



2019/20 Results Report

Submitted to the Canadian Beef Cattle Research, Market Development
and Promotion Agency

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I. Executive Summary

The Beef Cattle Research Council (BCRC) funds leading edge research to advance the competitiveness and sustainability of the Canadian beef cattle industry. A national industry-led funding agency, the BCRC works closely with other industry and government funding agencies to increase coordination, reduce duplication, and ensure priority research outcomes are addressed for the benefit of Canadian beef and cattle producers.

A division of the Canadian Cattlemen's Association (CCA), the BCRC is directed by a committee of 14 beef producers from across the country. The BCRC is funded in part through a portion of a producer-paid national levy, the Canadian Beef Cattle Check-Off. In 2019/20, the BCRC received on average \$0.82 (unaudited) of every \$2.50 of the Canadian Beef Cattle Check-Off collected by the provinces. This funding was leveraged with the Agriculture and Agri-Food Canada (AAFC) Canadian Agricultural Partnership (CAP) funding, where industry contributed 29% or \$1.34 million and government contributed 71% or \$3.3 million. In addition, the BCRC leveraged the Canadian Beef Cattle Check-Off for an additional \$1.6 million in research funding from government and industry partners through initiatives outside of the Beef Science Cluster.

This report covers the period April 1, 2019 to March 31, 2020. Research programming during this period was centered around the following areas:

- Maintaining or improving competitiveness in the production of beef cattle – animal health, feed efficiency, and feed production
- Supporting science-based policy, regulation, and trade
- Supporting science-based public education and advocacy
- Supporting the Canadian Beef Advantage through continual advancements in beef quality and food safety, and
- Accelerating the adoption of new innovations in the Canadian Beef Industry.

Section III i) of this report covers the projects funded under the third Beef Science Cluster managed by the BCRC. There were 24 research and extension Cluster projects reporting activities between April 1, 2019 and March 31, 2020. All projects covered areas relating to one of the following priority areas: Beef Quality and Food Safety; Animal Health, Welfare and Antimicrobial Resistance; Feed Production and Feed Efficiency; Forage Productivity and Environmental Sustainability; or Knowledge and Technology Transfer. With 2019/20 being only the second year of the five-year Cluster program, the reportable results are very limited; however, there were some preliminary findings. Relating to food safety, analyses of 750 STEC isolates collected from cattle and processing plants indicate that *E. coli* are not becoming more resistant to heat-based food safety interventions. Specific to animal health, preliminary data indicates that aside from body energy status, a rest stop did not benefit the welfare, health or performance of weaned, conditioned calves transported for 12 or 36 hours. Related to feed efficiency, findings have helped researchers better understand how bacteria use substrates such as pre and probiotics. The Beef Science Cluster project budgets and a link to each project factsheet, highlighting background, objectives and what the researcher will do under each project, is included in Section III i).

Section III ii) b) of this report includes a list of BCRC priority research projects funded by Canadian Beef Cattle Check-Off dollars and other industry investments. In 2019/20 researchers were awarded funding through an

open call for proposals where BCRC received applications from researchers. This marks the BCRC's second annual open call for proposals in over a decade. The Check-Off funding awarded for these projects is matched with government and other industry funding at a minimum 1:1 ratio. Under the open call for proposals, the BCRC received 74 letters of intent from researchers representing 31 different institutions. Of these, 35 researchers were invited to submit a full proposal, with 32 forwarding a proposal for funding. The BCRC engaged internal and external peer reviewers in the proposal selection process, and in February 2020 funding was approved for 16 projects. A summary of BCRC research projects for 2018 and 2019, including the project title, fact sheet link and budget is included in section III ii). Several projects, expected to start as early as April 2020, will be delayed due to COVID-19 impacts including limited ability to procure matching funds and/or to start projects given the severe restrictions on research facilities.

In addition to the knowledge and technology transfer activities under the Beef Science Cluster, such as the development and distribution of articles, decision tools, videos, blog posts and webinars, Knowledge and Technology Transfer is being advanced through a Canadian Beef Technology Transfer Network. In 2019/20 the network continued to facilitate greater communication and collaboration, resources and expertise were shared, and collaborative groups developed effective resources and strategies. The BCRC approved funding for two 2019 technology transfer and production economics projects as listed in Section III ii) d). Funding was also approved for five 2019 Proof of Concept (POC) projects - short-term (six months to one year) proof of concept-based research to help inform whether it is worth pursuing as a larger, more defined research investment in that area. As well, the BCRC continued to support the Cost of Production Network managed by Canfax Research Services (CRS). This Network, through its development of economic baseline data and analysis, supports industry competitiveness with a goal to have Canadian beef cattle cost of production data in every province/ecoregion to guide technology transfer and research priorities. The 2019/20 year was one of preparation, including the set up of provincial coordinators, ecoregions, and processes.

To support the implementation of long-term research capacity in research priority areas identified by the Canadian beef industry, two Research Chairs selected in 2018/19 successfully procured matching funds and were contracted during 2019/20. These Chairs include a Beef Production Systems Chair at the University of Alberta and a Chair in One Health and Production-Limiting Diseases at the University of Saskatchewan. BCRC investments for each of these two Chairs are 10-year investments of \$1.5 million (\$150,000/year), leveraged by a minimum of \$1.5 million from external funding.

The BCRC continues to oversee the Verified Beef Production Plus (VBP+) program. In 2019/20 BCRC funding facilitated the ongoing operation of the national VBP+ program, including the maintenance of a national standard, maintenance of the national CORS data management system and national website, and coordination of provincial delivery, audit systems, and record keeping. See section III ii) f) for the VBP+ 2019/20 progressive activities.

The fiscal year for the BCRC is July 1 to June 30, therefore the BCRC audited financial statements are not included in this report and are available upon request after August 31, 2020. The Canadian Beef Cattle Check-Off funding allocated to research programming in 2019/20 is discussed in various sections of this report and is projected at \$4,553,577.

