



BCRC (2009-2013) Results Report

Chairman's Message & Executive Summary

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Download the full report:

http://www.beefresearch.ca/files/pdf/BCRC_results_report_jan2014.pdf

CHAIRMAN'S MESSAGE



Tim Oleksyn
BCRC Chair

The Beef Cattle Research Council (BCRC) has a responsibility to report back to stakeholders (both industry and government) on how National Check-off dollars are invested in research and how they are contributing to advancements in the beef industry. It is important to measure progress in research to evaluate how to be most effective with limited dollars. The Council is proud to present this inaugural results report summarizing funding activities over the last five years.

Research has multiple applications including: improving productivity; supporting the Canadian Beef Advantage; providing data to inform policy, regulations and trade disputes; and educating the public on how beef is produced in Canada.

The development and publication of the National Beef Research Strategy in 2012 has allowed the BCRC to ensure that all areas of research critical to the long term success of the beef industry receive appropriate funding. These priority areas include animal health and welfare, feed grains and feed efficiency, forage and grassland productivity, specified risk material (SRM) disposal, beef quality and food safety. Balancing funding across all these areas with industry partners is a priority for BCRC. Placing excessive funding emphasis on one priority area is detrimental to industry as it risks the loss of research facilities and expertise in other areas. BCRC is currently collecting and analyzing data voluntarily submitted by other beef research funding agencies into a National Research Funding Inventory. This database will allow funding agencies to better communicate about funding decisions and will enhance collaboration to prevent unnecessary overfunding or unintentional neglect of critical long-term research priorities.

The success of applied research projects depends heavily upon the work of basic research. Because of the uncertainty of its outcome, basic research is typically considered higher risk and therefore has historically been funded by governments. As government funding for basic research is reduced, this will eventually impact applied research. There is a critical balance between basic research, applied research, and technology transfer that needs to be maintained as much as ensuring that research in all areas of the beef industry are supported.

The Government of Canada's development of the Science Clusters in 2009 was welcomed by the beef industry as it increased dialog on the importance of continued support for basic research and focused use of limited dollars on areas of industry priority. The science cluster program has leveraged resources and accelerated performance through a systems approach which encourages collaboration between researchers across the country. The development of the National Beef Research Strategy has provided all partners with clear industry priorities, giving direction to move forward.

An increased investment into technology transfer has ensured that this research will be communicated to industry. Encouraging adoption of new technology and providing recommendations for management changes can incrementally improve productivity on individual operations, driving industry competitiveness. This step completes the circle of growth and re-investment in research, as it provides value back to producers.

Tim Oleksyn, Chair
Beef Cattle Research Council

EXECUTIVE SUMMARY

Research supports the Canadian beef industry by addressing arising issues in a rapidly changing marketplace. This is key to driving competitiveness and innovation.

The 2009-2013 Canadian Beef Cattle Industry Science Cluster (Beef Cluster I) brought together Canada's leading federal government (Agriculture and Agri-Food Canada - AAFC), and industry research funders (Beef Cattle Research Council - BCRC and Alberta Beef Producers - ABP) to provide \$10.5 million in applied cattle, beef and forage research. Beef Cluster I funded 32 research activities that involved 51 lead researchers at seven federal sites and five universities in six provinces, in addition to several provincial government institutions and industry facilities.

The funding available through Beef Cluster I enabled industry to successfully encourage the development of effective teams of researchers spanning multiple AAFC and non-AAFC researchers and institutions across Canada on multiple research activities. In addition to strengthening research results and reducing duplicated research efforts, this collaboration ensured trained research expertise in key areas is maintained to facilitate future research. It also encouraged improved technology transfer and knowledge dissemination efforts aimed at the successful development and adoption of priority outcomes by Canada's beef industry.

BCRC's work to increase communication and collaboration between researchers and across industry partners is aimed at:

1. Increasing the percentage of successful research projects that meet industry needs
2. Reducing the lag from development to adoption
3. Increasing the proportion of producers adopting new technology

The success of applied research projects depends heavily upon the work of basic research. In some situations, necessary basic research may not have been undertaken with a specific purpose in mind or was potentially undertaken with a different end use in mind. Basic research is typically considered higher risk and its indirect benefits are more difficult to measure; therefore basic research has historically been funded by governments.

