



Research funded by the
Beef Cattle Industry
Science Cluster

under Growing Forward 2

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Introduction

The Beef Cattle Industry Science Cluster is a partnership between Agriculture and Agri-Food Canada (AAFC) and the Beef Cattle Research Council (BCRC) to ensure that proactive and strategic investments in applied research are allocated to programs that have the greatest potential to move the Canadian beef cattle sector forward. The partnership is focused on enhanced coordination and collaboration, and alignment of research activities with industry priorities to increase productivity, reduce costs, advance sustainability, and increase demand for Canadian beef.

Joint industry and government commitments to the second Beef Science Cluster total \$20 million, including \$14 million in funding from AAFC and \$5 million in funding from the research allocation of the [National Check-off](#) and provincial beef industry groups, with additional investments by provincial governments. Funding has been directed to 26 research projects that will be completed by March 31, 2018.

The establishment of research programs under the second Beef Cattle Industry Science Cluster was an extensive process initiated by the development of a comprehensive [National Beef Research Strategy](#). The development of the national strategy was led by the BCRC and the national Beef Value Chain Roundtable and involved the participation of key stakeholders and major beef research funders across Canada. It gained the commitment of the major funders to coordinate funding to achieve short, medium, and long-term outcomes in alignment with industry's priorities. Desired research outcomes by the second Beef Cattle Industry Science Cluster are directly aligned with objectives established under the National Beef Research Strategy.

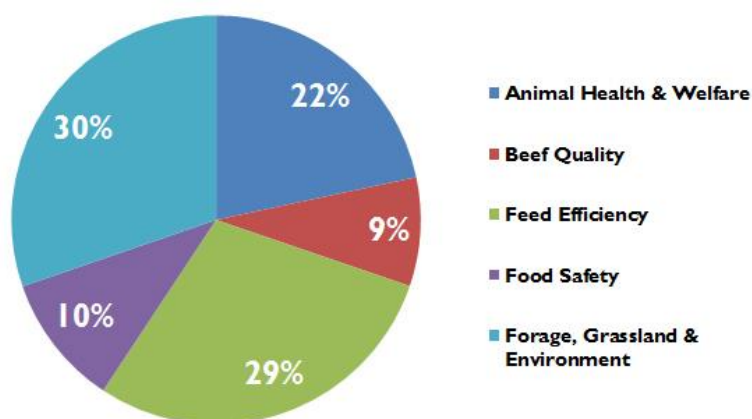
While considering approval of research projects under the second Cluster, the BCRC's staff and council members sought guidance and expertise from the industry's leading research experts. A Science Advisory Panel appointed by the BCRC offered research expertise from across Canada in a range of research areas. Independent peer reviews were also solicited for each proposal.

The second Cluster builds on the success of the first. Investments are focused on a portfolio of research that contributes to the industry's ability to meet the growing global demand for high quality, safe beef through responsible and profitable production practices that support a sustainable future for the Canadian beef cattle industry.

Four core research objectives under which more specific research programs have been established:

- *Improve production efficiencies:* through enhanced feed and forage production, increased feed efficiency, and decreased impact of animal health and welfare issues and production limiting diseases.

ALLOCATION OF CLUSTER 2 FUNDING BY RESEARCH PRIORITY AREA



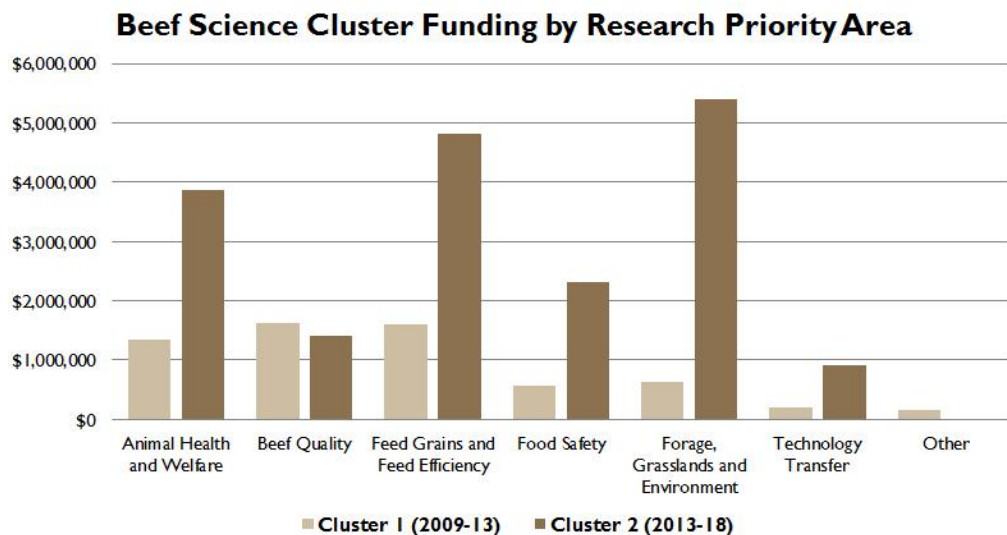
- *Improve beef demand and consumer confidence:* through reduced food safety incidents, supporting the Canadian Beef Advantage and improved beef quality through an audit program and primary production improvements, development and application of post processing technologies to optimize cutout values, and evaluation of the environmental footprint of beef production with recognition of positive contributions to present a balanced perspective.
- *Improve tech transfer:* through implementation of a long term Knowledge Dissemination and Technology Transfer strategy which focuses on regular communication to industry through extension tools including www.beefresearch.ca, videos, webinars and cost of production decision making tools, and promoting and enabling the engagement of researchers with industry.
- *Competitiveness, emerging issues and research capacity:* through flexibility in funding that allows industry to respond to emerging or critical issues in an expedient manner while maintaining professional capacity.

Investments in the second Cluster will lead to several benefits, including:

- maintaining or improving competitiveness
- support for science-based policy, regulation and trade
- informing science-based public education and advocacy
- supporting the Canadian Beef Advantage
- maintaining professional capacity to conduct long-term research and respond to emerging or critical issues in an expedient manner
- improving uptake of research knowledge and technologies by the industry

The BCRC, which operates as a division of the Canadian Cattlemen’s Association, developed the Cluster under Growing Forward in 2009 to enhance industry leadership in developing and managing applied science and technology research plans that are aligned with industry priorities. The first Beef Cattle Industry Science Cluster was a four year initiative with research funding allocated between April 1, 2009 and March 31, 2013.

Industry and government funding commitments through the first Cluster totaled approximately \$10.5 million directed to 32 research projects.



A results report on the first Cluster is available at:

<http://www.beefresearch.ca/blog/cluster-1-results-report/>. The report outlines how dollars were invested, and how that research is contributing to advancements in production efficiencies, quality and demand for Canadian beef. In many cases the financial impacts of deliverables to the industry were calculated, while some impacts may not be fully apparent for several years.

Animal Health and Welfare research projects

Major production limiting diseases can be costly, even devastating for an individual herd, and have the potential to harm the entire beef cattle industry. Applied research works to develop effective and economical management practices, and diagnostic and treatment tools. These reduce costs and losses associated with animal health and production limiting diseases in primary production sectors.