II. Background

The Beef Cattle Research Council (BCRC) funds leading-edge research to advance the competitiveness and sustainability of the Canadian beef cattle industry. In 2019/20, the BCRC received on average \$0.82 (unaudited) of every \$2.50 of the Canadian Beef Cattle Check-Off collected by the provinces. This funding is leveraged under various programs to maximize producer returns on their check-off investment. The BCRC leveraged the industry Check-Off dollars with Agriculture and Agri-Food Canada (AAFC) Canadian Agricultural Partnership (CAP) Science Cluster funding in 2019/20, where industry contributed 29% or \$1.34 million and government contributed 71% or \$3.3 million. In addition, BCRC leveraged the Canadian Beef Cattle Check-Off for an additional \$1.6 million in research funding from government and industry partners through initiatives outside of the Beef Science Cluster.

BCRC Mandate

To determine research and development priorities for the Canadian beef cattle industry and to administer the Canadian Beef Cattle Check-Off funds allocated to research

As the national beef cattle industry research agency, the BCRC plays an important role in identifying the industry's research and development priorities and subsequently influencing and maximizing the benefits of public sector investment in beef cattle research. The BCRC facilitates and encourages collaboration and coordination among researchers, other funding agencies and industry on provincial and national levels. The BCRC continues to lead the implementation of the *Canadian Beef Research Strategy and Technology Transfer Strategy*, working in partnership with other beef research funding agencies across Canada, to be more efficient with limited funding and ensure key research, capacity and extension priorities are addressed.

In addition to funding research, the BCRC plays a leading role in increasing industry uptake of relevant technologies through the delivery of its knowledge dissemination and technology transfer strategy. This information sharing across a broad audience of producers, researchers, funders and policy makers, supports communication networks across the country.

The BCRC is also responsible for the delivery of the Verified Beef Production Plus (VBP+) program, a program developed to educate producers and facilitate on-farm certification of practices related to food safety, animal care, biosecurity, and environmental sustainability. VBP+ training and certification are important in supporting industry's efforts to demonstrate to downstream supply chain stakeholders and consumers that Canadian beef is produced in a sustainable manner and that maintaining public trust is a priority.

This report covers the period April 1, 2019 to March 31, 2020. During this period, the BCRC's research and extension programming was funded through the Canadian Beef Cattle Check-Off, AAFC under CAP, and other national and provincial industry partners. Programs were centered around the following areas:

- Maintaining or improving competitiveness in the production of beef cattle – animal health, feed efficiency, and feed production
- Supporting science-based policy, regulation, and trade
- Supporting science-based public education and advocacy
- Supporting the Canadian Beef Advantage through continual advancements in beef quality and food safety, and
- Accelerating the adoption of new innovations in the Canadian Beef Industry.

III. Key Highlights for the 2019/20 Activities

i. Beef Science Cluster III projects

This section provides a list of the projects funded under the Beef Science Cluster III and managed by the BCRC. This third Beef Science Cluster is a \$21.7 million dollar program, with AAFC contributing \$14.1 million and industry contributing \$7.6 million over the five years. April 1, 2019 marked the start of the second year of this five-year, Beef Science Cluster under AAFC's CAP program. Under this Cluster, there are 24 research and extension projects reporting activities between April 1, 2019 and March 31, 2020. Most of the projects are funded over the five-year period, with the second year of data being collected during 2019/20. The reportable results for the multi-year projects remain very limited, however preliminary findings have been reported for some of the projects as noted below. Each project title, budget and link to the project factsheet is listed below. The project factsheets provide the background, objectives and what the researcher will do under each project.

a) Summary of Beef Science Cluster Research Projects

Project title	Factsheet	2019/20 budget (\$)	2019/20 actual (\$)	2019/20 NCO funds (\$)
Beef Quality and Food Safety				
BQU.08.17 <i>Development of prediction tools to optimize carcass value</i>	BQU.08.17	204,850	204,850	60,375
BQU.10.17 <i>Canada's National Beef Quality Audit at Retail and Processing</i>	BQU.10.17	0	0	0
FOS.01.17 <i>If E. coli shed by cattle is becoming resistant to antimicrobial interventions in abattoirs, how best to raise the hurdles?</i>	FOS.01.17	238,805	238,149	121,345
Preliminary results indicate that a different research team's reports of increasingly heat resistant E. coli have been attributed to a flawed lab methodology (Journal of Microbiological Methods, doi.org/10.1016/j.mimet.2019.105679). Analyses of 750 STEC isolates collected from cattle and processing plants indicate that E. coli are not becoming more resistant to heat-based food safety interventions (Appl. Environ. Microbiol. doi:10.1128/AEM.00512-20)				
FOS.07.17 <i>Identification of genetic and microbial markers for E. coli O157 super-shedders through longitudinal biopsy and monitoring</i>	FOS.07.17	154,115	154,115	55,000
Animal Health, Welfare and Antimicrobial Resistance				
ANH.04.17 <i>Assessing economic impacts and developing evidence-based decision support systems for sustainable parasitic roundworm control in Canadian beef cattle</i>	ANH.04.17	295,510	295,510	158,654
ANH.05.17 <i>Identification of treatment strategies for the most common causes of lameness in feedlot cattle</i>	ANH.05.17	156,305	156,305	73,000