Reduced government funding for basic research impacts the effectiveness of applied research for which funds are easier to obtain because applied research projects have more clear benefits to industry. *There is a critical balance between basic research, applied research, and technology transfer that needs to be maintained as much as ensuring that research in all areas of the beef industry are supported.*

Areas of basic research that will provide the most benefit to the beef industry in the future include rumen biology, understanding the physiology of the cow, soil science, plant physiology and genetics. Basic research continues to occur primarily through government (but to a lesser degree than before) and at universities. Industry needs to clearly communicate the importance of this basic research and may need to fund portions of it in order to maintain capacity in Canada.

This inaugural Beef Cluster I Results Report evaluates the effectiveness of research activities funded through the BCRC¹. The BCRC recognizes its responsibility to report back to stakeholders with measured progress in each research area in order to be most effective with limited research dollars. Evaluating research activities is challenging because there is a significant lag between the initial investment,

¹ Results presented in this report only include those projects that had funding start after 2009 and were completed in 2013.

commercialization, and a measurable impact following adoption by industry. Even when this lag is taken into account, many research activities are still difficult to evaluate. Funding for applied or near-market projects is easier to assess.

The largest financial improvements to industry over the past five years were in the priority areas of Animal Health & Welfare and Feed Grains & Feed Efficiency as these applied areas allow for almost immediate adoption of new technology and have a high level of private research investment.

Animal Health and Welfare

(5/11 successfully completed deliverables)

Minimizing the costs of animal health issues and production limiting diseases is critical to the economics of cow-calf and feedlot production. A 2% improvement in reproductive efficiency decreases the cost of cow-calf production by \$16.50 per head, and a 1% decrease in pre-weaning death loss reduces cost of production by \$7.45 per head. It is recognized that changes in management may require investment in order to achieve these results.

Beef Cluster I research developed more cost-effective diagnostic tests for two diseases that can seriously impair the reproductive performance in cow-calf operations, vibriosis and trichomoniasis. These tests are now moving towards further validation and commercialization. Mineral supplementation strategies for the cow herd in the pre-natal and early post-natal period were evaluated and approaches were identified that improved the health and growth performance of calves. The health risks associated with feeding industry standard levels of dried distillers' grains with solubles (DDGS) to feedlot cattle were assessed and found to be negligible.

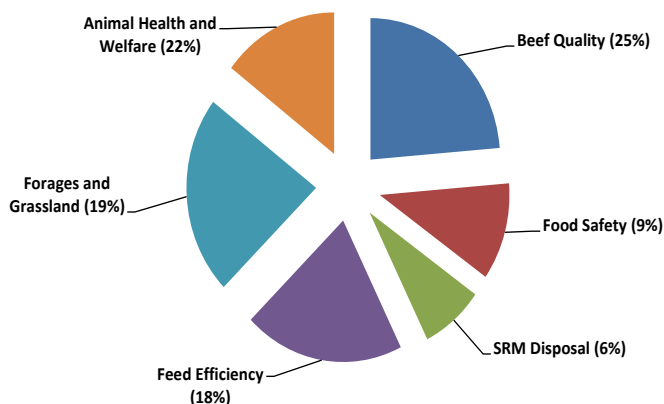
The National Beef Quality Audit quantified the degree to which animal management has improved since 1999 through the prevalence of horns (58% reduction), brands (82% reduction) and bruises (31% reduction). These results indicate quantifiable improvements in animal welfare through less frequent use of painful procedures and widespread adoption of improved facility design, animal handling and transportation practices. Liver discounts were identified as a significant opportunity for improvement. The effect of transportation practices on the health and welfare of weaned beef calves and market cows is being evaluated in collaboration with commercial truckers and feedlots, and will help inform efforts to develop science- and outcome-based transportation regulations and practices that contribute to the welfare of cattle.

The risk of transmission of two diseases that are being deregulated in Canada (no longer federally reportable) was evaluated. The biology, ecology and behavior of the ticks and biting fly vectors that transmit anaplasmosis and bluetongue were studied. Trapping methods to monitor the populations of these vectors were compared, and the distribution of these vectors suggests that the risk of disease spread appears to be minimal in Western Canada.