Learn more at <http://www.beefresearch.ca/research/animal-health-welfare.cfm>

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RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Identifying pre-clinical MAP infected cattle

Project Title:

Identifying Mycobacterium avium subsp. paratuberculosis (MAP) exproteome components recognized during early infection to develop diagnostic and vaccine targets

Project Code: ANH.01.13

Completed: *In Progress*

Researchers:

Lucy Mutharia, Ph.D. lmuthari@uoguelph.ca

Lucy Mutharia, Ph.D. (University of Guelph), Phillip Griebel, Ph.D. (University of Saskatchewan)

Background

Mycobacterium avium subspecies *paratuberculosis* (MAP) causes Johne's disease (JD), a chronic infectious disease of ruminants. Infection normally occurs in the neonatal period when calves ingest an infectious dose of MAP but clinical, irreversible and ultimately fatal disease does not occur until years later. In the meantime, animals with preclinical JD may look healthy while still shedding MAP in their feces, transmitting the disease to new animals.

There are no effective vaccines or treatments, and diagnostic tests fail to identify many infected animals in the pre-clinical state. A reliable, sensitive, specific diagnostic test that accurately identifies MAP carriers in the early stages of infection would greatly help efforts to control the disease.

One potentially promising approach involves identifying cell mediated immune responses (CMIR) and antibody responses. It is known that CMIR declines and antibody responses increase at the time that animals enter the clinical stage of the disease, but CMIR tests are not specific enough for diagnosing JD in the early stages.

Objectives

The main objective of this study is to identify proteins secreted by MAP that can elicit a MAP-specific CMIR.

What they will do

These researchers have identified two proteins secreted by MAP that induced strong CMIR in calves one-month after MAP infection. This indicates that systematic screening of the proteins secreted by MAP is the best approach to identify novel targets for a CMIR-based test to detect early-stage JD. In this study, the researchers will identify the rest of the proteins secreted by MAP and

generate recombinant versions. The ability of each protein to elicit a mucosal T-cell response will be determined, and the presence of these T-cells in blood will be determined.

Implications

The availability of well characterized MAP specific epitopes which induce CMIR early in infection would improve test sensitivity and specificity and facilitate effective management interventions to control MAP in beef herds.

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Beef Science Cluster

IN PROGRESS

Understanding risk factors of anaplasmosis transmission

Project Title:

Geographic variation in abundance and genetics of the anaplasmosis vectors *Dermacentor andersoni* and *Dermacentor variabilis*

Researchers:

Tim. Lysyk, Ph.D. Tim.lysyk@agr.gc.ca

Tim. Lysyk, Ph.D. (Agriculture and Agri-Food Canada), Neil Chilton, Ph.D. (University of Saskatchewan) and Kateryn Rochon (University of Manitoba)

Project Code: ANH.12.13

Completed: *In Progress*

Background

Anaplasmosis is a cattle disease caused by the blood-borne pathogen *Anaplasma marginale*, and is transmitted in North America by the Rocky Mountain wood tick (*Dermacentor andersoni*) and the American dog tick (*Dermacentor variabilis*). In Canada, *D. andersoni* occurs from western Saskatchewan to central British Columbia. *D. variabilis* occurs from Saskatchewan east, and appears to be undergoing a range expansion relative to historic records. There is little information on some of the most critical factors that determine the risk of anaplasmosis transmission.

Objectives

The objective of this study is to gather information on the distribution, abundance, and genetic diversity of these ticks in British Columbia, Alberta, Saskatchewan and Manitoba.

What they will do

The habitat and climatic conditions associated with the distribution and relative abundance of *D. andersoni* and *D. variabilis* will also be examined. This will provide baseline data that can be used for assessing effects of climate change and changing land use patterns on tick abundance and distribution, and the potential risk to cattle of infection with *A. marginale*. In addition, genetic studies will assess whether gene flow occurs among tick populations or whether the populations are isolated.

Implications

D. andersoni and *D. variabilis* abundance maps and predictive equations to help forecast shifts in abundance, as well as an

estimation of genetic similarity among tick populations may help identify areas less prone to transmission, as well as allow for targeted vector and pathogen surveillance and management.

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Beef Science Cluster

IN PROGRESS

Developing efficient, multi-pathogen tests for common cattle diseases

Project Title:

Development of a fully-automated DNA microarray-chip for multiplex detection of bovine pathogens

Project Code: ANH.13.13

Completed: *In Progress*

Researchers:

Aruna Ambagala, Ph.D. and Oliver Lung Ph.D. Aruna.Ambagala@inspection.gc.ca

Aruna Ambagala (Ph.D.) and Oliver Lung (Ph.D.), Centres for Animal Disease, Canadian Food Inspection Agency, Lethbridge, Alberta, Dale Godson, Ph.D. (Prairie Diagnostic Services), John Gilleard, Ph.D. (University of Calgary), Trevor Alexander, Ph.D. (Agriculture and Agri-Food Canada) and Tomy Joseph, Ph.D. (Manitoba Agriculture, Food and Rural Initiatives)

Background

Respiratory and enteric diseases are the most common and costly diseases in beef cattle. Both are multi-factorial disease complexes involving several viruses and bacteria. Effective control of these diseases can benefit from rapid and cost-effective diagnostic tests that can simultaneously detect all relevant pathogens in a single assay. Current diagnostic tests for these diseases are primarily single pathogen tests and are thus inefficient and require separate tests for each pathogen. DNA microarrays, combined with multiplex PCR, are capable of highly sensitive detection and differentiation of multiple pathogens in a single sample.

Objectives

To develop two cost-effective microarray chips that can be used on a new fully-automated technology platform - one for rapid identification of bovine respiratory disease pathogens and one for bovine enteric pathogens.

What they will do

First, sequence databases of the targeted pathogens will be created from available genetic information. The databases will be used to design pathogen-specific primers for amplification of target genes, as well as microarray capture probes for pathogen detection and differentiation. Amplification procedures will be developed and optimized separately for respiratory and enteric pathogens. Pathogen-specific capture probes will be screened for their sensitivity and specificity, and the probes with the highest sensitivity and specificity will be used in a user-friendly, fully-automated Rheonix Encompass MDx Workstation that does not require user intervention after sample introduction. The amplification procedures and two bovine microarray chips will be validated using laboratory and clinical samples from the CFIA, AAFC, MAFRI and PDS.

Implications

The two user-friendly automated assays for simultaneous detection and differentiation of important bovine respiratory and enteric pathogens will allow efficient use of samples and significantly reduce the cost, labour and time required for multi-pathogen detection. These assays will facilitate nation-wide surveys of disease prevalence and enhance biosecurity in the cattle industry.

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RESEARCH FACTS

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Beef Science Cluster

IN PROGRESS

Measuring and mitigating pain during castration

Project Title:

Effect of age and handling on pain assessment and mitigation of common painful routine management practices

Project Code: ANH.21.13

Completed: *In Progress*

Researchers:

Karen Schwartzkopf-Genswein, Ph.D. and Ed Pajor, Ph.D. Karen.genswein@agr.gc.ca
 Karen Schwartzkopf-Genswein, Ph.D. (Agriculture and Agri-Food Canada) and Ed Pajor, Ph.D. (University of Calgary), Eugene Janzen, D.V.M; M.V.S.) (University of Calgary), and Pain and Animal Welfare Group (University of Calgary)

Background

Public concern regarding the pain associated with castration, dehorning and branding of beef cattle is increasing. Past research has focused on individually housed dairy calves, or feedlot cattle. There is a lack of information regarding the influence of age and pain medication on preweaning beef calves in a herd environment.

Objectives

To evaluate the relative impacts of age, technique, and pain medication when preweaning beef calves are castrated at the same time as branding or as a separate procedure.

