



final report

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Prepared by: Clive Richardson
National Meat Industry
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Industry tutorials to update processors on current science relating to meat quality

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Abstract

AMPC requested that MINTRAC establish two forums for the extension of the latest information (meat science) developed by the Meat Industry Services and other providers nationally. This initiative was aimed at supplementing the information available to meat industry personnel through the Meat Technology Updates, AMPC fact sheets and published meat science outcomes.

Although these materials are readily available, meat industry personnel often do not have the time to research, locate and read the materials and in some cases, the scientific information is highly technical and needs additional explanation.

AMPC worked with MINTRAC to identify some key meat quality issues confronting industry and identify speakers to address these topics at sessions held in conjunction with MI and QA networks. The speakers explained these quality issues and their applicability to meat processing in Australia as well as answering the questions from participants.

Executive summary

This project was undertaken to test the feasibility of taking contemporary meat science research outcomes to the industry. This was to be done by providing scientists with a face to face opportunity to explain their research findings to industry personnel. Equally it was hoped to assess industry's interest in recent meat science research into quality issues.

To this end MINTRAC and AMPC trialled two alternative models for running the meat science information sessions. The first model trialled in Perth was conducted as an adjunct to the regular MI and QA network meetings. The session was delivered by Dr Robyn Warner for 2 and a half hours prior to the 11am start of the MI&QA manager's meeting.

This initial session was attended by a range of QA managers, regulators and RTO staff and covered the following topics:

1. Meat colour
 - Brief theory and the importance of meat colour
 - The measurement of meat colour – Subjective and Objective methods
 - Factors influencing meat colour and colour faults
 - Options available to improve meat colour
2. Emerging methods for improving meat tenderness
 - Brief theory and the importance of meat tenderness
 - Measurement of meat tenderness
 - Factors affecting meat tenderness
 - Existing and emerging methods of improving tenderness.

The material was well received and the presentation universally endorsed as relevant and useful to the industry personnel attending. However it was generally agreed that more time was needed to fully explore the topics.

The second session was run as a stand-alone day run the day after an MI&QA manager's network meeting in Brisbane. Again Dr Robyn Warner presented this time on meat colour and meat flavour. While describing the outcomes of research into meat colour and flavour Robyn covered:

- theory and the importance of meat colour
- measurement of meat colour –
- factors influencing meat colour and colour faults
- browning colour and metmyoglobin
- pale colour and rapid pH decline
- options available to improve meat colour
- Dark Cutting and causes of
- Managing dark cutters on
- theory behind meat flavour
- grass vs grain

Dr John Thompson from UNE also talked to the group presenting on meat tenderness and MSA. John dealt with the theory and the importance of meat tenderness how it could be measured of and the factors affecting meat tenderness. The factors discussed included:

- HGP
- Bos indicus content
- Gene markers Post mortem
- pH temperature window

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- tenderstretch
- ageing

Dr Thompson also looked at the progress being made with MSA in Australia including the numbers graded and the economic returns of MSA to processors and producers.

The day was well received with high levels of appreciation for the quality and content of the presentations. No respondents indicated that a day was too long for a meat science seminar.

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1 Background

For nearly twenty years, the Meat Industry Services Unit has developed and published a wide range of Meat Technology Updates and Information sheets as a means of disseminating new research findings, or responding to critical questions raised by industry personnel.

For the past four years, MINTRAC has included newly released fliers in Network meeting folders. Although these presentations are grouped and readily available to meat industry personnel through the meat update website, often people do not have the time to research, locate and read the materials. Many remain unaware of the materials because there has never been a need to research a particular issue. In addition there is a wide range of scientific publications relating to this area which are not accessed by processing plant personnel. In some cases, the scientific information is highly technical and needs additional explanation.

AMPC requested that MINTRAC establish two forums for the extension of the latest information (meat science) developed by the Meat Industry Services and other providers nationally. AMPC will work with MINTRAC to provide the panel of RD&E providers and establish an agenda of key food safety and food science issues confronting industry. Assessment of previous queries will provide background on these issues, as will AMPC's latest national member feedback initiative.

This project sought to extend current science relating to meat quality to meat processing personnel such as QA officers, supervisors, managers, meat inspectors and trainers.