The tools and knowledge developed through this research:

- have been incorporated into industry practice (in the case of DDGS feeding recommendations),

National Beef Science Cluster Funding



- are being further developed into commercially available diagnostic tests (in the case of vibriosis and trichomoniasis),
- will help industry develop producer recommendations to manage the risk of exposure to vectors of a de-regulated disease (tick-borne anaplasmosis), and
- inform the development of science-based cattle transport regulations.

Three projects (6 deliverables) were unable to achieve their stated objectives due to:

- (1) challenges obtaining MAP strains from the CFIA and U.S.,
- (2) errors in previous published work and unrelated health problems, and
- (3) an extension provided for one year so results are not available at this time.

Feed Grains and Feed Efficiency (13/15 successfully completed deliverables)

Feed is the single largest variable input cost in both cow-calf and feedlot production. For the feedlot sector, a 5% improvement in feed efficiency could reduce feed costs by over \$50 million annually, dramatically reducing feed grain usage. For the cow-calf sector, a 5% improvement in feed efficiency would reduce winter feeding costs by close to \$30 million annually.

Research quantified the influence of grain type, source, and processing on the nutritional value of DDGS for beef cattle. Four protein ingredients were tested and found that they can be used effectively in diets fed to backgrounded cattle. This study helped feedlots to appropriately price these alternative feeds relative to traditional feed grains, based on their effects on animal backgrounding and finishing performance, carcass value, beef quality and manure nutrient levels. Strategies effectively incorporating DDGS into backgrounding and finishing diets were developed and widely adopted by industry.

The impact of feeding DDGS was extended to assess manure composition, *E. coli* shedding and shelf life of beef (see the Food Safety and Beef Quality sections for those results). Composted manure contains less dry matter, moisture, and more nitrogen (N), phosphorus (P), sulfur (S) and salt than raw manure. Soil salt, P and S increased as manure from DDGS-fed cattle was applied at higher rates, particularly for composted manure. The increased P in the composted manures has the potential for P loading in soil and would require reduced rates to avoid excessive buildup of PO₄-P in the soil. P-based applications of manure would better match crop demand than N-based manure applications.

Genetic and physiological indicators of feed efficiency were also evaluated. This led to a better understanding of the interactions between selections for feedlot feed efficiency and other economically relevant traits (primarily fertility). Marker assisted expected progeny differences (EPDs) and indexes to assist in the identification and selection of breeding stock that are genetically superior for economically relevant traits were not completed through the Beef Cluster I, but a number of individual cattle breed associations are in the process of developing these tools.

The beneficial effect of improved feed efficiency on environmental indicators like methane and manure production was measured. Improving feedlot feed efficiency will have measurable environmental benefits; a 20% improvement in feed efficiency translates to a 30% decrease in manure production, as well as a 30% reduction in methane production.

Two deliverables were not met due to:

- Feed efficiency markers identified not working across different breeds, hindering the development of viable marker panels for commercial feedlots
- A reliable value for heritability could not be developed because phenotype data was not collected in multiple locations. Related research by the team is underway to determine this

Due to substantial investments by other industry partners, the BCRC elected not to invest in feed grain variety development through Beef Cluster I. As those investments come to an end, BCRC will invest in feed grain breeding research in Beef Cluster II (2013-2018).

Forage and Grassland Productivity (15/15 successfully completed deliverables)

Canada's forage industry is the single largest crop with 80% of production going to livestock feed. As a critical input for the cow-calf and backgrounding sector, Canada's forage productivity must continually improve to support Canada's international competitiveness.

Beef Cluster I research identified native grass and legume cultivars suitable for semi-arid rangelands, developed a new variety of a non-bloating legume, and discovered genetic markers that are significantly associated with barley silage digestibility. Appropriate forage and legume mixtures can provide an optimal ratio of forage quality and yield in Central and Eastern Canada.

Seeding dates and alternative annual forages were compared for swath grazing to reduce winter feeding costs of the cow herd. Research suggests that swath grazing triticale can reduce winter feeding costs by over \$100 per cow compared to wintering cows for 100 days in a corral. Savings were lower for swath grazed barley (\$89) due to lower yields, and for corn (\$83) due to higher input costs. This has significant implications for Canada's beef industry as reducing total winter feeding costs by as little as 1% would save Canada's cow-calf sector an estimated \$6 million annually. Triticale had the lowest production cost, higher yields, and a lower daily feeding cost compared to barley and corn. High-yielding crops which utilize a greater portion of the season than barley have the potential to reduce the cost of wintering cows further than previously envisioned.