ANH.06.17 <i>Effect of rest stop duration and quality on the welfare of cattle transported by road</i>	ANH.06.18	265,668	265,668	80,000
Preliminary results indicate that aside from body energy status, a rest stop did not benefit the welfare, health or performance of weaned, conditioned calves transported for 12 or 36 hours. (PLoS ONE 15(3): e0228492. https://doi.org/10.1371/journal.pone.0228492). Full results will be reported as they become available.				
ANH.13.17 <i>Mycoplasma bovis pneumonia in beef cattle</i>	ANH.13.17	165,069	165,069	0
ANH.21.17 <i>The Canadian Cow-Calf Surveillance Network</i>	ANH.21.17	333,213	333,213	100,000
ANH.30.17 <i>Investigating antimicrobial resistance (AMR) and virulence factors of Mycoplasma bovis</i>	ANH.30.17	81,575	81,575	0
AMR.10.17 <i>Characterizing the microbiome of beef cattle to identify risk factors that affect respiratory health</i>	AMR.10.18	134,498	117,258	0
Feed Production and Efficiency				
FDE.01.17 <i>Determining the minimum fibre requirement for feedlot cattle and improving the empirical prediction of ruminal pH</i>	FDE.01.17	278,850	278,850	76,575
FDE.06.17 <i>Genetic analyses of feed intake, feed efficiency, female fertility, and cow lifetime productivity in beef cattle raised under two environments</i>	FDE.06.17	217,908	217,908	52,425
FDE.09.17 <i>Further strategies to enhance the use of wheat grain in feedlot diets</i>	FDE.09.17	124,050	124,050	49,000
FDE.13.17 <i>Identification of causal mutations located in distortion regions in beef cattle genome associated with bull and cow fertility and its links to feed efficiency</i>	FDE.13.17	146,395	146,395	50,000
Preliminary results: With one year remaining on the project, researchers have developed a new method to distinguish bacteria strains based on how they take in nutrients. This will help researchers better understand how bacteria use substrates such as pre and probiotics.				
FDE.14.17 <i>Evidence-based prebiotic and probiotic solutions for improving gut health and feed efficiency in cattle</i>	FDE.14.17	81,725	76,277	0
Forage Productivity and Environmental Sustainability				
FRG.01.17 <i>Development of native and tame forage varieties and mixtures for improved forage and environmental productivity and resilience</i>	FRG.01.17	371,000	371,000	50,000
FRG.02.17 <i>Novel sainfoin cultivars for enhancing production efficiency of pasture and beef cattle and building capacity in forage breeding</i>	FRG.02.17	144,795	144,795	66,950
FRG.06.17 <i>Improving abiotic stress tolerance in alfalfa through the simultaneous down-regulation and/or genome editing-mediated knockout of multiple genes</i>	FRG.06.17	74,415	74,415	0

Preliminary results: this research team is the first in the world to successfully established CRISPR/Cas genome editing with high efficiency in alfalfa. This will allow researchers to speed up the alfalfa breeding process compared to traditional breeding program.				
FRG.09.17 Sustaining the legume component of grazed pasture mixtures for summer grazing and stockpiling complex mixtures in Eastern Canada	FRG.09.17	256,490	256,490	50,000
FRG.11.17 Increasing fall productivity in winter-hardy alfalfa by selecting for reduced fall dormancy	FRG.11.17	131,038	131,038	17,000
FRG.20.17 Evaluating the potential for increased forage productivity in mid-rotation native forested rangeland sites through an integrated forage, cattle and timber management approach (silvopasture)	FRG.20.17	113,850	113,850	0
ENV.07.17 A regionalized life cycle impact assessment model for the quantification of Canadian Beef production impacts on biodiversity	ENV.07.17	85,099	85,099	35,408
ENV.09.17 Assessment of occurrence of synthetic hormones (melengestrol acetate & trenbolone acetate) and the beta-agonist (ractopamine) in cattle operations and associated environments	ENV.09.17	123,050	123,050	50,000
ENV.15.17 Economic and environmental impacts associated with removal of growth-enhancing technologies in the Canadian beef cattle industry	ENV.15.17	84,468	84,468	50,000
Knowledge and Technology Transfer				
TEC.01.17 Enhancing Technology Transfer in the Canadian Beef Industry (see details below)	TEC.01.17	279,347	279,347	100,000
Science Coordination				
SCI.01.17 Science Coordination		166,860	162,357	46,654
Total		4,708,948	4,681,101	1,342,386

b) Knowledge and Technology Transfer

TEC.01.17 Enhancing Technology Transfer in the Canadian Beef Industry

This project is delivered internally by the BCRC, utilizing Cluster funding to focus on enhancing technology transfer in the Canadian beef industry through a broad range of activities. In year two, results include regular communication of research results with industry through numerous presentations and regular social media activity, substantial enhancements to website functionality, and mentorship of four applied researchers by producers and other industry experts. The following new resources were also developed and distributed to industry:

Knowledge and Technology Transfer Resource	Number developed in 2019/20
Fact sheets – http://www.beefresearch.ca/resources/fact-sheets.cfm	17
Interactive decision making tools – http://www.beefresearch.ca/resources/decisiontools.cfm	8
Articles for <i>Canadian Cattlemen - The Beef Magazine</i> - http://www.beefresearch.ca/blog/tag/canadian-cattlemen-magazine/	12
Webinars - http://www.beefresearch.ca/resources/webinars.cfm	8
Blog posts - http://www.beefresearch.ca/blog/	42
Infographics - http://www.beefresearch.ca/resources/images.cfm	5
Radio clips	3

While it is difficult to measure or qualify the adoption of innovative knowledge, especially in the short term, BCRC's technology transfer efforts appear to be successful based on consistently positive feedback from producers and other stakeholders, increasing website traffic, increasing subscribers and followers to BCRC newsletters and social media, and continued growth in the redistribution of our resources by other publications and organizations.

Webinar registrations and recording views have increased, and social media networks continue to grow. Survey feedback from the 2019/20 webinar series has been very positive, with the expectations of the majority of participants being met or exceeded. Participants also noted on the surveys that they had learned something new and/or intended to make production changes based on the information or motivation provided.

For more information on this project, see our factsheet: [Enhancing Technology Transfer in the Canadian Beef Industry](#).