2 Project objectives

This project sought to:

- hold 2 x workshops as industry "tutorials" to cover key topics – e.g. DFD, dark cutting, electro mobilisation, colour, tenderness and quality including E.Coli and Salmonella
- ensure accumulated scientific knowledge is updated and disseminated to industry personnel and trainers as part of the tutorials
- foster discussion and analysis of accumulated scientific knowledge to encourage appropriate adoption by industry through the expert panel
- facilitate the extension of accumulated scientific knowledge into both the training system and daily practice in meat processing plants.

3 Methodology

Originally it was intended that the workshops would be conducted in association with the Meat Inspection and Quality Assurance meetings already being held by MINTRAC. The first workshop, held in Perth, was planned along these lines.

The second tutorial was a full-day workshop, held the day after the Queensland MI&QA meeting in April 2013.

4 Results and discussion

4.1 Perth workshop

In consultation with CSIRO and AMPC, MINTRAC determined that the topics to be addressed would be meat colour and emerging methods for improving meat tenderness. Relevant CSIRO meat update publications were identified, and these were compiled into a booklet to be distributed to attendees.

The workshop was promoted alongside the planned Perth MI&QA meeting, and was scheduled to run for 2 hours before the meeting.

Although there was a relatively small attendance at the meeting, those who did attend engaged enthusiastically with the speaker and the material.

The following people attended:

- Ivan Boon Linley Valley Pork
- J Burnett DAFF WA
- Brendam Chia MAP WA Pty Ltd
- Andreas Kiermeier SARDI
- James Kobes DAFF WA
- Jenny Kroonstuiver National Meat Industry Training Advisory Council
- Charlie McCann Western Meat Packers Group
- Clive Richardson National Meat Industry Training Advisory Council

The Agenda addressed:

Meat colour

- Brief theory and the importance of meat colour
- The measurement of meat colour – Subjective and Objective methods
- Factors influencing meat colour and colour faults
- Options available to improve meat colour

Emerging methods for improving meat tenderness

- Brief theory and the importance of meat tenderness
- Measurement of meat tenderness
- Factors affecting meat tenderness
- Existing and emerging methods of improving tenderness

Following this meeting AMPC advised MINTRAC that they were not satisfied with the content, handouts, branding and organisation of the tutorial and advised that they sought a far greater level of involvement and consultation in the second tutorial, which was then delayed to late April 2013.

4.2 Brisbane workshop

AMPC determined the program, speakers, timing, and handouts of the second tutorial to be held in Brisbane. AMPC also organised for the tutorial to be filmed in preparation for the development of a webinar at a later date. MINTRAC's role was to advertise the tutorial, book the venue, pay the speakers and prepare sufficient copies of the papers for the tutorial.

The following people attended:

- Aaron Murphy Northern Co-Operative Meat Co Ltd
- Peter Pollard Northern Co-Operative Meat Co Ltd
- Geoff Davis Northern Co-Operative Meat Co Ltd
- Shane Hogan Northern Co-Operative Meat Co Ltd
- Troy Dillon Northern Co-Operative Meat Co Ltd
- Baden Pearse DAFF
- Mark Rickard SQIT
- Glen Eckhardt SQIT
- Ross Dodds SQIT

- Scott Crow Thomas Borthwick & Sons
- Amy Lealiifano Rivalea Australia
- Rob Smits Rivalea Australia
- Peter G Moore Kilcoy Pastoral
- Alice Matthews Kilcoy Pastoral
- Ben Robinson AUS-MEAT
- Brian Carey FPE
- Matt Hutton Australian Country Choice
- Matt Dorney MLA
- Jamie Hughes CSIRO
- Jenny Kroonstuiwer MINTRAC
- Clive Richardson MINTRAC
- Fahri Fahri AMPC
-

The Agenda for the second workshop included:

1. MEAT COLOUR (DR ROBYN WARNER- CSIRO)
 - Background theory and the importance of meat colour
 - Measurement of meat colour – Subjective and Objective methods
 - Factors influencing meat colour and colour faults
 - Browning colour and metmyoglobin, Pale colour and rapid pH decline
 - Options available to improve meat colour
 - What is Dark Cutting and causes of DFD
 - How can it be better managed on plant
 - Economic impacts and livestock handling
 - Strategies for reducing dark-cutting
 - MAP (Modified atmosphere packaging) and impact on Meat Quality
2. MEAT FLAVOUR (DR ROBYN WARNER- CSIRO)
 - Theory and Background
 - Grass vs grain
3. THEORY OF MEAT TENDERNESS (DR JOHN THOMPSON - UNE)
 - Background theory and the importance of meat tenderness
 - Measurement of meat tenderness
 - Factors affecting meat tenderness
 - Live animal
 - HGP
 - Bos indicus content
 - Gene markers
 - Post mortem
 - pH temperature window
 - tenderstretch
 - ageing
4. MSA MODEL (DR JOHN THOMPSON- UNE)
 - Numbers graded
 - Economic returns of MSA
 - Problems with boning groups
 - Optimisation
 - Where to from here?
 -

5. SCIENTIFIC PANEL DISCUSSION (Q&A SESSION)

4.3 Evaluation

An evaluation questionnaire was developed and distributed through Survey Monkey. However, only six responses were received. While the information provided is useful, these responses cannot be considered representative.

In summary the evaluations showed that:

- attendees found the tutorials both valuable and interesting
- the content was considered accessible, although some felt the sessions could have been longer and pitched a little more simply
- most felt their questions had been answered satisfactorily
- the handouts were considered useful and would be used for future reference
- most were likely to access the proposed webinar
- most felt they had received all the information needed in a timely fashion
- the location was considered suitable
- some were interested in future tutorials and suggested the following topics:
 - Animal welfare, Micro
 - Yields, costings, sales, livestock procurement

5 Success in achieving objectives

5.1 Hold 2 x workshops as industry “tutorials” to cover key topics

– e.g. DFD, dark cutting, electro mobilisation, colour, tenderness and quality including E.Coli and Salmonella.

Two workshops were held.

5.1.1 Workshop 1 – Perth

Workshop 1 was held in Perth on 3 August 2012, as part of the MI&QA network meeting.

Following the first workshop, AMPC indicated that they wished to have far greater input into the content, speakers and materials to be included in the workshops. As a result, the Brisbane workshop was markedly different to the Perth one with an expanded agenda, and additional speaker, and it was held on a separate day.

5.1.2 Workshop 2 – Brisbane

Workshop 2 was held in Brisbane on 19 April 2013, as a full-day tutorial program.

5.2 Ensure accumulated scientific knowledge is updated and disseminated to industry personnel and trainers as part of the tutorials

In addition to the presentations, handouts were compiled and distributed to all attendees.

5.2.1 Perth booklet – summary

General

5.2.1.1 Oxy torches and their effect on meat colour (2002)

Hot flames and oxyacetylene torches produce nitrogen dioxide gas. Internal combustion engines also produce it. Nitrogen dioxide is an energetic oxidising agent and the gas can rapidly oxidise the purple or red forms of myoglobin in meat to brown metmyoglobin.

5.2.1.2 UV light and its effect on fresh meat (2002)

UV radiation can be extremely effective in killing or damaging microorganisms. Bacteria on carcasses and primals take longer to begin to grow when they are exposed to UV light (i.e. their lag time is longer) and when they eventually do begin to grow, their rate of increase in numbers is slower.

5.2.1.3 Tenderstretch (2004)

Toughness caused by muscle contraction can be prevented by accelerating the onset of rigor mortis using electrical stimulation; or by hanging the carcass in a way that will stretch the muscles and not allow them to contract, hence the name 'Tenderstretch'.

5.2.1.4 Colour defects in meat, Part 1: Browning of fresh meat (2006)

Fresh meat eventually turns brown (sometimes interpreted as grey-brown); its acceptability to customers usually determined by loss of red colour ('bloom') rather than onset of bacterial spoilage. Display life is reduced by several factors that hasten discolouration. This article gives some realistic expectations for display life, discusses the basis for meat colour, and some reasons for premature loss of bloom.

