final report

Project Code: A.MQA.0008

Prepared by: Dr. Robin Jacob

Date published: August 2014

PUBLISHED BY
Meat and Livestock Australia Limited
Locked Bag 991
NORTH SYDNEY NSW 2059

Manipulating processing conditions to enhance lamb meat colour stability

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government and contributions from the Australian Meat Processor Corporation to support the research and development detailed in this publication.

Milestone

Experimental program 2 (Relationships between bloom depth and colour stability).
DAFWA will submit an interim report to AMPC outlining the results of experiment 2 and methodology of experiment 3.

Abstract

Experiment 2 was conducted using 280 lambs from 3 kills of the Katanning Resource Flock. Preliminary analyses suggest that bloom depth (mm) was correlated with retail colour stability (redness at the end of the display period). However, this relationship accounted for less than 30% of the variance. Terminal crossbred lambs had deeper bloom depth and increased colour stability compared to merino lambs; suggesting that meat from merino lambs had a higher oxygen consumption rate compared to meat from terminal crossbred lambs and this may have contributed to lower colour stability.

Project objectives

To use meat bloom rate to monitor lamb processing

- Quantify the relationship between pH temperature decline and bloom rate/depth in Australian lamb meat
- Evaluate bloom assessment at processing for predicting retail colour stability of lamb meat
- Validate improvements in meat colour stability at the retail level

Intended outcomes

- Lamb processors optimise processing conditions for colour stability, tenderness and drip loss simultaneously
- Lamb shelf life extended by 0.5 day through optimised processing conditions

Success in achieving milestone

Experiment 2 has been conducted and a preliminary analyses of the results done. Design of experiment 3 will require further consideration of the results achieved so far.

Overall progress of the project

Experiment 2 was conducted successfully. Two ageing periods was not possible but otherwise the experiment progressed as planned and a 5 day ageing period was used. Colour stability and bloom depth measurements were conducted using lambs from the three kills of the Katanning Resource flock for 2014. Colour stability was measured using the Hunterlab spectrophotometer to obtain a measure of redness (R630/R580). A colour scanner was used to measure bloom depth as this was deemed to be quicker than the glass clamp and camera technique described previously in milestone 3.

Bloom depth was measured by re-slicing the meat sample used for the colour stability measurement. An image was then taken of the orthogonal surface using a colour scanner. These images were used to measure the depth of colour change from the surface, at 3 points, by comparing the depth of the colour change to a scale. The mean of the 3 points was taken to be bloom depth (mm). This was done at the commencement of the retail period (about 6 hours post slicing) and again at the end of the retail period after retail colour measurement (about 77 hours post slicing). About 280 lambs were measured this way. Some preliminary analyses of this data have now been done and are presented below.

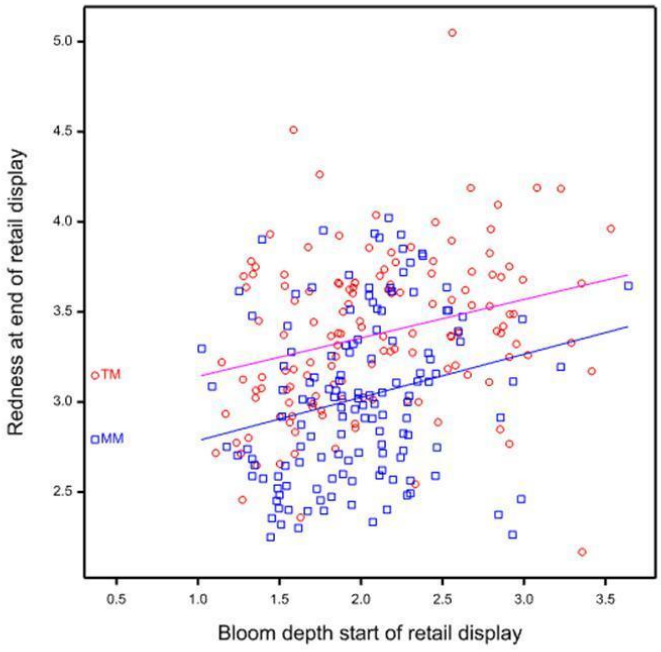

Figure 1 The correlation between bloom depth (mm) at the start of the display period (day 0) and the redness value (R630/R580) at the start of the display period (day 0)

