final report

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Automated Robotic Ovine Y-Cutter Project Working Group

Executive summary

The Automated Robotic Y-Cutter is an important first automated system in the small stock meat processing industry, however, commercial take up of the technology has been unsuccessful to date. Technical performance is considered a significant factor.

In order to clarify the technical development path forward in regard to a further development phase on the Automated Robotic Y-Cutter, a working group was assembled from major stakeholders and a site visit arranged to view the machine first hand.

The working group comprising of representatives from: IRL, Alliance NZ, MAR, AMPC, MLA, and CRF, invested 2 days to explore the strengths and limitations of the machine. The brainstorming sessions were then crystallised down to a mutually agreed development action plan.

The outcome of the working group mainly considered how operational data could be conveniently collected, analysed, and used to design system improvements. In addition, it was envisaged the Y-Cutter functionality may be restricted to a V-cut to improve reliability.

A 2012/2013 AMPC industry funded project may result from this work.

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1 Background

The Automated Robotic Ovine Y-Cutter was a system developed and implemented over 10 years ago. Two machines have been built and installed: Alliance Mataura, and CRF Colac.

While both machines can perform well, the systems have significant limitations related to the variability of stock. It was considered appropriate to form a working group to identify the limitations and to develop a plan going forward to improve the system and thereby facilitate future commericalisation of the design.

2 Project objectives

To assemble a suitable team of expertise comprising all major stakeholders: the tool developer IRL, the current machine users Alliance NZ and CRF, the Australian system integrator MAR, and the development funding bodies AMPC and MLA. The team was to investigate the performance of the machine and to make recommendations for the system's further development.

3 (Methodology) - Section

Project Working Group: Y-Cutting

Meeting at CRF: 18th & 19th May
Present:
Geoff Bates IRL
Patrick Lim IRL
Ross Smith Alliance NZ
Damian Benedicic MAR
Chris Ruberg MLA
John McGuren AMPC
Mick Bird CRF (Manager Process Floor Operations)
Joanne McMahon CRF (Processing Floor Supervisor)
Len Davis CRF (Maintenance & Equipment Performance)
Trevor Shaw CRF (General Manager Production)
Miffy Shelton CRF (Continuous Improvement)
Lindsay Alfred CRF (QA)

The Problem:
1. The sock ringer is inconsistent with animal variation and the cut is not symmetric, resulting in inconsistent Y-Cutter entry and a twisted Y-Cut path due to pelt twisting. The twisted Y-cut path results in difficulty for leg flayers to find the cut for opening, and the circular air knives cut overhanging wool with resulting carcass contamination;
2. The Y-cutter cannot reliably complete the "Y" cut in the brisket area due to animal variation (Merino skin folds);
3. The Y-Cutter robot path is not reliable due to animal variation with resulting tool pull out;

The Options:

Baseline: Manual Strip Cut	Envisaged: Automated "V"-Cut
1. 2 labour units x Strip Cutting 2. 1 x Y-Cut 3. 1 x Brisket rolling 4. 2 x Leg Flaying 5. 2 x Shoulder clearing 6. **TOTAL: 8 staff** 7. works well with manageable contamination issues	1. Robot V-cut 2. 2 labour units x NZ style leg clear and sock pull 3. 1 x Neck cut and lift brisket flap 4. 1 x Brisket rolling 5. 2 x Shoulder clear 6. **TOTAL: 6 staff** 7. NZ process more complex requiring training 8. NZ process increases OH&S risk from wrist cuts; 9. Saves 2 operators (@ $65k ea.) which equates to $260k / ann.

The NZ Experience:

- Alliance indicated average system performance (in terms of reliability) is between 94 – 98% (compared to <80% for CRF), due to carcass variation, and with the necessary objective of >99%.
- System performance being related to:
  - Washed animals;
  - Merely attempting the "V" cut;
  - Improved NZ style sock pull down technique, made easier with wet wool
  - Reduced carcass variation for the bulk of the season.