5.2.1.5 Colour defects in meat, Part 2: Greening, pinking, browning and spots (2006)

Part 1 discussed the development of a brown colour in fresh meat as a result of oxidation of the pigment myoglobin to metmyoglobin, Part 2 describes other undesirable colours and appearances.

5.2.1.6 Prevention of fresh meat colour defects (2006)

At retail level, customers are most influenced by eating colour in their decision to buy. Colour is perceived to be a valuable guide to the overall quality of meat; if a visual appraisal raises any doubts it is unlikely that purchase of that particular time will be considered further. Conditions of primary importance to meat colour are temperature, pH and the amount of available oxygen.

Beef

5.2.1.7 High rigor temperature and toughening in beef (2002)

Inappropriate application of electrical stimulation can contribute to toughening and changes in colour and texture similar to that observed in PSE pork.

5.2.1.8 Production factors affecting beef eating quality (2006)

This newsletter focuses on the on-farm, or production-based factors, that have been shown to affect beef palatability. The production factors covered include: within-breed and between-breed variation; sex; fatness; age; nutrition and growth path.

5.2.1.9 Pre-slaughter aspects of beef eating quality (2006)

Losses of both product quality and quantity during the critical pre-slaughter period are inevitable. These losses are the result of social, physical, environmental and nutritional stresses imposed on the animal between the farm/feedlot and the abattoir knocking box. In the interests of animal welfare and beef quality, it is essential that effective management strategies be implemented to minimise adverse pre-slaughter effects.

5.2.1.10 Electrical inputs during beef processing (2006)

During slaughter and dressing, beef carcasses may be subjected to a range of electrical inputs. These are used to: limit the danger to slaughterers from kicking; assist rapid bleeding; prevent broken backs from hide pulling; and optimise meat quality. Each of these applications may require a specific current, waveform and frequency. Use of incorrect electrical parameters may result in damage to the carcass, poor meat quality and safety risks.

5.2.1.11 High pH/Dark Beef (2006)

The pH scale is used to measure the degree of acidity or alkalinity present in meat. The 'ultimate' pH of meat, i.e. the final pH achieved by the muscles when the rigor processes have ceased, influences meat tenderness, colour, flavour and shelf-life.

Sheepmeat

5.2.1.12 Sheep meat eating quality (2006)

All consumers who buy sheep meat expect it to be tender and flavoursome. Toughness is caused by four major factors: advancing age of the animal; 'cold shortening' (the muscle fibre contraction that can occur during chilling); animal stress (unfavourable eat acidity, or pH); and the cut (i.e. connective tissue content/structure). Meat quality can be improved by careful selection of pastures, correct pre-slaughter handling and carcass processing.

5.2.1.13 Processing factors affecting sheep meat eating quality (2005)

Post-slaughter factors have a significant influence on the eating quality of sheep and lamb meat. This Meat Technology Update provides information for processors on how to optimise sheep meat eating quality and covers factors such as electrical stimulation (ES), hanging and cooling, and meat ageing. Some factors that influence retail display life are also discussed.

5.2.1.14 Producing quality sheep meat (2007)

This Meat Update presents recent findings on some slaughter floor influences on sheep meat eating quality.

New electrical inputs during slaughter and dressing help to deliver better quality sheepmeat. Medium voltage electrical stimulation enhances meat quality by improving tenderness and meat colour. High frequency immobilisation of bodies at slaughter reduces involuntary movement and permits abattoir workers to begin processing sooner. Medium voltage stimulation at low frequency (10Hz) hastens blood release.

Also discussed is the 'eating quality window' and its application by sheepmeat processors. Results show that without electrical stimulation, that proportion that falls within the window is about 5%. With optimal stimulation, the proportion rises to 90% based on a revised window of pH 6.0 between 18-45°C.

5.2.2 Brisbane booklet – summary

General

5.2.2.1 Oxy torches and their effect on meat colour (2002)

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5.3 Foster discussion and analysis of accumulated scientific knowledge to encourage appropriate adoption by industry through the expert panel

Dark cutting carcasses and poor eating quality continue to be issues for the meat industry even though the scientific community has had a relatively good understanding of this issue for decades. Part of this reason is that there are some very barriers to the industry understanding the import of scientific research.

