BCRC

BEEF CATTLE RESEARCH COUNCIL

2021/22 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) is the national industry-led funding agency that funds leading edge research and technology transfer activities to advance the competitiveness and sustainability of the Canadian beef cattle industry. 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, the BCRC is directed by a committee of 15 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 2021/22, the BCRC received on average $0.67 (unaudited) of every $2.50 of the Canadian Beef Cattle Check-Off collected by the provinces. This funding was leveraged under the Beef Science Cluster program with Agriculture and Agri-Food Canada Canadian Agricultural Partnership funding, where industry contributed 34% ($1.3 million) and government 66% ($2.5 million). In addition, the BCRC leveraged the Canadian Beef Cattle Check-Off for an additional $5.9 million in research funding and $800,000 in-kind from government and industry partners through initiatives outside of the Beef Science Cluster.

This report covers the period April 1, 2021 to March 31, 2022. Programming during this period was centered around the following areas:

- Increase producer profitability by increasing productivity or decreasing costs of production and risks.
- Develop, enhance and encourage adoption of beneficial practices and innovations that maximize the environmental benefits industry provides and continue to reduce our environmental footprint, while supporting industry competitiveness.
- Support continuous improvements in Canadian beef demand through advancements in the quality and safety of Canadian beef.
- Generate science to inform decision makers, policy and best management practices and to support consumer confidence and public trust.
- Develop, enhance and encourage adoption of leading-edge technologies that support industry competitiveness, automation and sustainability.
- Ensure the maintenance and rejuvenation of critical research capacity and infrastructure that facilitate proactive inquiry and innovation to support industry advancement.

Section III (ii) of this report covers the projects managed by the BCRC and funded under the third Beef Science Cluster. There were 18 research, extension and science coordination Cluster projects reporting activities between April 1, 2021 and March 31, 2022. The fourth year of the five-year Cluster program has now been completed, with preliminary findings reported and included in Section III (ii). For example, after studying why *M. bovis* infection leads to pneumonia in only some feedlot calves, researchers found that vaccination to control the inflammation and disease caused by other viral and bacterial respiratory pathogens also helps minimize losses due to *M. bovis*. Results from another project indicated that residues from growth promotants used to improve beef cattle efficiency in Canada pose minimal risks to the environment which can be further minimized by appropriate manure and runoff management. A summary of Beef Science Cluster projects, including the project title, factsheet link and budget is included in Section III (ii).

Section III (v) of this report includes a list of BCRC priority research projects funded by Canadian Beef Cattle Check-Off dollars and other industry investments through the BCRC's annual call for proposals. In 2021/22, the BCRC launched a condensed call focused on a few clearly defined project priority areas. Under this call,

20 expressions of interest were received from research teams across Canada. Of these, 14 teams were invited to submit full proposals and funding was approved for eight projects in June 2021. Successful applicants secured funding from other sources (government and industry), matching the Canadian Beef Cattle Check-Off dollars at a minimum of 1:1. Several projects approved in previous calls (2018 – 2020) are still underway or nearing completion. One such project compared the efficacy of intranasal vaccine use at birth relative to injectable vaccines administered at one or two months of age. Results indicate that administering mucosal vaccines at birth is an effective way to strengthen the immune system of newborn calves. Another project is evaluating different methods of using high moisture corn products in cow-calf and feedlot settings. Early results indicate that some methods may result in similar animal performance compared to barley-based diets. A summary of BCRC research projects, including the project title, factsheet link and budget is included in section III (v).

Funding was also approved for six Proof of Concept (POC) projects in 2021/22. These are short-term (six months to one year) projects to help inform whether it is worth pursuing as a larger, more defined research investment in that area. One such project focused on refining, simplifying, automating and speeding up a test for BRD pathogens. While more work is required to improve efficacy in detecting BRD in asymptomatic animals, the team was able to increase the speed of obtaining a result by 97% compared to traditional culture-based diagnostics. See section III (vi) for a complete list of the POC projects and preliminary research highlights.

The BCRC continued to support the implementation of long-term research capacity in 2021/22. The Beef Industry Forage Management and Utilization Chair was hired at the University of Saskatchewan, College of Agriculture and Bioresources, to expand the agronomic research capacity and to bring together expertise at the University of Saskatchewan and beyond to fill the gaps in forage research and disseminate findings to industry. This is the third Chair position supported by the BCRC to address industry identified gaps in research capacity. See section III (vii) for additional details on research capacity investments.

In addition to the Knowledge and Technology Transfer (KTT) activities under the Beef Science Cluster such as the development and distribution of articles, decision tools, videos, blog posts and webinars, KTT continued to be advanced through the Canadian Beef Technology Transfer Network and through an annual call for proposals. Through one such project a series of podcasts was created in 2021/22, to share science-based information about the Canadian beef industry. This project is only halfway complete and has already seen over 4,800 downloads. In 2021/22 the BCRC approved funding for four new KTT projects and had more than 60 individuals that participated in a Canadian Beef Technology Transfer Network annual meeting that facilitated communication and collaboration. See section III (viii) for details on the KTT program and project highlights.

The BCRC also continued to support priority surveillance networks related to production limiting diseases and antimicrobial resistance and use. In 2021/22, funding continued for three surveillance projects as well as the Canadian Cow-Calf Cost of Production Network. See sections III (ix) and (x) for details on the surveillance research network and related projects.

The BCRC continues to oversee the delivery of the Verified Beef Production Plus (VBP+) program. VBP+ has continued to advance producer training objectives and the delivery of on-farm certification services through VBP+ Delivery Services Inc. See section IV for an update on the progression of VBP+ programming.

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, 2022. The Canadian Beef Cattle Check-Off funding allocated to research programming in 2021/22 is highlighted in various sections of this report and is projected at **$5,804,493.**

II. Background

The Beef Cattle Research Council (BCRC) funds leading-edge research and technology transfer activities to advance the competitiveness and sustainability of the Canadian beef cattle industry. In 2021/22, the BCRC received on average $0.67 (unaudited) of every $2.50 of the Canadian Beef Cattle Check-Off. 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 2021/22, where industry contributed 34% ($1.3 million) and AAFC contributed 66% ($2.5 million). In addition, the BCRC leveraged the Canadian Beef Cattle Check-Off for an additional $5.9 million in research funding and $800,000 in-kind from government and industry partners through initiatives outside of the Beef Science Cluster

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 released the next five-year *Canadian Beef Research Strategy and Technology Transfer Strategy* in July 2021. This new Research and Technology Transfer Strategy will allow the BCRC, working in partnership with other beef research funding agencies across Canada, to address key research, capacity and extension priorities as identified by producers and industry partners.