4 (Results and discussion) - Section

The Working Group Recommended Action Plan:

1. Each stakeholder (CRF, Alliance, IRL, MAR, MLA, AMPC) was requested to summarise the 1.5 day brainstorming meeting and circulate in a brief report (1-2 pages), to clarify the key issues and reinforce mutual understanding, and to contribute to the final action planning. The working group reports will then be discussed by AMPC/MLA and an agreed project action plan released;

2. Review the Cost Benefit Analysis CBA to determine and justify the allowable R&D & Re-Commissioning budget (existing R&D expenditure is now "sunk cost", what is the return on investment for envisaged expenses going forward);

3. A significant conclusion was that the Sock Ringer is a major cause of problems, hence a re-design is recommended. Seek tenders.

4. Short term proposed solution:

    1. CRF to consider modifying their Leg Flaying & Sock Clear procedure (including staff re-training);

    2. CRF to consider appointing and training a motivated slaughter floor team leader to better monitor carcass batches and to assist the machine by selection of the most appropriate Y-Cutter program (Small / Medium / Large / Calf) <Alliance also indicated this has assisted their implementation>;

    3. CRF to initiate a service to the Y-Cutting tool (consider spare parts), and replacement of unreliable carcass sensor;

4. CRF to consider a service on the existing Sock Ringer to optimise its performance (MAR may be able to assist here with fault analysis and recommendations on minor modifications: for instance adjusting blade compliance to accommodate variable carcass leg diameter, and rub bar adjustment);

5. CRF to have robot path modified for "V" cut only on each program <S / M / L / C> (MAR to assist and provide training update on finetuning of robot path "way points" using the HMI (Human Machine Interface);

6. These actions would potentially allow the robot to re-enter production for limited ongoing trial & troubleshooting work;

5. Long Term solution starting with an Operational <or Failure> Mode Analysis of the robot system to determine reasons for unsuccessful operation. Seek tenders for the installation of a video recorder (web enabled) on the Y-Cutter system (either continuous, or triggered by a sensor to indicate a failed operation), and tools to analyse and report on failure modes. The objective being to identify system improvements (including: enhanced sensing and adaptive robot path) to increase reliability in the context of Australian and NZ stock variability. **NOTE: This type of fault analysis system approach may be applicable to other projects requiring improvement in system reliability from <90% to >99%.**

6. Y-Cutter system to develop upgrade to improve robot adaptability and hence reliability in performance. Seek tenders for a system upgrade including enhanced carcass sensing and enhanced robot control software.

7. Implementation of Y-Cutter system upgrade (CRF & Alliance) to act as show sites for the commercialisation of this technology.

Other Observations:

- A re-design of the Y-Cutter Tool from a "line cut" to a "strip cut" was considered, but the conclusion was this would be a major and quite complex re-design (for instance, the pelt would need to be tensioned prior to the cut).
- Further, additional suggestions to modify the Y-Cutter Tool to include "butterflies" to better open and separate the pelt from the leg were considered, but again costs of tool modification were highlighted;
- A final word of thanks to the working group participants all of which contributed greatly to the brainstorming, analysis, and final recommendations.

5 (Conclusions and recommendations) - Section

Additional summary reports were submitted by; IRL, MLA, Alliance, MAR, and CRF. The outcomes from this working group will be used to structure further work on this machine.

In addition, it is understood that the NZ system integrator MilMeq may also be conducting work in this area. There may be opportunities for Australia and New Zealand research bodies to work collaboratively on this project.

6 Reference list

Y-Cutter CBA 2009 – Matrix G.Palmer
Colac Visit Report May 2011 – Alliance Ross Smith

Colac Visit Report May 2011 – IRL Geoff Bates
Colac Visit Report May 2011 – MAR Damian Benedicic
Colac Visit Report May 2011 – CRF Mick Bird