals - The Sheep. These standards have been adopted in sheep animal welfare codes in all Australian states. PIMC also endorsed the principle of an industry accreditation program and dates for accreditation of mulesing operators.

The sheep industry has agreed to establish and implement minimum standards for the mulesing operation as one of several strategies to reassure clothing retailers that the Australian sheep industry is progressing towards the 2010 target. As part of this process, the sheep industry agreed to establish a program of mandatory accreditation for mulesing operators.

OBJECTIVE
The Australian Wool and Sheep Industry Taskforce and international retailers have signed a ‘compact’ to ensure best practice mulesing methods are implemented and maintained across Australia. This commitment includes the National Mulesing Accreditation Program (NMAP), an industry approved and operated program which maintains that all mulesing operators must become accredited.

Although surgical mulesing will be phased out by 2010, international concerns about welfare issues involved in surgical mulesing have highlighted the need for a mulesing accreditation scheme to be introduced before then. In light of these concerns, a National Mulesing Accreditation Program (NMAP) has been established, supported by Australian Wool Innovation Limited (AWI), to assure overseas woollen apparel retailers that animal welfare standards are being met.

EFFECT
The sheep industry is determined to find suitable and effective replacements for surgical mulesing by 2010 so that wool producers are able to protect their sheep without the use of the current mulesing technique. Significant industry funds are being employed to ensure that practical and cost effective replacements for surgical mulesing are available before the 2010 deadline.

The current technique of surgical mulesing has afforded valuable protection to Merino sheep against breech strike. The industry is providing regular updates to international retailers and industry stakeholders on progress towards the goal of an effective replacement to surgical mulesing. Two of these potential alternatives are showing promise. Many national and state industry representatives have firmly reiterated the commitment to phase out the current mulesing practice by 2010.
DESIRED OUTCOME

The NMAP program ensures the accreditation of mulesing contractors and woolgrowers who mules their own sheep. The process of accreditation will ensure that all mulesing operators employ consistent and effective mulesing practice including the use of appropriate pain control techniques until the practice is phased out. For contractors and other mulesing operators to become fully accredited, they will need to undergo a knowledge assessment and “hands-on” skills assessment.

The process involves a two-day training and assessment course provided by the Kondinin Group and the Livestock Contractors Association (LCA). Anyone accredited by LCA through this course will automatically receive accreditation for NMAP. The offer to present this training was made to other providers but only Kondinin were able to meet the standards of the NAMP. Woolgrowers will need to demonstrate sufficient knowledge to ensure that any problems are corrected before the final assessment. Assessors will be accredited and highly experienced in surgical mulesing and will mainly be contractors.

As mulesing is to be phased out in 2010, the rationale for compulsory accreditation has been questioned. The main value of accreditation is to maintain the confidence and trust of the wool retailers that the program agreed to by the Australian Wool and Sheep Industry Taskforce is being implemented. Industry is currently investigating ways to demonstrate it has achieved the targets set by Government and industry. This may seem bureaucratic and impractical to the average mulesing operator. If it could be demonstrated that agreed improvements and alternatives to surgical mulesing were not being implemented at a local level this could reinvigorate the protest campaign and irrevocably damage the confidence of wool retailers. Notwithstanding this risk, there are significant benefits for operators who become accredited:

- The non-surgical mulesing techniques may only be available to accredited operators
- Use of pain management may only be available to accredited operators
- The program will improve skills in a number of areas especially in relation to shear preparation and sharpening.
- Those already operating at best practice will be formally recognised as having attained a high level of competency.
- Training and accreditation also covers other areas associated with lamb marking including tailing, castration, stock identification and vaccination. Improving skills in these areas is likely to lead to production and time saving benefits.

CONCLUSION

Accreditation of all mulesing operators and compliance with new mulesing standards throughout Australia by the end of 2008 will ensure that the guarantees given to valuable wool customers can be met and that mulesing will be performed to a high standard of effectiveness and welfare compliance.

KEY WORDS

Mulesing, accreditation, wool.

Paper reviewed by: Richard Norris

REFERENCES

Mulesing Alternatives
Jules Dorrian, Affiliation Project Manager Blowfly Control

SUMMARY
Since the 2004 industry commitment to phase out mulesing by 2010, the pace has been on to find a combination of alternatives to replace conventional mulesing.

The industry sensitivities in accepting the need to change and the value of their investment through to a viable series of products has led to both phenomenal support and increased expectations from all parties.

This presentation will discuss the process and progress of the alternatives and the manner in which the sensitivities of the whole program have been addressed.