What they will do

In year 1, calves will be castrated (control, surgical or banding) at 0, 60 or 120 days of age. Physiological, behavioural and performance data will be recorded. The age identified as most appropriate for animal welfare will be examined in year 2, when the potential benefits of analgesic medications will be examined in conjunction with surgical castration. Year 3 will examine the effects of pain medication when surgical castration method is combined with hot-iron branding (at the age identified in Year 1). Additional physiological and behavioural measurements will be collected on subsets of each treatment group to assess long-term impacts of these procedures and medications.

Implications

This research will generate science-based recommendations regarding the best age to carry out painful routine management procedures and identify target ages which may require pain mitigation. A practical method of alleviating both acute and chronic pain associated with band and knife castration in young beef calves will also be assessed and identified. This information is required to make sound industry recommendations to the Beef Codes of Practice.

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Beef Science Cluster

IN PROGRESS

Establishing a long term surveillance network to support Canadian beef cattle research

Project Title:

Implementation of a longitudinal disease surveillance network for cow-calf operations in western Canada

Project Code: ANH.23.13

Completed: *In Progress*

Researchers:

John Campbell, DVM, DVSc john.campbell@usask.ca

John Campbell, DVM, DVSc, University of Saskatchewan, Cheryl Waldner, DVM, Ph.D., Murray Jekinski, DVM MSc., Steve Hendrick DVM, DVSc., Joseph Stookey, Ph.D., and Greg Penner, Ph.D. (University of Saskatchewan) and Eugene Janzen, DVM, MSc. (University of Calgary)

Background

Canada has no structured surveillance program to collect animal health management or disease incidence information in the beef industry. Over the past 20 years, this research group has generated surveillance and research information for the cow-calf industry on BVDV, antimicrobial resistance, Neospora, Johne's disease, calf loss, Trichomoniasis, vibrio, bull management, nutrition, environmental issues, and animal behavior. In each case, significant time, effort and resources were needed to recruit herds for relatively short-term projects. In the USA, the National Animal Health Monitoring Service (NAHMS) has a long term surveillance network that supports a variety of animal industries and is a critical resource for specific research initiatives. A similar strategy would be beneficial in Canada.

Objectives

To establish a western Canadian cow-calf surveillance network

What they will do

A group of 120 beef cow-calf herds from across Western Canada representing the industry at large and reflecting the most important regional, demographic, and size characteristics of the national herd will be recruited. This group of herds would become a "living laboratory" and the foundation of a surveillance network for the Canadian cow-calf industry. Vital baseline information on biosecurity practices, economics of production limiting diseases, animal welfare practices, antibiotic use, and herd nutrition and

management will be gathered. A serum bank will also be created to use for additional research projects and to investigate emerging disease threats. These herds would also act as sentinel herds to detect disease and management changes in Western Canada's beef industry.

Implications

This surveillance network will provide very timely and efficient answers to questions regarding animal health, welfare, biosecurity, and animal nutrition and other production practices and economics. If successful, it is expected that this this network can be maintained beyond the 5 year time frame of the current project.

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Beef Science Cluster

IN PROGRESS

Improving the barrier function of the gut to prevent disease

Project Title:

Improving the barrier function of the gut: an approach to minimize production limiting diseases

Project Code:

ANH.33.13

Completed:

In Progress

Researchers:

Greg Penner, Ph.D. greg.penner@usask.ca

Greg Penner, Ph.D., University of Saskatchewan, Steve Hendrick, DVSc., John McKinnon, Ph.D. and John Campbell, DVSc. (University of Saskatchewan)

Background

The cells lining the digestive tract have two seemingly contradictory functions. They need to absorb nutrients while also acting as a barrier to prevent disease causing organisms from entering the bloodstream.

Nutrient absorption has not been studied in great detail in ruminants, and barrier function even less so. The interplay between these two functions also raises the possibility that nutritional disruptions may also affect how well the gut can act as a barrier to pathogens.

Increased knowledge will help to identify opportunities to improve feed conversion efficiency, as well as a better understanding of diseases that are believed to result from pathogen movement across the digestive system (including laminitis, acute interstitial pneumonia, and general systemic inflammation).

Objectives

To better understand the interplay between the absorptive and barrier functions of the ruminant digestive tract

What they will do

A series of three intensive studies will be conducted to determine which regions of the gastro-intestinal tract pose the greatest risk for absorption of antigens and pathogens, establish which regions are most susceptible to compromised barrier function following feed restriction, determine the time line of recovery for barrier function after a nutritional challenge, and to explore treatments that may hasten the recovery of barrier function following feed restriction.

Implications

This study will improve our understanding of the gut's dual role in absorbing nutrients while excluding pathogens. This knowledge will potentially identify opportunities to simultaneously improve feed efficiency, animal health and welfare, and industry competitiveness.

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RESEARCH AND TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Quality research projects

The quality of Canadian beef products form the basis of consumer demand and trade and contribute significantly to competitiveness with other beef exporters and other protein sources in the world markets. Traditionally Canada has successfully produced a youthful, lean, commodity beef product based on a primarily grain-based feedlot production system. The product responds to a grading system which rewards for these characteristics. However, both the consuming public and our competitors continue to change and the beef industry recognizes the importance of strengthening our competitive advantages through improving product consistency and continuing to enhance carcass and meat quality.

Learn more at <http://www.beefresearch.ca/research/beef-quality.cfm>

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RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Extending the shelf life of marinated steaks

Project Title:

Effect of high pressure processing on quality, sensory attributes and microbial stability of marinated beef steak during refrigerated storage

Project Code:

BQU.01.13

Completed:

In Progress

Researchers:

Haihong Wang, Ph.D. Haihong.wang@gov.ab.ca

Haihong Wang, Ph.D., Alberta Agriculture and Rural Development, Jimmy Yao, Ph.D., Karen Erin and Mindy Gerlat (Alberta Agriculture and Rural Development) and Michael Gaenzle (Dr. rer. nat.) (University of Alberta)

Background

High Pressure Processing (HPP) can extend the shelf life of food by killing microorganisms that can cause spoilage. HPP has been approved for use in the US, but Canada's Food and Drug regulations classify HPP-treated products as novel foods.

Objectives

The objective of this activity is to investigate the effects of HPP on the quality, nutrition and shelf life of a marinated beef steak product stored under refrigeration.

What they will do

Beef steaks from the hip will be marinated and further processed using HPP technology. Different marinade formulations and HPP pressure and/or times will be compared to find the best potential parameters for this product. The processing parameters with the best potential to improve shelf-life, texture, cooking loss of products will be used in a full-scale study to determine the effectiveness and benefits of these interventions on the marinated beef product.

Implications

This study will establish new processing methodologies and guidelines for commercial production of high pressure processed, fresh marinated beef steaks with an extended shelf life, and generate data to inform Health Canada's approval of commercially manufactured high pressure processed fresh beef products.

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Beef Science Cluster

IN PROGRESS

Understanding dark cutters to reduce prevalence

Project Title:

Genetics and proteomics of dark cutting cattle in Alberta

Researchers:

Heather Bruce, Ph.D. hbruce@ualberta.ca

Heather Bruce, Ph.D. (University of Alberta), Walter Dixon, Steve Miller, Graham Plastow (University of Alberta), John Basarab (Alberta Agriculture and Rural Development), and Jennifer Aalhus (Agriculture and Agri-Food Canada)

Project Code: BQU.03.13

Completed: *In Progress*

Background

Dark cutting is a stress-associated condition that causes beef to have an unacceptable color and shorter shelf life. Dark cutting can reduce carcass value by up to \$346 per head, and has become more prevalent in recent years.

This activity builds on the results of activity BQU.02.09 funded under the first Cluster.