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 program. 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, 2021 to March 31, 2022. 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:

- Increase producer profitability by increasing productivity or decreasing costs of production and risks.
- Develop, enhance and encourage adoption of beneficial practices and innovations that maximize the environmental benefits industry provides and continue to reduce our environmental footprint, while supporting industry competitiveness.
- Support continuous improvements in Canadian beef demand through advancements in the quality and safety of Canadian beef.
- Generate science to inform decision makers, policy and best management practices and to support consumer confidence and public trust.

- Develop, enhance and encourage adoption of leading-edge technologies that support industry competitiveness, automation and sustainability.
- Ensure the maintenance and rejuvenation of critical research capacity and infrastructure that facilitate proactive inquiry and innovation to support industry advancement.

III. Research Activities

i. Introduction

This report highlights the BCRC research activities supported by the Canadian Beef Cattle Check-Off and other industry and government partners for the period April 1, 2021 to March 31, 2022. During this period, the BCRC provided funding to beef research projects under the Agriculture and Agri-Food Canada (AAFC) Beef Science Cluster program and additional projects based on specific needs and opportunities identified by the beef industry.

This April 1, 2021 to March 31, 2022 reporting period marks the fourth year of the five-year Beef Science Cluster III program - a $21.7 million dollar program, with AAFC contributing $14.1 million and industry contributing $7.6 million over the five years. Under this Cluster program, there are 18 research, extension and science coordination projects reporting activities between April 1, 2021 and March 31, 2022. Most of the Cluster III projects are funded over the five-year period, with a few projects wrapping up in each of 2021 and 2022. The reportable annual results for the multi-year projects remain limited, with the majority of meaningful results presented upon project completion.

The Science Cluster IV program announcement is anticipated for mid to late 2022. The BCRC began planning for the Cluster IV program launch with a call for proposals in summer 2021. The BCRC engaged internal and external peer reviewers in the proposal selection process and met in May 2022 to select a portfolio of projects to be included in the Beef Cluster IV application. Funding approval under the Science Cluster program is a highly competitive process. With initial planning in place, the BCRC is well positioned to make any required adjustments to its Beef Cluster Program plan prior to application submission in 2022/23.

Outside of the Cluster program, researchers were awarded funding during 2021/22 through the BCRC's annual open call for proposals. The 2021/22 call was structured differently than in the past to avoid overlapping with planning for Science Cluster IV. The budget for the 2021/22 call was reduced and focused on addressing a few clearly defined project priority areas, expressed as the following problem statements:

- Effective sanitation is key to ensuring food safety in beef packing and processing facilities. Traditional sanitation practices have relied heavily on the extensive use of hot water, sanitizers and labor; while very effective, these practices are also very costly and may not be optimal from a labor resource or environmental perspective. **Develop and evaluate cost-effective strategies to significantly reduce the use of (hot) water, sanitizers and labor to clean processing environments.**
- In some cases, beef producers have a supply of inexpensive, but poor-quality feeds on hand; these are not ideal from a nutritional, animal health or performance perspective. Producers need economically beneficial ways to use these feeds, while avoiding or mitigating the risks they pose. **Develop feeding**

strategies and /or other approaches to improve the digestibility and use of poor-quality feed in beef cattle diets.

- Inputs such as chemical fertilizers are expensive and often weather dependent. Producers are searching for alternative and economically viable options to improve annual and perennial forage yields. **Develop forage management, agronomic, or other strategies to cost effectively improve pasture or perennial crop yields.**
- Understanding the quality of available feed and formulating rations to meet the needs of different groups of cattle is key to optimizing productivity and profitability but only 25-60% of producers across Canada have their feed tested and not all producers use the feed test results to formulate rations. **Increase the percentage of beef producers in regions across Canada who test their feed annually and consistently use the results to formulate rations for each group of cattle.**
- Preventing reproductive, respiratory and other disease through effective vaccination helps safeguard the productivity and profitability of the herd. Although vaccination recommendations vary by region and by farm, vaccination rates are lower than ideal in all parts of the country. There is also concern that proper vaccination protocols are not always followed, including storage and handling of vaccines, which reduces or eliminates the effectiveness of vaccination. **Increase rates of veterinarian recommended vaccinations and improve vaccination efficacy in beef herds across Canada.**

Under the condensed 2021 annual call for proposals, the BCRC received 20 expressions of interest from research teams across Canada. Of these, 14 research teams were invited to submit a full proposal, with 13 forwarding a proposal for funding. All proposals addressed one of the above problem statements and were classified under program areas relating to Animal Health & Welfare, Beef Quality, Food Safety, Environmental Sustainability, Feeds & Feed Efficiency, Forages & Grassland Productivity, Surveillance, Technology Transfer and/or Production Economics. The BCRC engaged internal and external peer reviewers in the proposal selection process and funding was approved under the annual call for proposals for eight projects in June 2021. Seven additional projects were approved for funding outside of the annual call, as the planned budget was not all allocated through the annual call. Projects that addressed BCRC's research priorities were sourced through BCRC's other programs as well as direct discussions with researchers and other funders that had projects waiting for matching funds. For all proposals outside of the Cluster program, it was required that applicants leverage the Canadian Beef Cattle Check-Off by securing funding from other federal and provincial governments and/or industry funding programs, leveraging the Check-Off dollars on minimum at a 1:1 ratio.

The tables in the following sections (ii) to (vii) summarize the BCRC funded research projects by program area. The project title, timelines, budget and link to each available project factsheet are listed. The factsheets provide background, objectives and what the researchers will do under each project. Project factsheets, which are all available on the BCRC website (beefresearch.ca), are updated with a summary of project results upon project completion. The Research Highlights section highlights selected research results and benefits to the Canadian beef industry. More detailed results on all projects are available from the BCRC upon request.