Final Cluster expenditures for 2019/20 were not available at the time of report preparation due to the lag in time from when the Cluster fiscal year is completed and when research institutions submit expenses. Most projects are running on budget and the expectation is that all AAFC cluster funding will be expended. If any projects are underbudget, that portion of National Check-Off funds may be deferred allowing researchers to utilize the funding in subsequent years. It is expected that the total five-year industry contribution through National Check-Off funding and other sources will be expended by the end of the Cluster in 2023. The utilization of deferred funding was successfully demonstrated through the first two science clusters administered by the BCRC.

Total funding (industry and AAFC) on Cluster III projects in 2019/20 is projected at \$4,681,101.

Total 2019/20 projected National Check-Off funding for Beef Cluster III projects = \$1,342,386.

ii. BCRC Research Projects

In addition to research projects funded within the Beef Science Cluster program, the BCRC and industry and government partners funded additional projects based on specific needs and opportunities identified by the beef industry. The projects managed by the BCRC outside of the Science Cluster during 2019/20 are identified below. Some of these projects received funding from the Canadian Beef Cattle Check-Off, while others were funded from various other industry and government sources.

During 2019/20 researchers were awarded funding through an open call for proposals where the BCRC received applications from researchers. This marks the BCRC's second annual open call for proposals in over a decade, supported by the Canadian Beef Cattle Check-Off.

Under the 2019 open call for proposals, the BCRC received 74 letters of intent from researchers across Canada. Of these, 35 researchers were invited to submit a full proposal, with 32 forwarding a proposal for funding. All proposals addressed priority outcomes as defined by the BCRC, under priority areas relating to beef demand, industry competitiveness, and productivity. The BCRC engaged internal and external peer reviewers in the proposal selection process, and BCRC funding was approved for 16 projects in February 2020. It was required that successful applicants leverage the Canadian Beef Cattle Check-Off by securing funding from other federal and provincial governments and/or industry funding programs, and the Check-Off dollars were leveraged on minimum at a 1:1 ratio.

The following sections highlight the 2018 and 2019 projects funded under the open call for proposals, as well as projects receiving funding from other industry partners and managed by the BCRC.

a) Special Projects

Canadian Global Food Animal Residue Avoidance Database – CgFARAD, \$7,500

The Canadian global Food Animal Residue Avoidance Database (CgFARAD) plays an important role in the prevention of drug and chemical residues in foods of animal origin. Based at the Western College of Veterinary Medicine, University of Saskatchewan and the Ontario Veterinary College, University of Guelph, the CgFARAD service provides technical information and advice to Canadian veterinarians and government regulators on withdrawal issues relating to extra-label drug use and exposure to toxic chemicals in food animals. The clinical pharmacologists responsible for the CgFARAD are uniquely positioned to provide expertise to meet industry needs. The BCRC provides the beef industry's contribution to maintain this important capacity.

MISC.01.18 *Support for the Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS): Beef Feedlot Antimicrobial Resistance (AMR) Surveillance Framework Development, \$77,000 (not Check-Off funding)*

This project is managed by the BCRC and funded by industry partners. The BCRC's primary role is financial management and technology transfer upon completion. Reports on this project are available upon request.

Total 2019/20 National Check-Off funding for Special Projects = \$7,500

b) Priority Research Projects

Ongoing projects

The BCRC approved funding in previous years for the following projects. All projects are funded jointly by Canadian Beef Cattle Check-Off dollars leveraged with at least 50% other funding from government and/or industry partners. A brief description, fact sheet link, project completion date and National Check-Off funding approved for each project is listed below. **The completion dates could be delayed due to COVID-19 impacts, including limited ability to conduct the research with severe restrictions on research facilities.**

BCRC Priority Research Projects				
Project title	Factsheet	Project completion date	Total NCO funding (\$)	2019/20 NCO funding (\$)
MISC.02.18 <i>Validation of the safety and effectiveness of peroxyacetic acid for the European Food Safety Authority;</i>	To be created	March 2021	112,300	24,950
ANH.04.18 <i>Comparison of immune response and respiratory disease-sparing effect of homologous and heterologous prime-boost vaccine programs in beef calves.</i>	ANH.04.18	July 2022	47,350	40,248
ANH.07.18 <i>Effect of feeding ergot alkaloids on ruminal metabolism, growth performance, health and welfare of beef cattle: How much is too much?</i>	ANH.07.18	March 2022	124,370	105,715
ANH.19.18 <i>Characterization and optimization of visual pen checking criteria to improve BRD treatment outcomes in feedlot cattle</i>	ANH.19.18	May 2023	86,496	64,872
ANH.22.18 <i>Determining the effect of stress on the respiratory microbiome of cattle during transportation</i>	ANH.22.18	May 2022	79,480	59,610
AMR.02.18 <i>Use of bacteriophage-derived lysins in combatting multi-drug resistant (MDR) pathogens that cause bovine respiratory disease (BRD).</i>	AMR.02.18	September 2022	97,565	73,174
BQU.02.18 <i>Nutrient density and nutritional value of Canadian beef products</i>	BQU.02.18	April 2020	27,025	4,054
BQU.09.18 <i>Developing a Canadian Total Quality Management System for Beef Processing.</i>	BQU.09.18	June 2022	79,460	0
ENV.02.18 <i>The impact of agricultural land conversion on carbon stocks across Canada, with a focus on grazing lands</i>	ENV.02.18	April 2022	166,150	16,615
ENV.03.18 <i>Performance, Environmental and Economic Benefits of BioChar Supplementation in Beef Cattle Grazing Systems</i>	ENV.03.18	December 2022	121,018	96,242