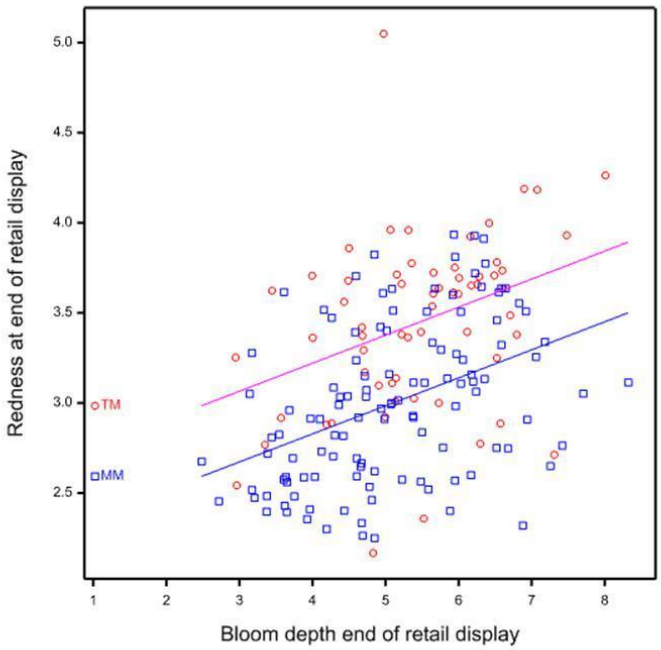

Figure 2 The correlation between bloom depth (mm) at the start of the display period (day 0) and the redness value (R630/R580) at the end of the display period (day 3)

Bloom depth was correlated with redness ($P<0.01$) at the end of the display period. However, the percentage variance accounted for was relatively low for this relationship, being 18.5% (Figure 1) when bloom depth was measured at the start and 29.2% (Figure 2) when measured at the end of the display period respectively. This suggests that bloom depth could be used to predict colour stability but the accuracy would be low. However, this requires further investigation as these analyses are very preliminary. Other covariates such as pHu may improve this relationship. Investigations of wavelength calculations other than redness (R630/R580) may also be worthwhile as this combination is known to confound metmyoglobin with deoxymyoglobin.

The total bloom depth more than doubled during the display period, increasing from 2 to 5.3 mm (Table 1). At the end of the display period the bloom had two components; red at the surface and brown deeper, compared to just one (red) at the start. Bloom depth was measured as the sum of the red and brown components.

Parameter	Breed		LSD	P value
	Merino	Terminal merino		
Redness at end of retail period (R630/R580)	2.97	3.36	0.11	< 0.01
Bloom depth start of retail display (mm)	1.86	2.14	0.12	< 0.01
Bloom depth end of retail display (mm)	5.15	5.47	0.29	< 0.01
Percentage red at end of retail display (%)	47.11	53.63	2.395	< 0.01

Table 1 Colour (redness) and bloom depth (mm) of merino and terminal lambs at the beginning and end of the retail display period

Meat from merino lambs had reduced colour stability (measured as the redness (R630/R580)) at the end of a simulated display period compared to terminal merino lambs, and this was consistent with similar findings from previous studies. This was further demonstrated by a monotonic change in redness over time (Figure 3) for merino compared to an increase being observed at day 1 then a decrease in redness for terminal merino lambs. Coincidentally, the bloom depth was lower for merino lambs both at the beginning and the end of the retail display period. Furthermore the percentage of the bloom depth still “red” at the end of the display period was less for merino lambs compared to terminal merino lambs. This would suggest that the oxygen consumption rate was higher for meat from merino lambs and this may have contributed to lower colour stability.

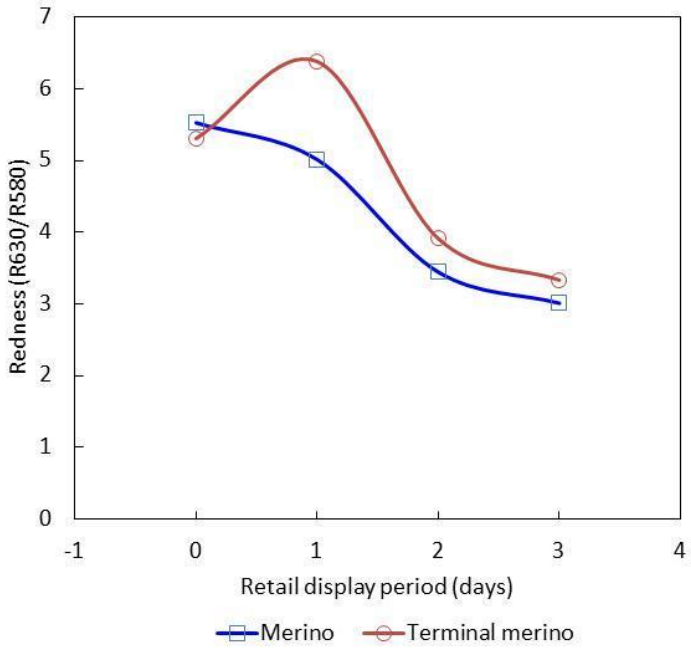

Figure 3 The change in redness during the display period for merino and terminal merino lambs.

Recommendations

- Further analyses need to be completed using data collected for other wavelengths and covariates to finalise the results from experiment 2.
- The results while preliminary are consistent with the proposition that bloom depth may explain some of the differences in colour stability. The comparison of data from merino and terminal crossbred lambs assisted with making this conclusion.
- Experiment 3 should therefore proceed after further analyses of the current results and further refinement of the measurement technique.

Appendices

Figure 4 Colour scanner images of the orthogonal surface of meat at the end of the display period.

Figure 5 Simulated retail display