ii. Beef Science Cluster III

Summary of Beef Science Cluster Research Projects

Project title	Factsheet	2021/22 budget ($)	2021/22 actual ($)	2021/22 NCO funds ($)
Beef Quality and Food Safety				
BQU.08.17 *Development of prediction tools to optimize carcass value*	BQU.08.17	130,455	130,455	60,375
BQU.10.17 *Canada's National Beef Quality Audit at Retail and Processing*	BQU.10.17	221,105	217,631	109,500
FOS.01.17 *If E. coli shed by cattle is becoming resistant to antimicrobial interventions in abattoirs, how best to raise the hurdles?*	FOS.01.17	113,770	111,331	51,781
FOS.07.17 *Identification of genetic and microbial markers for E. coli O157 super-shedders through longitudinal biopsy and monitoring*	FOS.07.17	105,940	105,940	25,000
Animal Health, Welfare and Antimicrobial Resistance				
ANH.04.17 *Assessing economic impacts and developing evidence-based decision support systems for sustainable parasitic roundworm control in Canadian beef cattle*	ANH.04.17	115,000	115,000	115,000
ANH.06.17 *Effect of rest stop duration and quality on the welfare of cattle transported by road*	ANH.06.17	95,281	95,281	50,250
ANH.21.17 *The Canadian Cow-Calf Surveillance Network*	ANH.21.17	338,388	338,388	150,000
ANH.30.17 *Investigating antimicrobial resistance (AMR) and virulence factors of Mycoplasma bovis*	ANH.30.17	136,840	136,840	20,000
AMR.10.17 *Characterizing the microbiome of beef cattle to identify risk factors that affect respiratory health*	AMR.10.17	124,025	124,025	62,750
Feed Production and Efficiency				
FDE.01.17 *Determining the minimum fibre requirement for feedlot cattle and improving the empirical prediction of ruminal pH*	FDE.01.17	207,687	207,687	69,155
FDE.06.17 *Genetic analyses of feed intake, feed efficiency, female fertility, and cow lifetime productivity in beef cattle raised under two environments*	FDE.06.17	225,489	225,489	51,750
FDE.09.17 *Further strategies to enhance the use of wheat grain in feedlot diets*	FDE.09.17	125,450	125,450	49,000
FDE.14.17 *Evidence-based prebiotic and probiotic solutions for improving gut health and feed efficiency in cattle*	FDE.14.17	128,150	128,150	30,000

Forage Productivity and Environmental Sustainability				
FRG.01.17 *Development of native and tame forage varieties and mixtures for improved forage and environmental productivity and resilience*	FRG.01.17	321,359	321,359	60,000
FRG.02.17 *Novel sainfoin cultivars for enhancing production efficiency of pasture and beef cattle and building capacity in forage breeding*	FRG.02.17	176,393	176,393	71,030
FRG.06.17 *Improving abiotic stress tolerance in alfalfa through the simultaneous down-regulation and/or genome editing-mediated knockout of multiple genes*	FRG.06.17	83,325	83,325	13,000
FRG.09.17 *Sustaining the legume component of grazed pasture mixtures for summer grazing and stockpiling complex mixtures in Eastern Canada*	FRG.09.17	241,103	239,433	55,108
FRG.11.17 *Increasing fall productivity in winter-hardy alfalfa by selecting for reduced fall dormancy*	FRG.11.17	147,043	147,043	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	80,500	80,500	13,800
ENV.07.17 *A regionalized life cycle impact assessment model for the quantification of Canadian Beef production impacts on biodiversity*	ENV.07.17	84,416	84,416	28,939
ENV.15.17 *Economic and environmental impacts associated with removal of growth-enhancing technologies in the Canadian beef cattle industry*	ENV.15.17	135,104	135,104	71,978
Knowledge and Technology Transfer				
TEC.01.17 *Enhancing Technology Transfer in the Canadian Beef Industry (see details below)*	TEC.01.17	297,918	297,918	96,526
Science Coordination				
SCI.01.17 *Science Coordination*	N/A	177,022	159,195	34,223
TOTAL		**3,811,763**	**3,786,353**	**1,306,165**

Research Highlights:

ANH.06.17: Effect of rest stop duration and quality on the behaviour and welfare of cattle transported by road - Factsheet

Dr. Karen Schwartzkopf-Genswein (AAFC, Lethbridge) and co-workers studied whether a feed, water and rest break during long-distance transportation provided any benefit to weaned beef calves.

Hundreds of calves were hauled long-distances by commercial truckers in three linked studies to evaluate the effects of transportation on calves that had been preconditioned vs. abruptly weaned, marketed through the

auction mart vs. ranch-direct and rested enroute vs. not. A vast number of animal physiological, behavioral, weight and health parameters were measured.

Short trips (12 hours) were less stressful than long trips (36 hours) and preconditioned calves travelled better than freshly-weaned calves, but marketing method (ranch-direct vs. auction mart) had no effect.

Providing the legally-required 8-hour feed, water and rest break during long haul transportation did not show any meaningful physiological, behavioral, health or welfare benefit to any group of calves.

These results should help the CFIA determine how to reasonably enforce Canada's new Animal Transport regulations. They will also be valuable in informing future industry and government policy discussions related to animal transport.

ANH.13.17: Mycoplasma bovis pneumonia in beef cattle - Factsheet

This project was completed in March 2021. Dr. Jeff Caswell (Ontario Veterinary College) and co-workers studied why *M. bovis* infection leads to pneumonia in some feedlot calves but not others.

Calves were experimentally infected with *Mycoplasma bovis* alone or with both *Mannheimia haemolytica* and *Mycoplasma bovis* bacteria, then treated with an antibiotic to kill the *Mannheimia* but not the *Mycoplasma*.

Calves infected with *Mycoplasma bovis* alone developed mild signs of disease. In contrast, calves that were also temporarily infected with *Mannheimia haemolytica* experienced more inflammation, more severe respiratory disease and were more likely to develop *M. bovis*-associated arthritis.

These results suggest that although there is currently no vaccine to prevent *M. bovis* infections, vaccination to control the inflammation and disease caused by other viral and bacterial respiratory pathogens will also help minimize losses due to *M. bovis*. Continued effort to encourage cow-calf producers to work with their veterinarians to develop and implement appropriate, prevention-based herd health practices (including proper vaccine storage, administration and follow-up boosters) is warranted.

FRG.11.17: Increasing fall productivity in winter-hardy alfalfa by selecting for reduced fall dormancy – Factsheet

Dr. Vern Baron (AAFC Lacombe) and collaborators have been working on developing new alfalfa varieties with decreased fall dormancy and increased winter hardiness.

The team grew Peace and Yellowhead alfalfa plants in a greenhouse under controlled temperature and light conditions, then reduced the artificial daylength and temperature to stimulate fall dormancy. They cut the alfalfa and allowed it to regrow for a month. For each variety, the shortest 50% of plants were eliminated and the tallest 50% were cut and allowed to regrow again. This process was repeated three times with the 50 tallest Peace and 50 tallest Yellowhead plants selected and seed was planted for a field trial.