Firstly many research findings while published have little exposure to meat industry personnel.

Secondly, many quality assurance and plant management personnel do not have science backgrounds and research findings as published and written up are not always "accessible" to non-science trained people.

These seminars give quality assurance managers and trainers an opportunity to explore these topics with genuine authorities and thus gain an insight into potential solutions for processing problems. Successful adoption of scientific advances is based very firmly on industry personnel having a good understanding of the principles. The electrical stimulation of sheep carcasses to improve eating qualities is a classic example where outcomes were not achieved in many establishments because on-plant personnel did not understand the principles and the requirements of the equipment. Seminars that enabled researchers and practitioners to sit down and explore the topic over a period face to face enable of these problems to be avoided.

5.4 Facilitate the extension of accumulated scientific knowledge into both the training system and daily practice in meat processing plants

Meat science seminars at which industry personnel and researchers can come face to face enable both parties to gain an understanding of

- the barriers that inhibit industry uptake of scientific development
- what is required to overcome these barriers.

This extension component of meat science research is essential for without the on-going uptake of the results of scientific research any subsequent investment in meat science research becomes more difficult to justify.

This symbiotic relationship that must exist between research and industry has to be built on mutual understanding. This is only possible if research outcomes translate into industry practitioner insight, uptake of new ideas and technologies and a dollar return to the sector.

This requires an interface between industry and the meat science community that can be fostered and developed through these seminars. This is because regardless how well written the science fact sheets, technology update bulletins etc are there will always need to be ongoing discussions in an environment that encourages collaboration.

These seminars are potentially a viable part of the process to give meat scientists broad access to industry to promote their findings and assist with their uptake.

6 Impact on meat and livestock industry – Now and in five years time

6.1 Establishing a community of practice

6.1.1 Opportunities for meat science researchers

The meat science seminars give scientists an opportunity to disseminate and explain their findings and “ground truth” their recommendations with industry practitioners. These seminars have given research participants an opportunity to explain the science that underpins meat quality and the relevance of their research.

This networking also enables researchers to establish ties back into industry and obtaining intelligence on the most pressing of meat quality issues thus informing their research proposals and increasing their relevance to industry. Likewise in the future these industry managers will in part due to these seminars be better informed when approving or promoting the approval of the uptake of science or participation in future research.

6.1.2 Opportunities for processing plant QA managers

The time necessary to review and distil the scientific research on any subject is daunting especially for those without science and research backgrounds. These seminars enable a QA manager a unique opportunity to gain an understanding of the body of research on a particular meat science topic in this case for instance dark cutting and meat flavour. The research findings once understood can then be incorporated into company policies, procedures and training programs, thus facilitating the uptake of research findings.

Without these research outcomes being exposed to industry there are very real possibilities that many worthwhile findings will become lost along with the reports.

In the long term this interaction between researchers and industry means that industry QA managers will be more willing to look to the research community to provide guidance on matters of meat science. At the same time researchers will have a vehicle to deliver the “extension” requirements of their industry funded research contracts and ways of validating the outcomes of their research.

6.1.3 Opportunities for meat processing training organisations

Many meat industry practices are founded on tradition and past experience and when documented are supported or justified on the grounds that they represent industry “best practice”. These seminars can give industry training organisations access to clear and concise summaries of the “science” related to a range of meat processing issues. This material can in turn be incorporated into training programs and materials thus giving future students a greater insight into the meat science associated with processing. Over time this will mean that future QA practitioners will be more able and willing to understand and embrace research outcomes.

7 Conclusions and recommendations

7.1 Conclusions

- Industry personnel welcomed the opportunities of hearing about current research outcomes and the implications for their plants
- There is undoubtedly an enthusiasm on the part of industry personnel to be informed about the meat science involved in a wide range of meat quality issues.
- QA personnel are keen to have access to meat scientists to be able to ask questions pertinent to specific on-plant issues.
- The research scientists seemed keen and able to work in the extension phase of their research projects and for their part industry personnel and trainers were keen to understand the implications of research for their operations.

7.2 Recommendations

- That opportunities be given to researchers to engage industry through the existing networks to disseminate current research outcomes and the implications for meat processing plants.