Objectives

The objectives of this activity are to determine whether dark-cutting carcasses are produced by animal management factors, and whether the ribeye muscle metabolism of dark-cutting carcasses is different than that of normal carcasses.

What they will do

The influence of animal management factors such as gender, implants, beta-agonists, melenestrol acetate, and transportation practices on dark cutting will be investigated by relating existing historical feedlot records to corresponding carcass data. Factors found to be associated with dark cutting will then be tested in a prospective study using new feedlot and carcass data, and results will be used to develop decision trees to help producers reduce the risk of dark cutting.

The proteomics study will compare glycogen metabolism and protein expressions in ribeye muscle samples collected from normal and dark-cutting carcasses. Carcass data from cattle in Alberta Agriculture and Rural Development and University of Guelph data sets that have been genetically characterized using the 50K SNP chip will also be analyzed to identify DNA sequence differences that may explain the proteomic differences.

Implications

Updated decision trees that help feedlot operators effectively reduce the incidence of dark cutting will provide economic benefits for Canadian feeders and packers. Identifying genetic factors that may influence the risk of dark cutting will help to beef quality through genetic improvement of seedstock.

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RESEARCH AND TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY



RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Improving tenderness in beef cuts

Project Title:

Genetics of eating quality of high connective tissue beef

Researchers:

Heather Bruce, Ph.D. hbruce@ualberta.ca

Heather Bruce, Ph.D., Graham Plastow, Leluo Guan, Paul Stothard and Zhiquan Wang (University of Alberta), Manuel Juarez and Changxi Li (Agriculture and Agri-Food Canada)

Project Code: BQU.06.13

Completed: *In Progress*

Background

A number of commercially available DNA tests for beef tenderness effectively identify differences in ribeye tenderness that are related to post-mortem aging. Unfortunately, the beef cuts that need the most improvement are those that are tough due to connective tissue, which does not respond to aging. Additionally, there are theoretical concerns that selecting for feed efficiency may reduce beef tenderness.

Objectives

- 1) determine how breed type, selection for feed efficiency, and carcass grade affect the meat quality and connective tissue characteristics of muscles from the strip loin, inside round, cross-rib and top sirloin
- 2) relate the meat quality and connective tissue properties of the major muscles of these cuts to each other and to the phenotype and genotype of the steers from which the muscles were harvested.

What they will do

Major muscles of the strip loin, top sirloin, inside round and cross-rib will be collected from steers from the Livestock Gentec breeding herds. Fifty steers from the Kinsella control, Kinsella efficiency, purebred Angus and purebred Charolais herds will be randomly selected and slaughtered over two years at the Agriculture and Agri-Food Canada Lacombe abattoir. Full carcass information will be collected from each carcass. The strip loin, top sirloin butt, inside round and cross-rib will be removed from one or both sides depending upon muscle size. Tissue for DNA and functional genomics will be collected from each muscle. Each muscle will be assessed for intramuscular pH, fat, protein, moisture, colour, drip loss, cooking loss, Warner-Bratzler shear force,

collagen content and collagen heat solubility, and consumer acceptability. DNA analyses will search for potential SNP markers that may explain differences in collagen characteristics and eating quality among muscles and populations, and the “control” and “efficiency” herds.

Implications

A better understanding of the genetic factors underlying differences in tenderness among different muscles of the beef carcass is an important first step in developing improved DNA marker panels for beef quality. Improved knowledge of the genetic interaction between feed efficiency and beef tenderness will be critical to effectively and appropriately implementing breeding tools for these traits.

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Beef Science Cluster

IN PROGRESS

2017/18 National Beef Quality Audit

Project Title:

National Beef Quality Audit

Researchers:

Mark Klassen klassenm@cattle.ca

Mark Klassen (Canadian Cattlemen's Association), Jennifer Aalhus, Manuel Juarez and Colin Gill (Agriculture and Agri-Food Canada), and Joyce Van Donkersgoed (Consultant)

Project Code:

BQU.07.13

Completed:

In Progress

Background

Benchmarking key beef quality attributes and cattle production practices to identify strengths as well as opportunities for further improvement requires periodic consumer satisfaction and carcass quality audits, and economic assessment.

Objectives

- 1) To measure beef quality improvements made since the previous audit
- 2) To quantify ongoing carcass defect issues

What they will do

A series of audits and surveys will be conducted. A *National Retail Audit* will benchmark Consumer Satisfaction with beef eating quality and satisfaction, validated by a Beef Tenderness Survey involving objective laboratory and trained panel assessment of tenderness; an Injection Site survey benchmarking the frequency and location of carcass injection site lesions; and a Shelf Life Microbiology survey benchmarking microbiological and other parameters related to shelf life.

A *National Plant Cooler and Processing Floor Carcass Audit* will benchmark carcass grading performance and carcass quality and offal attributes. A Production Practices and Quality Priorities Survey of feedlots, packers, retailers, and food service operators will identify industry quality enhancement priorities and current practices. All survey results will be shared with industry through various channels including a Beef Quality Symposium, brochures, videos, fact sheets, the Verified Beef Production network, publications in peer reviewed journals and forums such as the Beef Value Chain Round Table.

Implications

This research will quantify quality improvements made since the most recent Beef Quality Audit conducted under the current Beef Cattle Industry Science Cluster, identify economically meaningful opportunities for further improvement throughout the beef production chain, and communicate best production practices to achieve these improvements.

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RESEARCH AND TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Environment research projects

Research on the interface between beef production and the environment in which it is produced is important to providing producers the tools and knowledge they need to be optimal stewards of their land. Research also demonstrates the environmental benefits of cattle production by measuring its contributions to plant and animal biodiversity, carbon sequestration, reduced soil erosion and watershed protection. Research in this area also supports the advancement of science-based regulations.

Advancements in feed efficiency and forage and grassland productivity also contribute to environmental sustainability.

Learn more at <http://www.beefresearch.ca/research/environmental.cfm>

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RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Defining the Environmental Footprint of Canadian Beef Production

Project Title:

Defining the Environmental Footprint of Canadian Beef Production

Researchers:

Tim McAllister, Ph.D. and Karen Beauchemin, Ph.D. tim.mcallister@agr.gc.ca

Tim McAllister, Ph.D. and Karen Beauchemin, Ph.D., Roland Kroebel, Henry Janzen, Anne Smith, Sean McGinn and Frank Larney, Ph.D. (Agriculture and Agri-Food Canada) and Kim Ominski, Ph.D. (University of Manitoba)

Project Code: ENV.02.13

Completed: *In Progress*

Background

Beef is often portrayed as environmentally unfriendly, primarily due to narrow focus on the methane produced by rumen bacteria. Canadian researchers can provide a broader and more balanced perspective to this issue.

Objectives

To gather and assimilate information to describe how the environmental impact of Canada's beef industry has changed over the past thirty years.

What they will do

This research will bring together data collected by Canadian researchers under Canadian conditions, and use it to model how changes in industry practices have impacted the Canadian beef industry's environmental impact over the past 30 years. Specific focus will be placed on the types of feeds utilized by beef production, methane production by beef cattle, carbon sequestration by rangelands, manure nutrient production, land base and water required for beef production, and contributions to the maintenance wetlands and wildlife, bird, and plant biodiversity.

Implications

This information will provide the beef industry with balanced, factual information to justify the environmental attributes of the Canadian Beef Advantage, assessing the environmental goods and services provided by Canada's beef industry, and identifying ways in which different sectors of the beef industry can improve their environmental performance.