FDE.03.18 <i>Use of high-moisture corn products for finishing cattle and corn stover to extend the grazing season for pregnant beef cattle.</i>	To be created	September 2023	142,146	106,609
FRG.03.18 <i>Improving vegetative biomass yield and digestibility in alfalfa for enhanced livestock production.</i>	To be created	TBD	159,300	0
FRG.08.18 <i>Assessing the impact of grazing annual forage cover crops in an integrated crop-livestock system</i>	FRG.08.18	May 2023	193,850	71,948
FRG.09.18 <i>Enhancement of total lipid content/composition in non-GMO alfalfa and sainfoin for improved energy density and reduced methane emissions</i>	FRG.09.18	March 2023	182,188	136,641
FOS.01.18 <i>Persistence of Shiga toxin-producing Escherichia coli (STEC) in Cattle and Association with Clinical Infections in the Same Geographic Region</i>	FOS.01.18	March 2023	97,875	76,925
FOS.04.18 <i>Shiga-toxigenic E. coli persistence mechanisms and surface biofilm detection using near-infrared spectroscopy on beef processing facilities.</i>	FOS.04.18	March 2022	130,725	49,016
Total			1,847,298	926,619

Total National Check-Off funding approved for ongoing Priority Research projects = \$1,847,298

Total 2019/20 projected National Check-Off funding for ongoing Priority Research projects = \$926,619.

2019 projects approved in February 2020

The BCRC approved funding in February 2020 for the following projects. All projects are funded jointly by Canadian Beef Cattle Check-Off dollars leveraged with at least 50% other funding from government and/or industry partners. Most projects are three-year projects. A brief description, projected start date and National Check-Off funding approved for each project is listed below. **Several of the projects, expected to start as early as April 2020, will be delayed due to COVID-19 impacts including limited ability to procure matching funds and /or to start projects with severe restrictions on research facilities.** The implications of COVID-19 on research timelines and deliverables will be reported on in the 2020/21 Results Report.

2019 project description and National Check-Off funding

Project title	Project start date	Total NCO funding (\$)	2019/20 NCO funds (\$)
ANH.01.19 A screen for drugs that reveal <i>Mycoplasma bovis</i> to the bovine immune system: a novel approach to vaccine development.	September 2020	71,250	64,688
ANH.02.19 Application of a multi-omics strategy to investigate liver abscess development in beef cattle.	TBD	419,250	0
ANH.10.19 Antimicrobial use and resistance in cow-calf herds: Will anything change after the switch to prescription only sales of medically important antimicrobials?	September 2020	143,070	122,303
ANH.11.19 Surveillance of antimicrobial use and antimicrobial resistance in Canadian feedlot cattle; expansion of bovine respiratory disease pathogen susceptibility testing.	April 2020	47,430	45,800
ANH.18.19 Development of multiplex recombinase polymerase amplification (RPA) assays for the detection of antimicrobial-resistant (AMR) bacterial pathogens causing bovine respiratory disease (BRD)	March 2020	64,023	59,268
ANH.23.19 Stocking density and feed bunk space as a risk factor for liver abscesses.	March 2021	56,214	0
BQU.03.19 Validation of rapid evaporative ionization mass spectrometry (REIMS) for tenderness prediction.	June 2020	154,735	131,524
ENV.03.19 Prairie Ecosystem Services Project: Quantifying the contribution of wetlands in livestock production landscapes.	January 2021	190,555	0
ENV.07.19 Watershed-scale assessment of water and nutrient dynamics of pastures utilized by beef cattle.	June 2020	134,389	100,792
FDE.01.19 Canola supplementation of cows in late gestation leads to increased calf growth and modification of epigenetic, gene expression, and blood metabolite profiles.	TBD	137,074	0
FDE.03.19 Improving feed efficiency in the cow herd: Individual cow variability in fibre digestibility, feed efficiency, and methane emissions.	September 2020	7,500	0
FDE.06.19 Evaluating new next-generation strategies to boost breeding efficiency for Feed and Forage Production in Barley and Triticale.	TBD	265,500	0
FRG.08.19 Forage Potential of Hybrid Fall Rye (HR) in Alberta and Saskatchewan.	TBD	87,692	65,769
FRG.09.19 Corn intercropping strategies for extended winter grazing of beef cattle.	TBD	91,066	0
Total		1,869,748	590,144

Total National Check-Off funding approved for 2019 projects = \$1,869,748.

Total 2019/20 projected National Check-Off funding for 2019 Priority Research projects = \$590,144.

c) Research Capacity

In 2018/19 the BCRC began the process of developing Research Chairs in partnership with key Research Institutions through a competitive call for proposals. The intent of BCRC investment is to leverage other funding in the area of research capacity, such as the National Sciences and Engineering Research Council of Canada (NSERC) to implement long-term research capacity in areas of priority. The evaluation of Research Chair concepts by the BCRC considers the incremental nature of the proposed research capacity, institutional investments, program support, and capacity priorities that have been identified by industry.

The two Research Chairs selected in 2018/19 have successfully procured matching funds and were contracted during 2019/20. They include:

- Beef Production Systems Chair “to increase the competitiveness of those sectors of the Canadian beef industry that rely heavily on grazing-based forage resources, while maintaining a strong focus on beef production and market outcomes”, University of Alberta.
- BCRC Chair in One Health and Production-Limiting Diseases with the goal “to increase capacity for applied field research and surveillance in specific priority areas outlined by the beef industry including: animal health and welfare, antimicrobial use, resistance and alternatives, and on-farm food safety”, Western College of Veterinary Medicine, University of Saskatchewan.

The hiring processes for both Chair positions had been initiated in early 2020 with positions being advertised and applicants being short-listed for interviews. In both cases the interview and selection process has been delayed due to COVID-19 related travel restrictions. Candidate selection processes will resume in 2020/21 when travel and meeting restrictions are reduced.

