Residual Feed Intake: Innovative solutions to improving feed efficiency in beef cattle

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The Problem

- Feed costs are a severe and growing challenge to the global competitiveness of beef production in Canada.
- 56-71% of the cost of cow-calf production is associated with feed, and maintenance requirements take two-thirds of the feed energy consumed each day.
- Maintenance requirements and feed efficiency of beef cattle have remained largely unchanged over the last 100 years.
- Reasons included the time consuming and costly processes of measuring individual animal feed intake in cattle and the finding that selection for feed to gain ratio has been ineffective in improving feed efficiency in beef cattle
- Competing protein sources such as pork and poultry have made dramatic improvements in feed efficiency through both genetic and non-genetic means
- Alternatively, residual feed intake (RFI) is independent of body weight and average daily gain, and is defined as the difference between actual feed intake and the expected feed requirements for maintenance of body weight and production.
- RFI is moderately heritable and reflects the energy required for maintenance.

Hypothesis: Can RFI be used to select breeding stock for lower maintenance requirements without adversely affecting growth, carcass quality and composition, and heifer and bull fertility?

The Approach

New, innovative and Alberta-based technology was used to monitor individual animal feed intake and behaviour. This technology, referred to as the GrowSafe® System, integrates radio frequency (RF) identification with RF detection, data acquisition, computer software, wireless communication and internet conductivity.

Over 2000 bulls, steers, heifers and cows were measured for RFI and economically important traits including:

Body weight, growth
Skeletal/Frame size
Carcass quality
Whole body composition

Heat production
Net energy for maintenance
Feeding behaviours
Manure production
Methane emissions

Heifer age at puberty, age at 1st calving & pregnancy
Cow lifetime productivity
Bull fertility – semen quality, breeding soundness

What did we find

Selection for low RFI (efficient) breeding cattle will:

- Have no effect on growth rate, body size or weight,
- Reduce feed intake at equal body size & growth
- Improve feed to gain ratio by 10-15%,
- Lower maintenance requirements,
- Have slight to no effect on carcass yield/quality
- Reduce methane production by 20-30%.

- Have no effect on cow pregnancy & weaning rates
- Have no effect on calf weaning weights
- Have no effect on production efficiency
- Produce cows that are in better body condition,
- Produce cows that consume less feed
- Produce replacement heifers that may be slightly delayed in their age at puberty.

1999- 1st in North America to integrate the concept of RFI with GrowSafe System technology

2002- 1st first in North America to report on the relationships of RFI with body composition, heat production, and methane/manure production.

2005- 1st in North American to report expected progeny difference (EPD) values for RFI and incorporated them into a multi-trait economic index.

2009 - 1st in North America to commercially validate the economic benefits associated with selection for low RFI in beef cattle- $25-$29 million/yr in feed savings in Alberta assuming a 30% adoption rate.

Who Benefits and How

Cow-Calf, seedstock and feedlot managers:

- Purchasing a LOW RFI bull with optimal body size, growth rate and fattening potential should produce offspring that have reduced annual feed costs of $26/hd for feeder cattle and $15/hd for replacement heifers.
- Potential benefits, accrued after 7-10 years of selection for RFI, are estimated at $50-100 million annually for Alberta's beef cattle industry.

High Technology Companies: Increased sales of GrowSafe Systems (US, Canada, Australia) estimated at $5-10 million dollars annually.

Genetic Companies: Genetic marker panels for RFI will be developed and marketed world wide.

Carbon Credit Aggregators: Estimated at $1-2/hd assuming $10/t CO_2e.

Public: Less manure and methane produced per kg beef.

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