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RESEARCH AND TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Feed Grains and Feed Efficiency research projects

The profitability and health of the finishing sector relies in large part on the production of high quality and yielding feed grains, and animals that are highly efficient in converting feed mass into increased body mass. Research in this area provides identification and validation of economical methods of identifying seedstock with improved feed efficiency and the development of new feeds and alternative feeding strategies.

Learn more at <http://www.beefresearch.ca/research/feed-efficiency.cfm>

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RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Improving barley and triticale feed

Project Title:

Germplasm and variety development of barley and triticale for animal feed with a focus on feed quality, yield and disease resistance of both grain and annual forage production

Project Code: FDE.04.13

Completed: *In Progress*

Researchers:

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James Helm, Ph.D., Patricia Juskiw, Ph.D., Joseph Nyachiro, Ph.D., Kequan Xi, Ph.D., Mazen Aljarrah and Jennifer Zantinge (Alberta Agriculture and Rural Development) Bill Legge, Ph.D., Harpinder Randhawa, Ph.D., and Kelly Turkington, Ph.D. (Agriculture and Agri-Food Canada), Flavio Capettini, (International Center for Agricultural Research in the Dry Areas), Karim Ammar, Ph.D. (International Maize and Wheat Improvement Center)

Background

For over 40 years, the FCDC has used germplasm from CIMMYT and ICARDA to develop barley varieties with improved disease resistance, agronomic, yield and quality traits. In order to take advantage of all aspects of the genetic screening, the participants will carry out individual breeding programs. Continued improvements in the yield and nutritional quality of barley grain and annual forages are essential to maintain a competitive cattle feeding sector in Canada.

Objectives

1. To develop varieties of barley (grain and forage) and triticale (forage) with improved nutritional quality, yields, yield stability, disease resistance, and water use efficiency, and
2. To expand the germplasm resources available to ensure that future varietal development continues into the future.

What they will do

This research team has unique access to international genetic resources and scientific expertise. They will apply traditional selection and molecular marker technology to improve the yields, digestibility (evaluated using NIRS technology), efficiencies of nitrogen water use of barley (focusing on both grain and forage) and triticale (focused on forage). An important foundational trait for all crops is disease resistance. Access to international germplasm will ensure that new varieties developed contain genes that confer resistance to diseases that affect barley in other parts of the world, and that can be expected to arrive in Canada over time.

Beef cluster funding will be directed towards the disease nursery activities being conducted through AAFC Brandon.

Implications

In addition to promising new sources of germplasm, over 2000 potential new lines and crosses will be made and screened each year. This project will result in the release of more than six new varieties with higher energy density, energy yield, better agronomics, and improved yield stability.

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RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Understanding and improving feed efficiency of beef cows

Project Title:

The impact of genomic selection for feed efficiency on the cow-calf sector, performance parameters and underlying biology

Project Code:

FDE.07.13

Completed:

In Progress

Researchers:

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Yuri Montanholi, Ph.D. and Alan Fredeen, Ph.D. (Dalhousie University) Douglas Hodgins, Ph.D. (University of Guelph), Kendall Swanson, Ph.D. (North Dakota State University), Rupert Palme, Ph.D. (Vetmeduni Vienna), and Leluo Guan, Ph.D (University of Alberta)

Background

Feed efficiency is one of the most economically important traits in beef cattle production. However, genetic improvements in feed efficiency have been limited and slow, primarily because measuring the actual feed intake of individual animals is extremely labor intensive, time consuming and expensive. A better understanding of how various physiological and metabolic processes influence feed efficiency is important to developing inexpensive, rapid methods of reliably predicting feed intake. Genetic relationships between efficiency and other economically important traits such as health and reproductive performance are also relatively unknown.

Objectives

To develop needed tools and information to allow the beef industry to effectively improve feed efficiency of beef cows

What they will do

Building on research initiated under the first Beef Science Cluster (FDE.06.09), this team will focus on alternative predictors of efficiency, including infrared thermography, blood and fecal hormones and metabolites, rumen microflora (methanogens), liver and muscle histology and calorimetry and DNA markers. This activity will also look at the relationship between feed efficiency and other important production parameters such as cow size, intake, fertility, calf weaning weight, longevity, cow health and calf immune status. This will help determine whether (or how) genetic selection for feedlot efficiency may impact the cow-calf sector.

Implications

The knowledge and tools developed through this research will help the beef industry to better understand the broader benefits and consequences of efforts to genetically improve feed efficiency in the beef industry.

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RESEARCH FACTS

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Beef Science Cluster

IN PROGRESS

Evaluating corn silage

Project Title:

Increased use of high energy forages in conventional feedlot beef production

Researchers:

Karen Beauchemin, Ph.D. karen.beauchemin@agr.gc.ca

Karen Beauchemin, Ph.D., Vern Baron, Ph.D., Brian Beres, Ph.D., Tim McAllister, Ph.D., Xying Hao Ph.D., Lana Reid, Ph.D. (Agriculture and Agri-Food Canada) and Mary-Lou Swift, Ph.D. (Alberta Agriculture and Rural Development)

Project Code: FDE.09.13

Completed: *In Progress*

Background

Rising feed grain prices may encourage feedlots to consider alternatives to purchased grains in order to maintain profitability. Traditionally, the higher fiber content and lower energy content of forages leads to lower feed conversion efficiency and increased manure production. The highly variable energy content of corn silage makes it challenging to maintain animal growth rate when cattle are fed higher forage diets.

Objectives

To obtain basic information on how genotype, growing location, and year influence corn silage yield, chemical composition, and nutritive value (in vitro digestibility).

What they will do

Basic information on how genotype, growing location, and year influence corn silage yield, chemical composition, and nutritive value (in vitro digestibility) will be gathered. This is needed to develop predictions of total digestible nutrient (digestible energy) content, as well as identify inclusion rates for different varieties of corn silage in beef cattle diets that will optimize cattle performance and carcass quality. Manure production and nutrient content from high forage diets will also be assessed, and evaluated as a soil amendment.

Implications

This research will provide the beef industry with needed information about the economic potential of incorporating high energy corn silage into feedlot rations.

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RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Exploring potential benefits of prebiotic, probiotic, and synbiotic use in cattle

Project Title:

Prebiotic, probiotic, and synbiotic technologies for targeted applications in food safety and ruminant productivity

Researchers:

D. Wade Abbott, Ph.D. wade.abbott@agr.gc.ca

D. Wade Abbott, Ph.D., Robert Forster, Ph.D., Trevor Alexander, Ph.D., Tim McAllister, Ph.D., and Dallas Thomas, M.Sc. (Agriculture and Agri-Food Canada), Harry Gilbert, Ph.D. (New Castle University), and Parastoo Azadi, Ph.D. (Complex Carbohydrate Research Center)

Project Code: FDE.15.13

 Completed: *In Progress*

Background

Prebiotics are nutrient sources that favor the bloom of beneficial bacteria within the host animal. Probiotics are live cultures of bacteria that are fed to improve digestive system health. Synbiotics is the combination of probiotic and prebiotic strategies to achieve a health outcome. There is experimental evidence that probiotics and prebiotics may improve the health of monogastrics, but their potential benefits for ruminants are less well understood, due to the complexity of rumen microbiology. Short- and long-term outcomes of these treatments for ruminant productivity, metabolic efficiency, feed digestibility and food safety have not been assessed.