BCRC Research Capacity investments for the above two Chairs are 10-year investments of \$1.5 million (\$150,000/year), leveraged by a minimum of \$1.5 million from external funding. Consequently, the funding timelines for new investments are proposed to be staggered. The next opportunity to invest in new research capacity is intended to start in 2022/23. It typically takes two years for the BCRC to complete a call for proposals and then allow time for successful applicants to procure matching funds. The BCRC plans to launch its next research capacity call for proposals in July 2020.

Total 2019/20 projected National Check-Off funding for Research Capacity projects = \$300,000

d) Knowledge and Technology Transfer

In addition to the knowledge and technology transfer activities under the third Beef Science Cluster, which include the development, maintenance and distribution of articles, decision tools, videos, and webinars, knowledge and technology transfer in Canada's beef industry is being advanced through the Canadian Beef Technology Transfer Network. The Network brings together groups and individuals actively involved in knowledge and technology transfer that supports Canadian beef producers and advances the Canadian beef industry. By facilitating greater communication and collaboration through the Network, resources and expertise are shared, undue duplication is avoided, and collaborative groups are empowered to develop effective resources and strategies that are applicable long-term across regions and in line with the Canadian Beef Research and Technology Transfer Strategy. The group continues to grow and identify valuable

opportunities to communicate and collaborate with each other on beef and forage technology transfer initiatives.

To develop collaborative extension projects, including economic-based decision-making tools for producers, the Council invited calls for letters of intent for technology transfer and production economics projects in June 2018 and June 2019. The list of knowledge and technology transfer projects funded through these calls are listed below. All projects are one to two years in length and are funded jointly by Canadian Beef Cattle Check-Off dollars leveraged with provincial and federal government and/or industry partner funding.

The BCRC also funded and/or managed the 2018 and 2019 proof of concept (POC) projects listed below. This funding supports short-term (six months to one year) proof of concept-based research to help inform whether it is worth pursuing as a larger, more defined research investment in that area. The POC projects are funded jointly by Canadian Beef Cattle Check-Off dollars leveraged with provincial and federal government and/or industry partner funding, with some being funded solely by private industry.

2018 and 2019 project description and projected 2019/20 National Check-Off funding				
Project title	Factsheet	Project Start and End date	Total NCO funding (\$)	2019/20 NCO funds (\$)
KTT.01.18 <i>Early Calf Health and Survival Management Risk Assessment Tool</i>	KTT.01.18	May 2020 – Jul 2022	36,657	27,492
KTT.02.18 <i>Forage U-Pick: A forage species selection, weed management, and seeding rate mobile site - a tool for western Canada.</i> The up-to-date interactive tool for western Canada allows producers to select forage varieties for specific growing conditions, determine seeding rates for new stands or pasture rejuvenation, and manage weeds in forages.	KTT.02.18	Mar 2019 – Apr 2020	49,875	7,481
KTT.05.18 <i>An Interactive Tool to Inform Johne's Disease Control in Beef Herds: What to Test, When and How Often</i>	KTT.05.18	Sept 2019 – Aug 2021	17,850	0
KTT.01.19 <i>The Value of Record Keeping for Decision-Making on Canadian Cow-Calf Farms and Ranches.</i>	To be created	Sept 2020	40,950	0
KTT.04.19 <i>Evaluating Premiums for Weaned Calves Marketed with Value-Added Management Characteristics</i>	KTT.04.19	Apr 2020 – Mar 2022	10,500	8,925
POC.02.18 <i>Exploring the potential of using Carnobacterium Maltaromaticum A5 as a bioprotective agent in meat plants to improve the safety and shelf life of meat.</i> Preliminary results: Researchers found that at low concentrations <i>C. maltaromaticum</i> A5 is unable to prevent spoilage microbes from taking over	POC.02.18	May 2019 – Apr 2020	49,830	0
POC.04.18 <i>Exploring options for BRD diagnostics 2.0 – a point of care metagenomic nanopore sequencing pilot study.</i>	POC.04.18	Apr 2019 – Mar 2020	0	0

POC.06.18 <i>Enhancing the bovine respiratory microbiome through promoting commensal bacterial growth</i>	POC.06.18	Apr 2019 – Jul 2020	0	0
POC.08.18 <i>Exploring corn intercropping strategies to increase protein and profitability of beef cattle grazing.</i>	POC.08.18	May 2019 – Mar 2020	0	0
POC.01.19 <i>Using genetic algorithms to predict antibiotic resistance levels in Canadian feedlot cattle to promote individual animal diagnosis and prevent unnecessary antibiotic use.</i>	POC.01.19	Jan 2020 – Jan 2021	50,000	40,000
POC.02.19 <i>Marbling relationship between Canadian and Japanese grade sites.</i>	POC.02.19	Apr 2020 – Mar 2021	49,856	49,856
POC.05.19 <i>Evaluation of feedlot water bowls for pen-level surveillance of antimicrobial-resistant bovine respiratory pathogens.</i>	To be created	TBD	50,000	0
POC.06.19 <i>Evaluation of a Remote Early Disease Identification (REDI) system to identify feedlot cattle with bovine respiratory disease (BRD)</i>	To be created	TBD	50,000	50,000
POC.09.19 <i>Chemical free sanitizers to prevent E. coli contamination and reduce food waste</i>	POC.09.19	Apr 2020 – Mar 2021	50,000	42,500
Total			455,518	226,254

Total National Check-Off funding approved for 2018 and 2019 Knowledge and Technology Transfer projects = \$1,869,748

Total 2019/20 projected National Check-Off funding for Knowledge and Technology Transfer projects = \$226,254

e) Surveillance Research Network

A key priority identified in the Canadian Beef Research & Technology Transfer Strategy is supporting the establishment of priority surveillance networks related to production limiting diseases and antimicrobial resistance and use. The intent of these networks is to inform industry practice, policy, and future research priorities. In 2019/20, there were no investments in the establishment of surveillance research networks related to production limiting diseases and antimicrobial resistance and use. Although this area is a clear priority and future investment is required, current work proposed under the Beef Science Cluster III to establish a national cow-calf surveillance network and also ongoing discussions with the Public Health Agency of Canada and other government entities require further time to define where near-term industry investments in this area are most effective.