The first generation of reduced fall dormancy alfalfa plants regrew at least as well or significantly better after the last fall cut than their unselected Peace or Yellowhead parents in the field. The reduced dormancy Peace population and its parental variety yielded the same, but the reduced dormancy Yellowhead yielded 40% better than its parental generation. The Yellowhead varieties also died off at warmer temperatures than the parental varieties. Further years of testing is being done to evaluate these effects.

ENV.09.17: Assessment of occurrence of synthetic hormones (melengestrol acetate & trenbolone acetate) and the beta-agonist (ractopamine) in cattle operations and associated environments - Blog Post

This project was completed in March 2021. Dr. Frank Larney (AAFC Lethbridge) and coworkers evaluated how long residues from growth promotants used to improve beef cattle efficiency in Canada remained in the environment.

This team evaluated fresh manure samples, pen floor residues, catch basins, groundwater samples and samples from land that feedlot manure was spread on from pens with cattle given trenbolone acetate (TBA), melengestrol acetate (MGA) and ractopamine (RAC), as well as a control group given no hormones.

Both TBA and MGA broke down quickly - researchers could not detect their presence in catch basin, groundwater or field soil. All residues were gone long before pens were restocked with the next batch of cattle. RAC residues broke down more slowly and could still be detected in pen floors up to five months after the feeding period as well as in catch basins (but not ground water). Composting pen floor material broke down over 95% of RAC in less than one month.

Growth promotants provide significant production and environmental benefits. This study found that their residues pose minimal risks to the environment and that these can be further minimized by appropriate manure and runoff management. This work provides valuable science to help address consumer and public trust questions related to the safety of growth promotant technologies and their impact on the environment.

Beef Science Cluster III Budget overview

As we saw in 2020/21, most Cluster projects are running as scheduled. There were COVID-19 related interruptions over the past two years, but most researchers were able to manage their projects and conduct the research within their respective institutional safety protocols. The researchers and their teams showed great resilience during the pandemic and remained very committed to meeting their deliverables for March 31, 2022. The researchers are on track to meet the overall project deliverables. It is projected that the total 2021/22 expenditures for Cluster projects will be $25,000 under budget. These funds will be deferred to projects in 2022/23, with researchers committed to utilizing the additional funds for project enhancements. It is further projected that the total five-year industry contribution through National Check-Off funding and other industry sources will be expended by the end of the Cluster program on March 31, 2023.

Total funding (industry and AAFC) on Cluster III projects in 2021/22 is projected at $3,786,353*
**Includes funding provided directly to the BCRC from the following provincial organizations:*
Alberta Cattle Feeders' Association = $30,000; Beef Farmers of Ontario = $30,000; Les Producteurs de bovins du Québec = $26,000

Total 2021/22 projected National Check-Off funding for Beef Cluster III projects = $1,306,165

iii. Beef Science Cluster IV

The Science Cluster IV program announcement is anticipated for mid to late 2022. To prepare for the Cluster IV program launch, the BCRC began planning in 2021/22. The BCRC launched a call for Cluster project proposals in summer 2021 and received 73 letters of intent from research teams across Canada. Of these, 42 research teams were invited to submit a full proposal, with 39 forwarding a proposal for consideration. In an effort to achieve both industry and AAFC cluster objectives, seven additional proposals were solicited directly

from research teams where specific gaps in research were identified. The BCRC engaged internal and external peer reviewers in the proposal selection process and met in May 2022 to select a portfolio of projects to be included in the Beef Cluster application. Funding approval under the Science Cluster program is a highly competitive process. With initial planning in place, the BCRC is well positioned to make any required adjustments to its Beef Cluster Program plan prior to application submission in late 2022.

iv. Special Projects

The BCRC is managing the following projects in recognition of their priority to industry.

CgFARAD: The Canadian Global Food Animal Residue Avoidance Database (CgFARAD) project/membership is an ongoing initiative that the BCRC supports based on identified benefit to industry. 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, 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.

MISC.01.18: Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) Beef Feedlot Antimicrobial Use/Antimicrobial Resistance (AMU/AMR) Surveillance Framework Development, is funded by industry partners and other funding organizations, with the BCRC's primary role being project management and technology transfer upon project completion. The program provides farm-collected AMU and AMR data which helps inform veterinarians and participants on the appropriate selection of antimicrobials, thereby promoting prudent antimicrobial use and stewardship. These data are also utilized by CIPARS surveillance analysts to better understand AMR across the food chain.

ANH.25.19 (*Blog Post*): Surveillance of antimicrobial use and antimicrobial resistance in Canadian feedlot cattle, is funded by other funding organizations, with the BCRC providing administrative support. This project builds on previous research (e.g., *Project 6.41 Factsheet*) which established a framework for on-farm surveillance of AMU and AMR in Alberta feedlots. The current project broadens data and sample collection to include feedlots in Alberta, Saskatchewan and Ontario, where 90% of Canada's fed cattle production occurs. In addition to injectable and in-feed antimicrobial use data, fecal samples are collected to isolate and assess enteric bacteria (of interest from food safety and human health perspectives) for antibiotic susceptibility. In early 2022, the federal government formally approved funding to make the CIPARS feedlot surveillance initiative an ongoing program. A companion project (ANH.11.19; discussed in Section III (v)) is building on this project to assess antimicrobial resistance in respiratory bacteria.

BCRC Special Projects

Project title	Project end date	Total NCO funding ($)	2021/22 NCO funding ($)
CgFARAD - Canadian Global Food Animal Residue Avoidance Database	Ongoing	7,500	7,500
MISC.01.18 - CIPARS Beef Feedlot Antimicrobial Use/Antimicrobial Resistance Surveillance Framework Development	Mar 2023	Managed by BCRC and funded externally by partners (no NCO funding)	
ANH.25.19 - Surveillance of antimicrobial use and antimicrobial resistance in Canadian feedlot cattle	Mar 2023	Managed by BCRC and funded externally by partners (no NCO funding)	

Total 2021/22 projected National Check-Off funding for special projects = $7,500

v. Priority Research Projects

The BCRC is funding the following projects with funding made available to researchers through an annual open call for proposals directed to achieve specific priority outcomes in identified program areas. All projects are funded jointly by Canadian Beef Cattle Check-Off dollars leveraged with at least 50% funding from government and/or industry partners. The project title, National Check-Off funding and fact sheet link for each project is listed below.