Lower fertilizer costs improved returns for alfalfa-grass mixed pastures. Economic simulation indicated substantial benefit to alfalfa inclusion and small detriments to rested grazing, though these may be overcome if cow-calf performance on early-seeded and early-swathed annuals could be improved.

These results will contribute to improved soil health, pasture longevity and productivity, and reduce production costs in the cow-calf sector.

Beef Quality (7/12 successfully completed deliverables)

The National Beef Quality Audit showed consumer ratings of the flavour, juiciness and tenderness of a variety of steaks (top sirloin, strip loin, boneless cross rib, inside round) improved 8-12% from 1999 to 2009. Improved satisfaction with the eating quality of Canadian beef will contribute to improved consumer confidence. Another National Beef Quality Audit will be conducted under Beef Cluster II (2013-2018).

Over the last five years the proportion of carcasses grading AAA or higher increased from 51.6% in 2008 to 56.7% in 2012, while the proportion of yield grade 1 carcasses decreased from 60.8% in 2008 to 48.8% in 2012. Dark cutting beef (B4 grade) prevalence in youthful cattle decreased from 1.4% in 2008 to 1.2% in 2012.

The dark cutting phenomena is more complex than previously suspected. Dark cutting in beef carcasses was not affected by slightly lower chilling temperatures, indicating that the incidence of atypical or borderline dark cutting is not likely related to the number of carcasses in the cooler. Three distinct subcategories of dark cutters were observed (classical, atypical, and borderline).

Optimal feeding strategies to enhance omega-3 levels in mature and youthful cattle were researched but not developed. A fatty acid workshop held in the fall of 2009, clarified that the omega-3 fatty acids predominant in beef have no known human health benefits.

Four plant enzymes were found to increase the heat solubility of perimysium, and are therefore potentially useful for the tenderization of meat. The flavours imparted by kachri and ginger were acceptable to a trained taste test panel and if a method of injecting a more concentrated solution of these enzymes was devised, both tenderness and flavour may be improved. The DNA panel was able to explain 40% of the genetic variation in beef tenderness in the population it was developed in.

While promising DNA markers were found within each population, very few markers had predictive value across populations. This suggests that breed-specific marker panels are likely the most appropriate approach to follow until the actual functional mutations responsible for differences in tenderness and eating quality are identified.

Beef demand has stabilized over the past 15 years after declining throughout the 1980s and into the first part of the 1990s. While gains were seen in AAA grading production, there were fewer yield grade 1 cattle and more yield grade 3. By focusing all market signals on AAA production, the industry is actually seeing a net loss as costs from additional fat deposition on the animal are accrued by the feedlot which is then trimmed by the packer.

Five deliverables were not met due to:

- Communication efforts are still underway
- Breed specific markers were identified but few work across breeds or populations. Within breed panels are being pursued by purebred associations

Food Safety (9/12 successfully completed deliverables)

Research evaluated the effectiveness of various food safety interventions applied to cattle, whole carcasses, beef cuts and trim routinely applied at commercial beef processing facilities. Modern beef packing plants using multiple interventions can produce dressed carcasses carrying as few as four (4) viable *E. coli* cells per carcass. However, beef can be contaminated with pathogens during carcass breaking. Contamination from personal equipment can be wholly avoided by ensuring that hands, cotton gloves, steel mesh gloves and knives are thoroughly and regularly cleaned, and by wearing disposable rubber gloves between cotton gloves and steel mesh gloves.

While lactic acid sprays and washes are very beneficial for reducing microbial contamination on dressed carcasses, they had limited benefit on beef trim. E-beam treatment achieves more comprehensive pathogen control on trim. Treatment with a 1kGy e-beam eliminated more than 99.99% of the VTEC and 99% of the *Salmonella*. A trained panel observed no effects of irradiation on the colour, aroma, texture, juiciness or flavour of beef patties made with a variety of treated and non-treated ground beef mixtures, even with patties made entirely with beef that had been e-beam treated.