Objectives

1. To develop a method to track prebiotic passage and utilization throughout the entire digestive tract
2. To develop animal models to evaluate changes in the rumen's microbial population, prevalence of foodborne pathogens and feed digestibility

What they will do

Researchers will develop a method to track prebiotic passage and utilization throughout the entire digestive tract, and develop animal models to evaluate changes in the rumen's microbial population, prevalence of foodborne pathogens, and feed digestibility. The impact of prebiotics on the metabolic efficacy of lambs and enteropathogenic *Escherichia coli* (EPEC) colonization will also be studied.

Implications

This research will help the Canadian beef industry to better evaluate and understand the potential of prebiotic, probiotic, and synbiotic approaches to improve animal productivity and food safety.

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Beef Science Cluster

IN PROGRESS

Selecting for improved feed efficiency and carcass quality – putting theory into practice

Project Title:

Improvement of cow feed efficiency and the production of consistent quality beef using molecular breeding values for RFI and carcass traits

Researchers:

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Graham Plastow, Ph.D. (University of Alberta), John Basarab, Ph.D., Divakar Ambrose, Ph.D., and Marcos Colazo, Ph.D. (Alberta Agriculture and Rural Development), Tom Lynch-Staunton (Livestock Gentec), Stephen Miller, Ph.D. (University of Guelph and Livestock Gentec), Heather Bruce, Ph.D., Barry Irving, Ph.D., and Zhiquan Wang, Ph.D. (University of Alberta), Carolyn Fitzsimmons, Ph.D., Changxi Li, Ph.D., and Manuel Juarez, Ph.D. (Agriculture and Agri-Food Canada)

Project Code: FDE.17.13

Completed: *In Progress*

Background

Research under the first Beef Science Cluster (FDE.05.09 and BQU0.3.10) identified a number of genomic markers for efficiency of feed use in the feedlot and beef tenderness. However, the potential impact of selecting for improved feed efficiency on maternal traits (cow winter feed requirements and reproductive traits) is unknown, and the ability of genomic carcass quality markers to sort cattle into more uniform slaughter groups has not been studied.

Objectives

To demonstrate the use and economic value of genomic tools to breed more efficient cow herds and to sort feeder cattle into more uniform slaughter groups

What they will do

One study will use 420 crossbred cows, each randomly divided into control vs. efficient groups based on age, body weight and breed composition. In addition, two purebred herds of 125 Charolais and 170 Angus cows will be selected for efficiency. The control groups will be selected based on traditional measurements such as calving ease, temperament, and weight, while the

efficient heifers will be selected based on a multi-trait maternal index based on estimated breeding values (EBVs) for these traits, as well as residual feed intake (RFI) and feedlot profitability traits (in CH heifers only). Sires will be replaced at a rate of 25%/year selected similarly (traditional traits vs. genomic enhanced breeding values (GEBV) for these traits). Cows will be measured for reproductive performance, and progeny will be measured for individual feed intake and behaviour, growth, and carcass characteristics. The effectiveness of the breeding programs will be compared between the selection and control herds.

Steer progeny from this breeding program will be used in the second study. Molecular Breeding Values for ADG, backfat adjusted RFI, carcass weight, grade fat, ribeye area, marbling score and lean meat yield will be calculated for all steers before entering the feedlot. Steers from the GEBV breeding program will be assigned to a 70:70 Quality Grid program or a lean meat yield / maximum weight gain program. Steers will be fed using GrowSafe in commercial feedyards where feasible for the final 90-100 d of feeding to obtain RFI and individual feed intake. Carcass data will be collected from all steers.

Implications

This research will demonstrate how selecting for improved feed efficiency impacts maternal traits, as well as test whether genomic tests can sort cattle into more uniform slaughter groups.

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Beef Science Cluster

IN PROGRESS

Studying cattle's feed efficiency throughout the finishing period

Project Title:

Understanding the physiology behind changes in feed efficiency throughout the finishing period

Project Code:

FDE.19.13

Completed:

In Progress

Researchers:

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Greg Penner, Ph.D., John McKinnon, Ph.D., (University of Saskatchewan), Luis Burciaga-Robie, Ph.D., (Feedlot Health Management Services), Steve Miller, Ph.D. (University of Guelph) and Erasmus Okine, Ph.D. (University of Alberta)

Background

Feed efficiency and cost of gain strongly impact feedlot profitability. Feed efficiency is thought to decline with advancing days on feed, though factors contributing to this are unclear. Understanding changes in feed efficiency over the course of the finishing period may identify opportunities to further improve feedlot production efficiencies.

Objectives

To improve our understanding of how digestive physiology, nutrient absorption, and post-absorptive nutrient utilization vary over the feeding period.

What they will do

Several studies will evaluate whether diet (varying in starch and fat content), days on feed, and their interaction affect apparent total tract digestibility, short-chain fatty acid absorption from the reticulo-rumen, and post-absorptive nutrient utilization by cattle. Basic knowledge obtained from initial tightly controlled metabolism studies will be used to identify periods during the growth curve where feeds varying in energy content, substrate, and cost may be used to improve feed efficiency. These strategies will be tested with applied feeding trials in small pen studies, then validated in large-scale commercial study that will evaluate production economics under industry-relevant conditions.

Implications

This research will help to identify potential strategies to optimize feed efficiency, animal health, and cost of production.

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RESEARCH AND TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Food Safety research projects

In order to maintain consumer demand for beef domestically and internationally, research and innovation focus on improving food safety interventions, methods to quantify their effectiveness, and the development of strategies that counteract multiple pathogens.

Learn more at <http://www.beefresearch.ca/research/food-safety.cfm>

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RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Understanding non-O157 STEC associated with cattle and beef carcasses

Project Title:

Prevalence, persistence and control of non-O157 shiga toxin producing *Escherichia coli*

Researchers:

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Keith Warriner PhD, Carlos Leon-Velarde PhD (University of Guelph), Roger Johnson PhD (Public Health Agency of Canada), Mueen Aslam PhD (Agriculture and Agri-Food Canada)

Project Code: FOS.01.13

Completed: *In Progress*

Background

The food safety risks associated with *E coli* O157:H7 are well established and the beef industry has placed a sustained effort in devising strategies to control it. *E coli* O157 is highly pathogenic due to its ability to produce Shiga toxin, among other virulence factors. In recent years, there is increased awareness that illness can also be caused by other Shiga toxin producing *E coli*, collectively referred to as non-O157 STEC. In the US, the Top 6 non-O157 STEC have been given the same status as *E coli* O157. Canada's beef processing industry needs to be prepared to implement the appropriate testing and recall measures for these STECs, as the US is Canada's main beef export market.

Objectives

The objective of this study is to fill many of the knowledge gaps that exist with respect to non- O157 STEC associated with beef.

What they will do

Specifically, a comparative study will be undertaken to evaluate the different screening methods used for non-O157 STEC testing. Studies will be performed on pre- and post-slaughter cattle at slaughter houses to determine the prevalence of non-O157 STEC associated with cattle and carcasses at several points of the processing chain. Retail ground beef will also be screened for the Top 6 non-O157 STEC. The tolerance of STEC isolates to food safety interventions including acids, high pressure processing and heat will be assessed.

Implications

This research will provide an estimate of the food safety risks posed by non-O157 STEC, provide an independent assessment on the suitability of non-O157 STEC screening techniques, and verify whether current interventions applied to control *E. coli* O157 will also control other STECs. Canada's beef industry will benefit from increased knowledge that will help to assure consumers about the safety of Canadian beef.