BCRC Priority Research Projects

Project #	Project title	Project end date	Total NCO funding ($)	2021/22 NCO funding ($)	Factsheet
AMR.02.18	Use of bacteriophage-derived lysins in combatting multi-drug resistant (MDR) pathogens that cause bovine respiratory disease (BRD)	Sep 2022	97,565	9,756	Factsheet
ANH.01.19	A screen for drugs that reveal *Mycoplasma bovis* to the bovine immune system: a novel approach to vaccine development	Sep 2023	71,250	0	Factsheet
ANH.01.21	Understanding the modes of action of yeast as a direct fed microbial for feedlot cattle	Apr 2023	159,000	119,250	Available June 2022[1]
ANH.02.19	Application of a multi-omics strategy to investigate liver abscess development in beef cattle	Mar 2025	419,250	0	Available June 2022[1]
ANH.02.21	Understanding contagious transmission informs best management practices for respiratory disease in feedlot calves by leveraging whole genome sequencing of a unique isolate collection	Dec 2023	98,606	73,954	Available June 2022[1]
ANH.03.20	Scratching the surface: Investigating the Prevalence, Nature, and Potential Causes of Itchy Cattle	Mar 2024	280,000	0	Factsheet
ANH.04.18	Comparison of immune response and respiratory disease-sparing effect of homologous and heterologous prime-boost vaccine programs in beef calves	Jul 2023	47,350	0	Factsheet
ANH.04.21	Effect of avermectin and tetracycline on the rumen microbiome and resistome of Beef cattle	Jan 2023	65,000	65,000	Available June 2022[1]
ANH.07.18	Effect of feeding ergot alkaloids on ruminal metabolism, growth performance, health and welfare of beef cattle: How much is too much?	Mar 2023	185,500	0	Factsheet
ANH.08.20	Infectious causes of calf diarrhea (scours) and efficacy of current vaccination strategies to prevent scours in beef calves in Western Canada (phase 1)	Apr 2024	108,738	0	Available June 2022[1]
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?	Aug 2023	143,070	0	Factsheet
ANH.11.19	Surveillance of antimicrobial use and antimicrobial resistance in Canadian feedlot cattle; expansion of bovine respiratory disease pathogen susceptibility testing	Sep 2022	45,800	0	Factsheet
ANH.12.20	Investigating foot rot and its microbiological relation to digital dermatitis	Dec 2023	97,394	0	Factsheet

ANH.17.20[2]	Assessment of animal condition and welfare outcomes to improve timely euthanasia in feedlot cattle	Mar 2025	105,625	0	To be developed
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).	Jul 2023	64,023	0	Factsheet
ANH.19.18	Characterization and optimization of visual pen checking criteria to improve BRD treatment outcomes in feedlot cattle	May 2023	86,496	0	Factsheet
ANH.19.20[2]	Enhancing respiratory health of beef cattle through modulation of innate immunity, analysis of the resistome, and identification of culturable bacteria	Jun 2024	300,000	0	To be developed
ANH.20.20	Rapid characterization of the viral microbiome in arriving feedlot calves to inform vaccine gaps and risk assessment for bovine respiratory disease	Apr 2024	227,010	0	Available June 2022[1]
ANH.22.18	Determining the effect of stress on the respiratory microbiome of cattle during transportation	May 2022	79,480	0	Factsheet
ANH.23.19	Stocking density and feed bunk space as a risk factor for liver abscesses	Mar 2024	56,215	0	Available June 2022[1]
ANH.25.20	Comprehensive evaluation of the effect of extended-term delivery of local anesthetic on mitigating the pain caused by castration	May 2024	79,055	0	Factsheet
ANH.29.20	Insights into environmental transmission of Escherichia coli in beef production	Dec 2024	84,000	0	Available June 2022[1]
ANH.30.20	Antimicrobial use and resistance in eastern Canadian cow-calf herds - establishing a baseline for antimicrobial stewardship	Sep 2023	155,745	116,809	Available June 2022[1]
BQU.03.19	Validation of rapid evaporative ionization mass spectrometry (REIMS) for tenderness prediction	May 2023	154,735	0	Factsheet
BQU.09.18	Developing a Canadian Total Quality Management System for Beef Processing	Jun 2022	79,460	11,919	Factsheet
ENV.02.18	The impact of agricultural land conversion on carbon stocks across Canada, with a focus on grazing lands	Apr 2022	166,150	0	Factsheet
ENV.03.18	Performance, Environmental and Economic Benefits of BioChar Supplementation in Beef Cattle Grazing Systems	Dec 2022	121,018	6,623	Factsheet
ENV.03.19	Prairie Ecosystem Services Project: Quantifying the contribution of wetlands in livestock production landscapes	Mar 2024	190,555	0	Factsheet
ENV.07.19	Watershed-scale assessment of water and nutrient dynamics of pastures utilized by beef cattle	May 2023	134,389	0	Factsheet
ENV.07.20	Quantifying the effects of adaptive multi-paddock grazing on soil carbon sequestration and soil organic matter quality	Apr 2024	108,162	0	Available June 2022[1]
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	Jul 2026	137,074	102,806	Available June 2022[1]
FDE.01.21	Further exploration of calcium oxide to improve the quality of indigestible feeds	Mar 2024	59,956	44,967	Available June 2022[1]
FDE.03.18	Use of high-moisture corn products for finishing cattle and corn stover to extend the grazing season for pregnant beef cattle	Sep 2023	142,146	0	Factsheet