The BCRC continues to support the Cost of Production Network managed by Canfax Research Services (CRS). The Cost of Production Network, through its development of economic baseline data and analysis, supports industry competitiveness with a goal to have Canadian beef cattle cost of production data in every province/ecoregion to guide technology transfer and research priorities.

The 2019/20 year for the Canadian Cow-Calf Cost of Production Network was one of preparation, including the set up of provincial coordinators, ecoregions and processes. The Network is collaborating with existing

cost of production (COP) programs like AgriProfit\$, and directing producers there with agreements in place for data to be submitted to the national network. Add-on projects have also been developed building on the BCRC foundational investment. One is the CRSB economic assessment with a student scheduled to start in September 2020 to support this project. This project will include the collection of GHG emission data and evaluation of production systems that have a win-win with both lower emissions and lower COP in their future farm scenarios. A funding application is pending in the Maritime provinces for a dairy-beef COP extension; this project will evaluate the opportunities in these production systems.

Pilot testing of four focus groups was scheduled for March and April 2020 but was delayed due to COVID-19 restrictions put in place. The intention is to have the pilot farm focus groups in the fall of 2020 with the bulk of data collection occurring in Jan-March 2021. Communication materials continue to be developed and revised to meet social distancing measures and requirements.

Total 2019/20 projected National Check-Off funding for the Cost of Production Network = \$60,000

f) Verified Beef Production Plus

In addition to sponsoring research and technology development in support of the Canadian beef industry, the BCRC oversees the Verified Beef Production Plus (VBP+) program. BCRC funding facilitates the ongoing operation of the national VBP+ program, including the maintenance of a national standard, maintenance of the national CORS data management system and national website, and coordination of provincial delivery, audit systems, and record keeping.



Implementation of the development of two separate streams of activity for VBP+, training and certification, saw significant progression in 2019/20. This development involved the transfer of certification services from the Provincial Delivery Agents (PDA) to a newly formed company, VBP+ Delivery Services Inc. that is wholly owned by the CCA (BCRC). Allowing the PDAs to focus solely on producer training and education not only maintains distance between third-party certification and producer education, but it enables the PDAs to enhance their training and education delivery, including an emphasis on re-training, continuing education, and the addition of regionally specific content.

VBP+ Delivery Services Inc. (VBP+ Inc.) began delivering certification services in November of 2019, starting with the provinces of British Columbia, Alberta, and Saskatchewan. The success of the certified sustainable sourcing initiatives saw many audits performed between November 2019 and February 2020. There were many learnings during the transition of those provinces, which helped to refocus the timeline of the transition of provinces east of Saskatchewan. It is anticipated that all the provinces will be transitioned by July 2020.

The development of a comprehensive electronic audit management tool played a significant role in the growth of VBP+ Inc. during this period. This tool, which is slated to be completed in June of 2020, will allow VBP+ Inc. to more efficiently manage:

- Auditor assignments, auditor competencies and auditor continuing education
- Multiple scoring and classification of audit questions to meet various stakeholder outcomes and equivalencies, including CFIA, On-Farm Food Safety Technical Designation, Canadian Roundtable for

Sustainable Beef (CRSB), National Farm Animal Care Council (NFAC), Animal Care Assessment Framework, and potentially European Union Certification

- Greater reporting capability including regionally specific scoring on different pillars and corrective action aggregate data which can then inform training content development

At the same time the electronic audit management tool was being developed, work was ongoing on the redevelopment of the VBP+ training platform and content. To ensure that there was continuity between what was expected of beef producers at a certification event and content in the training materials, development of a new reference manual was started. This reference manual will be used to develop a training workbook, on-line workshops, in-person workshops, and webinar workshops. There will also be a train-the-trainer platform designed to ensure continuity of program delivery by both coordinators and sub-contracted trainers. The development of this electronic management tool was timely as it easily allowed for a transition to remote audit delivery when the COVID-19 pandemic hit in early 2020.

VBP+ Inc. successfully completed an oversight audit from NSF International Inc. as part of the oversight of the Canadian Roundtable for Sustainable Beef (CRSB) in December 2020. Much of the work being mentioned previously will allow VBP+ Inc. to not only maintain their accreditation as a certification body for the CRSB but will allow VBP+ Inc. to apply for multiple accreditations, including reapplication for equivalency for the NFAC Animal Care Assessment Framework and application to the CFIA to perform European Union export audits.

VBP+ has seen much change over the past year and experienced much growth. Looking forward, and in most part, due to the work completed over the past year, VBP+ will be well positioned to meet all outcomes and expectations of its industry partners, beef producers, stakeholders, and end-users.

The VBP+ project budget is aligned with the BCRC fiscal year, July 1 to June 30. Consequently the 2019/20 actual program expenditures will be finalized subject to the close of the year end on June 30th.

Total 2019/20 projected National Check-Off funding for VBP+ = \$595,578.

IV. BCRC Administration and Management

The BCRC is overseen by an operating committee of 14 cattle producers, which are appointed by the provincial producer organizations and proportionally represent the provincial allocation of the Canadian Beef Cattle Check-Off to research. The BCRC is led by an Executive Director who oversees research and extension programming development and implementation, playing a key role in establishing and refining industry research priorities in consultation with other stakeholders. The Executive Director acts as a liaison and facilitation link among the BCRC committee and BCRC staff, CCA, the Canadian Beef Advisors, the Canadian Beef Cattle Research, Market Development and Promotion Agency, technical advisors, and national and provincial interest groups with similar research objectives. The Executive Director encourages coordination of priorities and funding allocations between agencies in alignment with the *Canadian Beef Research and Technology Transfer Strategy*.