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RESEARCH AND TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY



RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Practical and effective food safety procedures for beef packing plants

Project Title:

Identification and validation of commercially practicable practices and procedures for improving the microbiological safety and storage stability of beef

Project Code:

FOS.04.13

Completed:

In Progress

Researchers:

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Xianqin Yang, Ph.D., Colin Gill, Ph.D., and Frances Nattress, Ph.D., (Agriculture and Agri-Food Canada) and Lynn McMullen, Ph.D., (University of Alberta)

Background

Recent work has shown that *E. coli* can essentially be eliminated from dressed carcasses in commercial packing plants. Carcass chilling processes can be operated to supplement or largely substitute for decontaminating treatments. Machinery and personal equipment can be cleaned and used in ways that prevent such equipment from recontaminating meat during carcass breaking. As a result, food safety issues with beef may arise if known best practices and treatments and practices necessary to produce cuts and trimmings free of pathogenic *E. coli* and *Salmonella* are incompletely or inappropriately implemented.

Objectives

The objective of this research is to characterize how effectively commercial beef packing plants are implementing effective commercial treatments and intervention procedures to control pathogenic and spoilage bacteria.

What they will do

Data and observations will focus on hide-on carcass washing with 1.5% NaOH, carcass chilling, cleaning and drying of meat conveying equipment, and cleaning and use of personal equipment. Results will be incorporated in a Quantitative Risk Assessment / Cost Benefit Analysis of control of product contamination with *E. coli* at beef packing plants. Bacteria isolated from commercial vacuum packaged beef during current storage trials will be identified to determine the specific organisms that limit product storage life so that their sources in beef packing plants can be identified and controlled.

Implications

This research will identify which commercial interventions and practices plant personnel should focus on to give maximum control of pathogens and spoilage organisms for minimum cost. Effectively controlling hazardous and spoilage microorganisms will facilitate trade of chilled beef to overseas markets where customers expect product to have a storage life of at least 120 days, and possibly 180 days.

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RESEARCH AND TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY



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BEEF CATTLE RESEARCH COUNCIL

RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Evaluating the potential contribution of beef cattle to antimicrobial resistance

Project Title:

Surveillance of *E. coli*, enterococci, antimicrobial resistance (AMR) and Enterococcus species distribution in beef operations and associated environments

Researchers:

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Project Code: FOS.10.13

Completed: *In Progress*

Background

Public concern to antimicrobial use (AMU) and resistance (AMR) in livestock is increasing, as is continuing pressure for industries and governments to address these concerns. Science-based, epidemiologically sound research is critical for sound industry policy and communication, legislation, and educated consumer choices.

Objectives

1. To determine how AMU in beef cattle potentially contributes to antimicrobial resistance (AMR)
2. To determine the prevalence of indicator bacteria (*E. coli* and enterococci) in feedlot cattle and downstream drainage basins to identify the potential chain of transmission within these environments

What they will do

This study will focus on antimicrobials classified as being of high and very high importance in human medicine. AMU records will

be collected from Alberta feedlots. *E. coli* and enterococci will also be isolated from bovine feces, manure drainage/catchment basins at feedlots, downstream surface water and retail beef, and compared to isolates obtained from human clinical samples. The zoonotic potential of these species and any link between AMU in livestock and humans colonized by antibiotic resistant enterococci will be examined. Advanced genotyping techniques will be used to evaluate similarities and differences between enterococci species isolated from cattle and humans, as well as the genetic sequences of genes associated with AMR in cattle and human clinical cases.

Implications

This study will provide insights into the relationships between AMU in feedlot cattle, the nature of AMR bacteria in cattle, and the possible spread of pathogens and AMR bacteria in downstream environments. These results will help to identify appropriate on-farm intervention points for the control of AMR in feedlots, and help to decipher and quantify the association between AMU and AMR in Canada's beef production system with AMR in humans. This continues the leadership role that the Canadian beef industry has taken in promoting and quantifying good antimicrobial stewardship within feedlot production systems.

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RESEARCH AND TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Forage and Grasslands research projects

The health and profitability of the cow-calf sector depend on forage and grassland productivity. Research is focused on the development of strategies that will improve grassland management to increase productivity and sustainability. Research also works to develop annual and perennial forage varieties with increased biomass yield per acre, maintained or improved nutritional value, improved water efficiency, and appropriate economic characteristics.

Learn more at <http://www.beefresearch.ca/research/forage-grasslands.cfm>

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RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Improved swath grazing through new annual forage varieties and grazing management

Project Title:

Innovative Swath Grazing/Increasing Forage Research Capacity

Researchers:

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Vern Baron, Ph.D.(Agriculture and Agri-Food Canada), John Basarab, Ph.D, Patricia Juskiw, Ph.D., Mazen Aljarrah and Mary-Lou Swift, Ph.D. (Alberta Agriculture and Rural Development), John McKinnon, Ph.D., (University of Saskatchewan), Albert Kuipers (Grey Wooded Forage Association), and Al Sheaffer, Ph.D. (Agriculture and Agri-Food Canada)

Project Code:

FRG 04.13

Completed:

In Progress

Background

Through improved agronomic and grazing management practices, researchers and producers have increased the yields of the crops seeded for swath grazing. This has reduced overwintering feed costs for the cow herd. However, improving the overall nutritive value of the swathed-grazed crop is necessary and reducing weathering p during fall, winter and spring continues to limit pasture carrying capacities.

Objectives

To further improve pasture carrying capacity and reduce overwintering costs by evaluating new annual forage varieties and developing management strategies with improved forage quality that is maintained throughout the swath grazing season.

What they will do

Plant breeders with Alberta Agriculture and rural Development (ARD) have produced advanced lines of barley and triticale with improved fiber digestibility. However, these new lines must be tested for resistance to weathering loss and compared to popular forage types under winter grazing conditions. This research includes a comprehensive weathering trial and two winter grazing trials to evaluate the suitability of this new material for overwintering beef cows, and will train and mentor a new post-doctoral fellow to reinforce Canada's forage research capacity.

Implications

This research will provide recommendations regarding the selection of new annual forage varieties to reduce weathering losses and to develop high quality swath grazing system. Increasing nutritive value or maintaining nutritive value could increase carrying capacity, more, by lowering the dry matter (DM) intake required for maintenance. This would reduce the daily feed cost per cow, further, and could make the swath grazing system more flexible, allow cows to maintain good body condition during extremely cold conditions without supplementation, and allow swath-grazing to be used over a broader geographical area. The training and mentoring of a young researcher will contribute to continuation of practical, producer oriented research of a similar nature.

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RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Developing improved native and tame forage varieties for Western Canada

Project Title:

Development of plant material (grasses, legumes) and mixtures for forage production in the Prairie region

Researchers:

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Michael Schellenberg, Ph.D. (Agriculture and Agri-Food Canada), Bruce Coulman Ph.D. and Eric Lamb Ph.D. (University of Saskatchewan) Hushton Block Ph.D., Mae Elsinger, Alan Iwaasa Ph.D., Yuxi Wang Ph.D., Don Thompson Ph.D., Yong-Bi Fu Ph.D., and Katherine Buckley Ph.D. (Agriculture and Agri-Food Canada)

Project Code: FRG.08.13

Completed: *In Progress*

Background

There is a critical shortage of forage researchers, in particular plant breeders in Canada, and several of the few remaining researchers are nearing retirement in the near future. A reliable and productive forage base is critically important to maintaining a sustainable and competitive beef industry in Canada. This challenge is becoming increasingly acute as high grain prices increasingly force forage onto marginal land. This project will build on perennial forage breeding research initiated under the first Beef Science Cluster (FRG.01.09).

Objectives

To provide industry with improved forage varieties.