FDE.03.19	Improving feed efficiency in the cow herd: Individual cow variability in fibre digestibility, feed efficiency, and methane emissions.	Dec 2024	7,500	0	Available June 2022[1]
FDE.04.20	Level of fat from canola seed supplementation in pregnant beef cow diets - Effects on cow and calf performance	Aug 2026	139,214	0	Available June 2022[1]
FDE.05.20	Development and demonstration of a genomics-enhanced whole herd genetic management platform to improve beef production efficiency and quality	Aug 2024	318,900	0	Available June 2022[1]
FDE.06.19	Evaluating new next-generation strategies to boost breeding efficiency for Feed and Forage Production in Barley and Triticale	Feb 2024	265,500	0	Factsheet
FDE.07.20	Examining the microbial basis of forage digestion efficiency in beef cattle	Mar 2025	214,434	0	Available June 2022[1]
FOS.01.18	Persistence of Shiga toxin-producing Escherichia coli (STEC) in Cattle and Association with Clinical Infections in the Same Geographic Region	Mar 2023	97,875	9,402	Factsheet
FOS.01.20	In-Plant Validation of Harvest Processing Equipment Sanitization Best Practices	Nov 2024	71,489	53,617	Available June 2022[1]
FOS.01.21[2]	To explore conditions for improving the efficiency of water usage during sanitation	Aug 2024	172,050	0	To be developed
FOS.02.21	SRM Risk Analysis - Problem Formulation & Risk Analysis	Mar 2023	90,000	30,000	To be developed
FOS.04.18	Shiga-toxigenic E. coli persistence mechanisms and surface biofilm detection using near-infrared spectroscopy on beef processing facilities	Mar 2023	130,725	34,000	Factsheet
FRG.01.20	Collaborative testing and development of forage barley varieties for western Canada	Mar 2024	44,425	0	Available June 2022[1]
FRG.02.21	Low-cost forage management (hay and pasture systems, legume seeding) impacts on productivity and soil health of old grassland	Mar 2026	235,492	176,619	Available June 2022[1]
FRG.03.18	Improving vegetative biomass yield and digestibility in alfalfa for enhanced livestock production.	Aug 2024	159,300	0	Factsheet
FRG.04.21	Evaluation of polycrop mixtures for swath grazing, soil health and economics	Aug 2024	190,178	142,633	Available June 2022[1]
FRG.08.18	Assessing the impact of grazing annual forage cover crops in an integrated crop-livestock system	May 2023	195,350	16,800	Factsheet
FRG.08.19	Forage Potential of Hybrid Fall Rye (HR) in Alberta and Saskatchewan	Mar 2023	87,692	13,154	Factsheet
FRG.09.18	Enhancement of total lipid content/composition in non-GMO alfalfa and sainfoin for improved energy density and reduced methane emissions	Mar 2024	182,188	18,219	Factsheet
FRG.09.19	Corn intercropping strategies for extended winter grazing of beef cattle	Mar 2025	91,066	0	Available June 2022[1]
FRG.10.21	Assessment of the transcriptomic response of edited SPL8 alfalfa genotypes to drought stress	Dec 2022	39,500	39,500	Available June 2022[1]
FRG.11.20[2]	Complex forage blends: reducing supplementation costs through strategic forage selection	Mar 2025	166,782	0	To be developed
FRG.12.20	Quantifying the economic benefits and carbon capture efficiency of including forages in cropping systems: A test using long-term data from the Breton plots	Mar 2024	62,662	0	Available June 2022[1]
FRG.14.20	Identification of genetic factors contributing to abiotic stress tolerance in intermediate wheatgrass	Mar 2024	21,500	2,150	Factsheet

MISC.03.20	Remote Inspection & Grading Pilot Project	Jul 2023	201,779	0	To be developed

[1]A number of factsheets have been developed but will not be live on the beefresearch.ca website until June 2022 when a website update/re-launch takes place; these have been marked as "Available June 2022"

[2]Project has been approved but the funding agreement is pending

Total 2021/22 projected National Check-Off funding for ongoing Priority Research projects = $1,087,178.

Manitoba Beef Producers priority research project investment in 2021/22 contracted through the BCRC = $3,000

Project Highlights:

ANH.04.18: Comparison of immune response and respiratory disease-sparing effect of homologous and heterologous prime-boost vaccine programs in beef calves - Blog Post

Dr. Nathan Erickson (Western College of Veterinary Medicine, University of Saskatchewan) and coworkers studied whether giving an intranasal vaccine at birth would provide better immune protection to calves than giving an injectable vaccine at a month or two of age.

Calves were either given an intranasal vaccine against respiratory viruses (BRSV, BHV-1 and PI3) or sterile water (control) within 24 hours of birth. All calves were injected with a 5-way vaccine against BRSV, BHV-1, PI3 and BVD Types 1 and 2 at pasture turnout (48 days of age) and at weaning (6 months). Blood samples were collected each time calves were vaccinated, as well as two weeks after pasture turnout and weaning to evaluate antibody levels.

Calves that were intranasally vaccinated at birth responded better to the injected booster vaccine given at pasture turnout. The intranasally vaccinated calves also had higher antibody levels at weaning (when all calves were given the second vaccine injection) and two weeks after weaning.

Mucosal vaccines are an effective way to strengthen the immune system in newborn calves, when circulating maternal antibodies are able to inactivate traditional injectable vaccines.

ANH.11.19: Surveillance of antimicrobial use and antimicrobial resistance in Canadian feedlot cattle, expansion of bovine respiratory disease pathogen susceptibility testing - Factsheet; Blog Post

Dr. Sheryl Gow (Public Health Agency of Canada) and collaborators are studying antibiotic resistance in bovine respiratory disease bacteria (*Mannheimia haemolytica, Pasteurella multocida* and *Histophilus somni*).

They are collecting samples from cattle that are enrolled in the CIPARS feedlot surveillance sites in Alberta, Saskatchewan and Ontario. This program is also collecting antibiotic use data, as well as bacteria of potential concern to human health (e.g., *E. coli, Campylobacter, Enterococcus, Salmonella*).

Because feedlots use antibiotics to treat animal health concerns, understanding the trends and prevalence of antibiotic resistance in BRD bacteria is critical to informing responsible antibiotic stewardship in feedlot animal health programs.

The CIPARS feedlot surveillance program is the result of years of industry commitment to on-farm antibiotic use and resistance research in collaboration with feedlots, veterinarians, AAFC and CIPARS. Earlier in 2022, the federal government formally approved funding to make the CIPARS feedlot surveillance initiative an ongoing program.

FDE.03.18: Use of high-moisture corn products for finishing cattle and corn residue to extend the grazing season for pregnant beef cattle - Factsheet

Dr. Greg Penner (University of Saskatchewan) and co-workers are evaluating different ways of utilizing high moisture corn (grain corn that is combined at 30% moisture, passed through a roller mill and then ensiled) or snaplage (the same process but utilizes the whole ear of corn, not just the grain) in both cow-calf and feedlot settings.

More years of data collection are needed but in the first year no statistical differences in animal performance were found in the feedlot when feeding either high moisture product compared to a barley-based control diet. Similarly, for cows grazing residues from high moisture corn, no differences in body weight or body condition score (BCS) were observed when compared to those grazing whole plant barley swaths.

FRG.12.20: Quantifying the economic benefits and carbon capture efficiency of including forages in cropping systems: A test using long-term data from the Breton plots

Dr. Ed Bork (University of Alberta) and his colleagues are using previously collected data to evaluate the long-term costs and benefits associated with integrating forages into a crop rotation from an agronomic, environmental and economic perspective.

