final report

Project Code: A.MQT.0033
Prepared by: John Thompson

Date published: June 2009

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

Teaching & Research Support for Meat Industry Eating Quality Programs

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.

Abstract

A senior lecturer in meat science (Dr Geert Geesink) was employed at UNE since February 2007. During this time, Geert Geesink was involved in a range of research and teaching activities for, or related to, MSA and MQST programs.

In addition, recommendations were formulated for new research aimed at improving the understanding and control of meat tenderisation during ageing of beef.

Contents

Project objectives

The Research Organisation will achieve the following objective(s) to MLA's reasonable satisfaction:

To fund a half time position in Meat Science UNE which will have responsibilities to undertake research projects under the direction of MLA / MSA:

Specifically the position will provide:

- A succession plan for Meat Science inputs at a Professorial level at UNE
- Consulting advice on technical matters to MSA grading projects
- Undertake defined MSA research projects
- Undertake defined MQST projects

It is proposed that defined projects related to current commercial eating quality issues will be specified for each research year by an Industry Eating Quality Committee. Such research topics could be:

- Analyses of industry trends using MSA databases
- Research into improved meat quality using generation #2 meat electronics
- Research into on-line measurement technologies and the impact on eating quality

Success in achieving milestone

G. Geesink has been employed at The University of New England as a senior lecturer since February 2007. The progress in teaching and research activities since his appointment are described below.

Overall progress of the project

Education

Since being employed G. Geesink has been involved in several educational activities.

At MSA this included teaching in the week long Meat Science module delivered as part of MSA grader training.. During the project there have been 5 Meat science courses As a result, about fifty persons, employed in the meat industry, have successfully met the knowledge requirements of this module.

At UNE, G. Geesink is course coordinator for the following courses:

- Meat Technology (MEAT 418/518)
- Sheepmeat Production and Marketing (ANPR 420/520)

These courses provide an overview of the beef and sheep industry, with a strong emphasis on the different factors affecting meat quality. Consequently, the fundamentals and importance of the MSA grading system for the Australian beef industry is dealt with in detail.

The Meat Technology course attracts about 30 students annually. As part of the course, the students are taken on an industry tour, giving them an opportunity to observe their

theoretical knowledge put in practice. Alternatively, it offers the companies visited an opportunity to inform the students about career options in the meat industry.

Apart from teaching in the courses mentioned above, G. Geesink has presented a number of lectures for the following courses:

- Animal Production and Production Science (ANSC 300)
- Feedlot Management (ANPR 440/540)
- Animal Production Systems and Products (ANPR 211)

Publications

G. Geesink has contributed to the following publications:

- Geesink, G.H. and Veiseth, E. (2009). Muscle enzymes: Proteinases. In: Handbook of Muscle Food Analysis. Nollet, L and Toldra, F. (Eds.), Taylor and Francis Group, LCC.
- Hopkins, D.L. and Geesink, G.H. (in press). Protein degradation and post mortem tenderisation. In: Current Topics for Applied Muscle Biology and Meat Science. M. Du (Ed.), CRC Press.
- Geesink, G. and Zerby, H. (in press). Meat Production. In: Sheep and Wool Handbook. Cottle, D.J. (Ed.) Nottingham University Press.
- Toohey, E.S., Hopkins, D.L., Van de Ven, R., Thompson, J. and Geesink, G. (2009). Pre-rigor interventions: The effect on myofibrillar degradation and shear force. (ICoMST 2009, in preparation).

Research

Regarding research projects, G. Geesink has coordinated and/or contributed to a number of MQST, Beef CRC and Sheep CRC projects.

- MQST projects

    1. Very Fast Chilling

       For the purpose of this project it was determined whether accelerated post-mortem proteolysis could account for the observed tenderizing effect under certain VFC conditions. The outcome of this was that accelerated proteolysis could be ruled out as a contributing factor.

       This assisted in focusing the allocation of resources for following experiments towards establishing the critical time and temperature parameters to achieve a tenderizing effect under VFC conditions.