Supporting the Executive Director, the BCRC Science Director and Research and Innovation Coordinator manage priority research projects as well as projects undertaken within the Beef Cattle Industry Science Clusters. The Extension and Communications Director and Science and Extension Coordinator support the Technology Transfer & Knowledge Dissemination Strategy. In January 2020, an Operations Manager joined the BCRC team, to support the development and implementation of BCRC's business planning, budget development and management, and results and financial reporting processes. In addition, administrative, financial, and technical expertise as required support the BCRC operations.

The Executive Director also oversees the VBP+ Business Manager who works with various contractors and is directly responsible to deliver the national VBP+ program.

A Science Advisory Panel comprised of industry, academic and governmental scientific expertise, continues to support the BCRC's research program. This expertise helps to ensure the delivery of research plans that are directed towards industry's research objectives and achieve the outcomes desired by industry.

National Check-Off funding directed to the BCRC general administration and management expenses for 2019/20 is projected at \$505,096.

V. Financial Note

The fiscal year for the BCRC is July 1 to June 30 and therefore the BCRC audited financial statements are not included in this report. In many instances, the projected expenditures in this report reflect the July to June fiscal period. Consequently the 2019/20 actual expenditures are to be finalized subject to the close of the year end on June 30th. The BCRC 2019/20 financial summary will be available upon request after August 2020.

Projected Canadian Beef Cattle Check-Off funding allocated to research programming in 2019/20 is outlined in various sections of this report and includes the following:

Beef Science Cluster research projects = \$1,342,386

Other BCRC research projects = \$2,110,517

Verified Beef Production Plus = \$595,578

BCRC general program management and administration = \$505,096

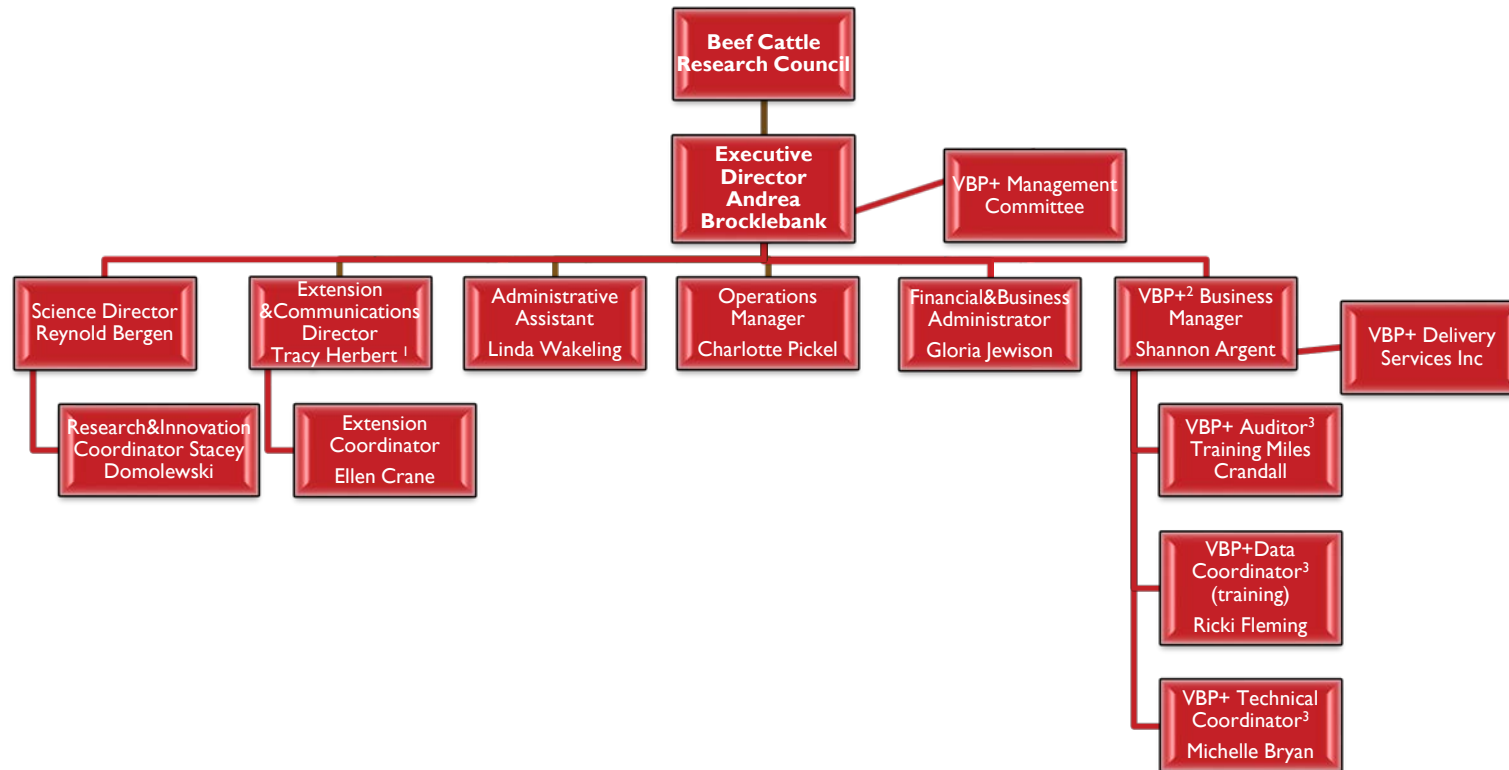
Total Beef Cattle Check-Off funding - \$4,553,577

VI. Appendix – BCRC Organization Chart



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Beef Cattle Research Council Organization Chart



1. Effective October 17, 2019 Tracy Herbert is on maternity leave; position temporarily being filled by Janice Bruynooghe

2. Verified Beef Production Plus

3. Part-time contract

Note: In addition to permanent positions, BCRC and the VBP+ Program hire services from various experts, on a contractual basis as required