The Breton Research Plots in west-central Alberta support and compare at least five different long-term crop rotations that differ from one to eight years in duration. These plots date back to 1929 and rotations have 40 years' worth of data available for this research group to evaluate the effects of forage inclusion on soil carbon content.

Researchers have collected additional plant and soil samples on these plots and are using that to evaluate the long-term impacts of these crop rotations.

vi. Proof of Concept & Validation Trials

The BCRC funded the proof of concept (POC) projects listed below, including six new projects approved for funding in 2021. 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 a particular area where there is greater uncertainty but also potential opportunity or the need for validation trials. The POC projects are funded jointly by Canadian Beef Cattle Check-Off dollars leveraged with provincial and federal government and/or industry partner funding.

BCRC Proof of Concept Projects

Project #	Project title	Project end date	Total NCO funding ($)	2021/22 NCO funding ($)	Factsheet
POC.02.19	Marbling relationship between Canadian and Japanese grade sites	Mar 2022	49,856	0	Available June 2022[1]
POC.02.20	Safety and Immunogenicity of an Ocular Vaccine Delivery Vehicle	Jul 2022	49,680	0	Factsheet
POC.05.19	Evaluation of feedlot water bowls for pen-level surveillance of antimicrobial-resistant bovine respiratory pathogens	Sep 2022	50,000	0	Factsheet

POC.08.20	Will recurrent selection for improved salt tolerance interact with soil microbe to enhance alfalfa performance, root development and nodule formation under salt stress?	Mar 2022	27,640	4,146	Factsheet
POC.08.21	Assessing the viability of real-time pathologist assisted field necropsies to improve diagnostic outcomes of beef cattle cases submitted to UCVM's Diagnostics Services Unit (DSU)	Dec 2022	35,075	29,814	Available June 2022[1]
POC.09.19	Chemical free sanitizers to prevent E. coli contamination and reduce food waste	Jun 2021	50,000	7,500	Factsheet
POC.11.21	Bacterial metabolites as natural antimicrobials for controlling biofilm formation by pathogens	Sep 2023	49,910	49,910	Available June 2022[1]
POC.14.20	Effects of maternal supplementation of vitamin A during late gestation on intramuscular fat deposition in the offspring	Jun 2023	48,530	41,251	Available June 2022[1]
POC.15.20	Development and Evaluation of a Novel Optical Sensor Thermometer for the Measurement of Core Body Temperature in Cattle	Jun 2022	50,000	0	Factsheet
POC.16.20	Broad-spectrum immunity to enteric pathogens by training innate intestinal immunity in young calves	Aug 2022	49,450	0	Factsheet
POC.16.21	Antimicrobial Peptides that specifically inhibit the BRD pathogen *Mannheimia haemolytica*	Apr 2023	48,875	41,544	Available June 2022[1]
POC.17.21	Identifying alfalfa varieties best suited to pasture rejuvenation	Feb 2023	49,013	41,661	Available June 2022[1]
POC.21.21	Modulating nitrogen responses in forage grasses for improved nitrogen use efficiency, yield, and grazing tolerance.	Mar 2024	39,930	33,941	Available June 2022[1]
POC.23.21	Can we "super charge" colostrum using pre-partum supplementation?	Nov 2022	46,625	39,631	Available June 2022[1]

[1]A number of factsheets have been developed but will not be live on the beefresearch.ca website until June 2022 when a website update/re-launch takes place; these have been marked as "Available June 2022".

Total 2021/22 projected National Check-Off funding for Proof of Concept projects = $289,398.

Project Highlights:

POC.04.18: Exploring options for BRD diagnostics 2.0 – a point-of-care metagenomic nanopore sequencing pilot study – Blog Post

Dr. Cheryl Waldner and her team from the University of Saskatchewan conducted this proof-of-concept study to refine, simplify, speed up and automate an existing test for Bovine Respiratory Disease (BRD) pathogens.

When compared to the gold standard, the new test almost always detected the same (or more) bacteria than culture. The new technique performed best in samples from very sick cattle that contain a lot of bacteria. More work is needed to make the tool effective for detecting BRD before symptoms appear.

Most of the steps involved in the new test could be reliably performed at a veterinary clinic with limited equipment and takes less than six hours, which is 97% faster than the week needed for traditional lab culture-based diagnostics, but still too slow to use in a commercial setting. This team is continuing to refine the test and improve its speed, informativeness and portability.

This tool will help to determine which pathogens are present in the animal which will allow the user to treat the sick animal with more targeted antibiotics.

vii. Research Capacity

The BCRC began the process of developing Research Chairs in partnership with key research institutions in 2018/19. This program addresses industry identified gaps in research capacity. 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 identified by industry.

The BCRC has held two successful Research Chair call for proposals with the first two Research Chairs approved by the Council in 2019 and a third approved in December 2020. The Chairs 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. Dr. Gleise M. Silva was hired in April 2021 to fill this position.
- **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. Dr. Cheryl Waldner was hired in January 2021 to fill this position.
- **Beef Industry Forage Management and Utilization Chair** with the goal "*to develop and evaluate agronomic strategies to optimize forage establishment, yield, quality and stand longevity and identify feeding and grazing strategies that optimize animal performance while contributing to improved soil health and environmental sustainability*", University of Saskatchewan. Bree Kelln was hired in April 2022 to fill this position, contingent on her successfully defending her PhD.

BCRC Research Capacity Projects

Project #	Project title	Project end date	Total NCO funding ($)	2021/22 NCO funding ($)
CHAIR.01.18	Beef Cattle Research Council Industrial Research Chair in One Health and Production-Limiting Diseases (the "NSERC Chair")	Dec 2024	750,000	150,000
CHAIR.02.18	BCRC - Hays Chair in Beef Production Systems	Mar 2030	1,500,000	150,000
CHAIR.01.20	Beef Industry Forage Management and Utilization Chair	Mar 2030	2,500,000	1,250,000

Total 2021/22 National Check-Off funding for Research Capacity projects = $1,550,000.

viii. Knowledge & Technology Transfer

The BCRC funds Knowledge and Technology Transfer (KTT) activities and projects under the Cluster III program and also external to the Cluster program. All projects are funded jointly by Canadian Beef Cattle Check-Off dollars leveraged with at least 50% funding from government and/or industry partners.

Cluster III program

Under the Cluster III program, activities completed in 2021/22 include the development, maintenance and distribution of extension resources including webinars, videos, articles and decision tools.