    2. Measurement of Beef Quality and Eating Quality Traits using on-line Near Infrared Spectroscopy.

       For the purpose of this project two experiments were conducted to determine whether NIR measurements can contribute to MSA grading, and/or objectify MSA grading criteria. At present, the data from these experiments is being analysed. Reports on this project are forthcoming.

3. Utilising the “Boa” stretching technology to improve the quality of hot boned striploins.

   Within this project the effect of different stretching technologies on meat quality parameters (tenderness, colour and waterholding capacity) were investigated. The results of this experiment have shown that the Boa technology can improve the tenderness of hot-boned striploins to a similar level as striploins from tenderstretched or superstretched carcasses.

   No beneficial or adverse effects were noted for colour stability. A possible negative effect of the Boa technology is a reduction in water-holding capacity as compared to other stretching treatments. In addition, Boa treated samples were used in consumer tests, allowing for the incorporation of this technology in The MSA grading model.

4. Enzyme tenderizers for fresh meat.

   This project was recently started and has the objective to characterise enzyme tenderizers in order to identify their optimal use in red meat applications.

- <u>Beef CRC projects</u>

1. Verification of gene markers for tenderness
   The activities within this project concerned the involvement in slaughter trials, laboratory analysis and interpretation of the results.

   The main activities within this project concerned the planning of the experiments, determination of factors affecting tenderness (shear force, compression and sarcomere length), and statistical analysis and interpretation of the results.

2. Understanding biology of marbling and fat distribution, and interactions within production systems, to enhance gene discovery and phenotypic prediction (in progress).

   The activities within this project concerned the involvement in slaughter trials, laboratory analysis and interpretation of the results. As a sub-project within this program we intend to investigate to what extend animal age affects the activity of the calpain/calpastatin system, and therefore, tenderization.

   For this sub-project samples are collected from muscles with known differences regarding the importance of ageing for ultimate tenderness. Data from this experiment should assist in extending the knowledge regarding the effect of animal age on the tenderness of different muscles and the interaction with ageing.

3. Understanding the mechanistic effects of gene markers for tenderness (in progress)
   The aim of this project is to determine the effect of the different isoforms of calpain and calpastatin responsible for their established gene marker effect on tenderness.

For the purpose of this project muscle samples were collected representing a range of gene markers for tenderness. Elucidation of the functional effects of polymorphisms in the calpain and calpastatin genes may aid in the design of interventions at a production or processing level to maximize the tenderizing capacity of the calpain system.

- Sheep CRC projects

1. Comprehensive range of new meat science phenotypes measured.

   G. Geesink has coordinated four slaughter trials to collect phenotypic data. During these trials G. Geesink has facilitated the collection of data for the MLA sponsored project on the use of NMR to predict meat quality.

   During these trials samples for a large range of phenotypic data were collected. (pH and temperature decline, sensory analysis, sarcomeres length, shear force, compression, intramuscular fat, fatty acid composition, meat colour, skin and wool quality, etc. etc.).

   Within this program, UNE is responsible for the analysis of intramuscular fat for about 2000 samples annually.

Recommendations

For the near future two projects are recommended to aid and improve the MSA grading system:

- Rapid on-line pH determination.

  This project proposes to address the need to predict the ability of specified cuts to age (based on modelling from the MSA blue dataset), depending on their rate of pH and temperature decline.

  Preliminary results from UNE indicate that a rapid, and moreover, reliable pH measurement is feasible on pre-rigor carcases. It is anticipated that this project will be conducted in close collaboration with the Heat Toughening project (A.MQT.0029), and the SmartStim project.

- A mechanistic model for meat tenderness.

  Based on data provided by MARC (Clay Center, NE), it appears feasible to construct a mechanistic model for beef tenderness of different muscles. The basis of this model is the measurement of three components determining meat tenderness (connective tissue content, sarcomere length and post mortem proteolysis).

  A full report regarding the analysis of this dataset is in preparation. However, it is anticipated that using a mechanistic approach may significantly reduce the costs associated with improving and extending the MSA grading system.

Appendices

Copies of publications are supplied in PDF format.