What they will do

Both traditional selection techniques and advanced genomic tools will be used to develop improved tame and native forages using plant nurseries and plots established in Lethbridge, Swift Current, Saskatoon and Brandon. Seedling establishment, stand persistence, growth patterns, species composition, yields, and nutritional quality will be evaluated in grazing and animal trials in several environments (Swift Current, Saskatoon and Brandon). Promising varieties will be further evaluated in regional forage trials.

Implications

This program will provide Western Canada's beef industry with a package of improved tame (hybrid brome, meadow brome, crested wheatgrass and alfalfa) and native forages (northern wheatgrass, blue bunch wheatgrass, prairie sand reed, nodding brome grass, purple and white prairie clovers, Canadian milkvetch, ascending milkvetch and slender milkvetch).

The training and mentorship of two PhD's and one postdoc in forage breeding, genomics, and ecology/agronomics through this project will help to address some of the forage research capacity issues of concern.

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RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Developing improved tame forage varieties for western Canada

Project Title:

Nutritional evaluation of barley forage varieties for silage

Researchers:

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John McKinnon, Ph.D., David Christensen, Ph.D., Peiqiang Yu, Ph.D., and Greg Penner, Ph.D. (University of Saskatchewan) Tim McAllister, Ph.D., John Baah, Ph.D., and Vern Baron, Ph.D. (Agriculture and Agri-Food Canada)

Project Code:	FRG.09.13
Completed:	<i>In Progress</i>

Background

Although barley silage is an important component of backgrounding and finishing diets in Canada, there is limited information available regarding the digestibility and nutritional quality of barley forage varieties. Plant cell wall degradability, and specifically the extent and rate of neutral detergent fibre (NDF) digestion in the rumen is believed to range from 40 to 80% due to environment, plant maturity and varietal differences. The effects on silage digestibility can seriously reduce backgrounding gain feed efficiency.

Objectives

To determine which barley forage varieties are best suited for silage.

What they will do

Researchers will compare feed quality characteristics (including the extent and rate of cell wall degradation) of barley varieties grown for silage, evaluate ensiling characteristics of barley varieties selected for high or low cell wall degradability, and compare the performance (rumen function, digestibility, growth, carcass quality) of animals that have been fed silage from barley varieties selected for extremes in rate of cell wall degradability.

Implications

This research will help beef producers to decide which barley variety to grow in order to produce silage with enhanced feed efficiency, reduced manure production and lower costs of gain.

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RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Determining optimal forage species mixtures

Project Title:

Pasture mixtures and forage legumes for the long-term sustainability of beef production

Project Code: FRG.13.13

Completed: *In Progress*

Researchers:

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Background

Forages are a major feed component for the cow-calf and backgrounding sectors of the beef industry. There is considerable room for improving beef production from pastures and stored forages. Appropriately managed pasture with a significant legume component is inherently one of the most sustainable feed sources for cattle. Forage species have different yield potential and nutritional quality, which can influence the productivity of beef cattle in pasture. Little research has been done to determine which forage species combinations have the greatest potential to improve beef production from forages.

Objectives

To identify forage species mixtures that provide the best opportunity to enhance beef productivity both on pasture and with stored forages.

What they will do

This research will continue research initiated under the first Beef Cluster (FRG.07.10) for an additional three years. This will allow the evaluation of how the forage species in the seed mixtures stabilize in the pasture over several years of grazing pressure.

Additional research will investigate stand establishment and productivity under differing levels of nitrogen fertilization in different geographical regions (sites in Nova Scotia, Quebec, and Ontario).

Implications

The results of this research will allow producers to make better pasture seeding choices to increase beef production per acre.

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RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Creating a forage industry chair to maintain research expertise

Project Title:

Building long-term capacity for resilient cow-calf production systems through creation of a forage industry chair supporting training and research in evaluation and utilization

Project Code: FRG.14.13

Completed: *In Progress*

Researchers:

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Karin Wittenberg, Ph.D. (University of Manitoba), Paul Jefferson, Ph.D. (Western Beef Development Centre), Kim Ominski, Ph.D., and Derek Brewin (University of Manitoba) Bruce Coulman, Ph.D. (University of Saskatchewan), Kathy Larson (Western Beef Development Centre), Jennilee Bernier and Glenn Friesen (Manitoba Agriculture, Food and Rural Initiatives), Leanne Thompson (SK Forage Council), Corie Arbuckle (MB Forage Producers) and Cam Dahl (Manitoba Beef Producers)

Background

Cow-calf producers in Western Canada have widely adopted extended fall and/winter grazing practices using both annual and perennial forages. Competition with high value annual crops has resulted in higher land prices and decreased land base for forage production in many beef producing areas. Expertise in integration of land, plant and animal management is critical to increasing the productivity of both the forage land base and cow herd.

Objectives

- 1) To support the establishment of a permanent Western Canada Forage Industry Chair at the University of Manitoba
- 2) To provide leadership and technology transfer for several projects focused on the evaluation and utilization of novel annual and perennial forages for late season and overwinter grazing

What they will do

These projects will serve as training opportunities for five graduate students, with the research focused on forage quality retention

in extended grazing systems, animal nutrient status, health and reproductive performance. Production data accompanied by economic analyses will facilitate extension, technology transfer and industry adoption of promising results.

Implications

Establishment of a Forage Industry Chair program will increase graduate student training and research capacity and contribute towards technology transfer efforts in Western Canada.

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Other research programs

Learn more at <http://www.beefresearch.ca/research/other-research.cfm>

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RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster

IN PROGRESS

Improving technology transfer and knowledge dissemination in the Canadian beef industry

Project Title:

Improving technology transfer and knowledge dissemination in the Canadian beef industry

Researchers:

Tracy Sakatch sakatcht@cattle.ca

Andrea Brocklebank and Reynold Bergen, Ph.D. (Beef Cattle Research Council)

Project Code: TEC.01.13

Completed: *In Progress*

Background

Obtaining the full benefit from research and innovation investments requires adoption and implementation of relevant knowledge by the target user. The first Canadian Beef Cattle Industry Science Cluster facilitated the development of a 10 year Knowledge Dissemination and Technology Transfer Plan, the hiring of a Beef Extension Coordinator, and the development of an industry Technology Transfer website (www.BeefResearch.ca).

Objectives

To improve knowledge dissemination by supporting and delivering a range of technology transfer mechanisms with a clear focus on accelerating the uptake of research results and outcomes by industry.

What they will do

The proposed activity will enable continued implementation of the Knowledge Dissemination and Technology Transfer Plan. Using a full-range of technology transfer tools, the BCRC will lead national coordination of extension efforts, support technology transfer efforts initiated by industry partners, and collaborate with external consultants on extension initiatives. The intention is to enhance or accelerate existing industry extension efforts, and fill in gaps where needed. Extension efforts will include regular communication with industry through the creation and distribution of fact sheets that summarize research findings and articles that discuss research outcomes or priorities. New resources, such as a video series, webinars and cost of production decision tools for producers will be created and made available through www.BeefResearch.ca. Over time, user feedback will inform enhancements

to the website's functionality (e.g. the addition of user forums). Engagement of researchers with industry will also be a focus, including involvement of young researchers in a mentorship program, and events that bring researchers and industry stakeholders together to share understandings of research outcomes and industry needs. Feedback from industry, analysis of website analytics and results of an economic analysis initiative underway by Canfax Research Services will inform continual improvements to BCRC's approach to technology transfer.

Implications

Providing timely information and effective tools to industry stakeholders, including producers, researchers and governments, will help improve beef production efficiencies and beef demand, public awareness and consumer confidence. This is expected to positively impact the profitability and sustainability of the Canadian beef industry.

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