The results of these research activities will contribute to further improve food safety practices in the beef industry, and continued efforts to achieve the regulatory approval of e-beam irradiation for beef. Success in these efforts will reduce the risk of future beef recalls and improve consumer confidence in the safety of Canadian beef in both domestic and export markets. While reductions in the incidence of *E. coli* in beef have occurred over the past decade, this does not reduce the negative impact to industry when a recall occurs. Measuring the benefit of this reduction is difficult as the benefit is from avoiding a recall. Although the cost of a recall incident can be calculated after the fact, it is difficult to estimate the costs that were *not* incurred by an event that *did not* happen.

Cranfield (2013) found that simulations from 1998:Q3 to 2010:Q3 showed that on average one additional beef recall in Canada would lead to a 2,260 tonne reduction in beef consumption per quarter (with a range of 710-5,740 tonnes), valued around \$26.5 million at the retail level (with a range of \$8-67 million); this is equivalent to a one percent drop in consumer beef expenditures.

Three deliverables were not met due to:

- Research was redirected to focus on *E. coli* versus *Salmonella* and *Listeria*
- Only one DDGS inclusion rate was used in the study (representative of industry practices)

Specified Risk Material (2/2 successfully completed deliverables)

Research found that 99.9% of BSE prions are destroyed after 28 days of composting in beef manure. These results can inform the review of Canada's Enhanced Feed Ban, which currently prohibits the movement of composted manure that may contain deadstock among farms. If legalized, the ability for producers to use fertilizer from composted SRM will offset some of the costs accrued by industry, particularly for feedlots looking to sell manure to farmers in their area and are currently paying for deadstock removal.

Technology transfer activities were significantly enhanced through Beef Cluster I. A 10-year Technology Transfer and Knowledge Dissemination Strategy was developed and led to the hiring of a Beef Extension Coordinator. Consequently, the Canadian beef industry's communication regarding the value and results of applied cattle, beef and forage research has reached unprecedented levels. Much of this communication has occurred through the beefresearch.ca website developed in 2012, with continued communication through the Canadian Cattlemen's Association's (CCA) Action News e-newsletter, regular articles in Canadian Cattlemen – the Beef Magazine, a Beef Research School video series developed in collaboration with realagriculture.com, as well as more traditional communication through the Verified Beef Production program, agricultural print media and speaking engagements at various industry events. Increased investment into technology transfer ensures that research results from Beef Cluster I will be communicated to industry and its partners, with the enhanced opportunity for greater and faster uptake of innovation.

Building Capacity - Highly skilled personnel specializing in food safety, beef quality, forage and grassland productivity and feed efficiency were trained through Beef Cluster I. One of these individuals has been hired as a food safety researcher at AAFC Lacombe, one of the forage researchers trained has become a Forage Management Specialist with the Saskatchewan Ministry of Agriculture, and one feed efficiency researcher was hired at the Nova Scotia Agricultural College of Dalhousie University. Maintaining and enhancing current research capacity in Canada to ensure all priority areas are covered is needed, so that Canadian specific issues and regional conditions can be addressed directly instead of relying on US research and extrapolating for the Canadian situation. This is critical to the long term vitality of the beef industry. Unfortunately, industry efforts to get several of these scientists hired into permanent positions to reinforce federal carcass composition and forage research capacity at AAFC Lacombe and AAFC Swift Current have not yet been successful. Preventing further reductions in federal research capacity is a high priority for BCRC.

Improved **industry recognition** of the value of applied research has led to an increased allocation of the National Check-off dollar to research. Since 2010, four provinces (Saskatchewan, Alberta, B.C. and Nova Scotia) have doubled their percentage allocation to national research through the National Check-off, while only one province (Ontario) has decreased its allocation.

Several important findings resulted from Beef Cluster I, particularly around the value of coordinated research funds. There is potential for improved effectiveness through additional collaboration and cooperation between funders.

With few exceptions, Beef Cluster I has been a notable success and has laid a solid foundation to build upon in future Beef Clusters. Beef Cluster II (2013-2018) builds on Beef Cluster I research to move towards the beef industry's long term objectives as set out in the National Beef Research Strategy.