Five webinars were held featuring producers, agrologists, researchers, veterinarians and other beef and forage industry experts. More than 1,100 individuals were in attendance during the live presentations, the majority of which identified as being cattle producers. Webinar registrations and recording views remain high. Survey feedback from the 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.

New resources developed include four production-focused topic webpages, 46 blog posts, 16 research results summary fact sheets, 12 e-newsletters, 12 articles for *Canadian Cattlemen - The Beef Magazine*, one interactive decision-making tool, 11 infographics, two radio clips and eight videos.

Videos produced included a focus on promoting two existing decision-making tools, the Bull Valuation Calculator and Value of Calving Distribution Calculator, to raise awareness about these resources' practical application for producers. Released in February 2022, these two videos have been viewed more than 6,500 times to date. Other videos provide important industry-related updates including overviews of the BCRC Beef Researcher Mentorship Program, the Canadian Beef Industry Award for Outstanding Research and Innovation and the Five-Year Canadian Beef Research and Technology Transfer Strategy.

A decision-making tool was designed to identify economic opportunities and risks from backgrounding or preconditioning cattle. Producers can use the calculator to project net returns from preconditioning or backgrounding compared to selling cattle at weaning, as well as to identify the production cost, cattle performance, or cattle price scenarios that could potentially result in positive net returns.

The BCRC's technology transfer efforts consistently receive positive feedback from producers and other stakeholders. Website traffic increases each year with BeefResearch.ca having over 500,000 pageviews in 2021/22. Analytics indicate that the audience is interested in a variety of topics, particularly those that are most practical and related to seasonal activities for the sector. Articles and other resources developed through this project are frequently and increasingly redistributed by industry groups, trade magazines and other media, as well as by producers on social media.

Social media networks continue to grow. The number of email subscriptions also continues to increase. Currently, more than 3,700 individuals are subscribed to the BCRC blog and more than 1,800 are subscribed to the BCRC's monthly e-newsletter, *The Wire*.

In addition to the production and distribution of extension resources, four scientists participated in the Beef Researcher Mentorship program, which engages researchers who study cattle, beef, genetics, feed or forage production with producers and other Canadian beef cattle industry stakeholders. Following a competitive application process, participants are paired with two mentors, develop a roadmap to identify goals and plans to achieve them and are provided a small travel budget. Participants report having gained a large amount of practical knowledge about Canadian beef production and realities and having built a network of people that support their ability to conduct research and communicate results of priority and relevance to the industry.

Activities internal to BCRC

Over the last several years the BCRC has invested in internal activities to develop content, decision making tools and resources that are aligned with key extension priorities identified by industry. During 2021/22, two internal activities were advanced. One was an initiative on ***Eastern content expansion*** which focused on improving the visibility and uptake of the BCRC content by beef producers in Ontario, Quebec and Atlantic provinces through a focus on:

- Resource modification and/or development to ensure relevance to eastern Canadian producers
- Decision making tools modification and/or development including data gap assessment and scenario development
- Webinar and other modular resource development to support regional extension program delivery
- Eastern extension network expansion to grow awareness of the BCRC resources

Increased relationship building with extension specialists in Central and Eastern Canada has led to greater collaboration and promotion of BCRC extension resources applicable in those regions. Given the tremendous interest in this project and the number of priorities identified by the stakeholder advisory group, this project will continue into 2022/23 to allow for the comprehensive development of content and resources.

The second internal activity was an ***Enhancing extension through veterinary collaboration*** project. Industry surveys have repeatedly demonstrated that producers look to veterinarians for advice and information on many topics including animal health, nutrition, feeding strategies and productivity. Veterinarians are often stretched for time and do not have expertise in all areas. This project is intended to identify opportunities where veterinarians can further inform and persuade producers to adopt practices or technologies that benefit them and the industry - creating awareness of existing BCRC resources and developing new resources where appropriate. Through consultation with both mixed practice and bovine-focused veterinarians and Registered Veterinary Technicians (RVTs) across Canada, opportunities for improvement in beef herds were identified and plans developed to create resources to be used by veterinary clinics and producers to make improvements in those areas, such as videos, handouts and customizable templates. In 2021/22, a series of how-to videos dubbed #Calf911 were developed which have received over 10,000, 3,500 and 6,000 online views respectively. An awareness campaign was launched to increase familiarity of existing BCRC extension resources in the large animal veterinary community. Results from the awareness campaign were tracked and analyzed and will be used to inform a modified, strategic continuation of the campaign in 2022/23.

Activities external to BCRC

The ***Canadian Beef Technology Transfer Network*** continued in 2021/22, in recognition that further resources are necessary to expand the reach of the BCRC's extension initiatives while supporting external initiatives through national and/or regional networks to encourage the broader and more rapid uptake of relevant technologies and practices. The Network brings together groups and individuals actively involved in knowledge and technology transfer that support 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. In July 2021, more than 60 individuals participated in an online annual meeting that facilitated communication and collaboration.

Under the 2021 KTT call for proposals, which ran in tandem with the 2021 priority research project call for proposals, four KTT proposals were funded. It is important to note that the funding of KTT activities through a call for proposals is a relatively new and unique concept. This has limited the number of proposals funded, as extension groups become aware and learn about the program and parameters and identify matching funding sources. The BCRC staff focused on creating awareness and working directly with potential applicants during the past year.

BCRC Knowledge and Technology Transfer Projects					
Project #	**Project title**	**Project end date**	**Total NCO funding ($)**	**2021/22 NCO funding ($)**	**Factsheet**
KTT.01.18	Early Calf Health and Survival Management Risk Assessment Tool	Jul 2023	36,656	3,666	Factsheet
KTT.01.19	The Value of Record Keeping for Decision-Making on Canadian Cow-Calf Farms and Ranches	Jul 2022	40,950	12,000	Factsheet
KTT.01.21	Motivations, barriers and alternatives to feed testing for cow-calf producers	Dec 2023	40,950	30,713	Available June 2022[1]
KTT.02.20	The Big Beef Podcast	Mar 2023	14,556	1,456	Factsheet
KTT.04.19	Evaluating Premiums for Weaned Calves Marketed with Value-Added Management Characteristics	Mar 2022	10,500	1,575	Factsheet
KTT.04.20	Leveraging the Canadian Beef Improvement Network's (CBIN's) Collaboration and Resources to Advance Genetic Improvement Across the Canadian Beef Industry	Mar 2023	49,864	0	Factsheet
KTT.05.18	An Interactive Tool to Inform Johne's Disease Control in Beef Herds: What to Test, When and How Often	Mar 2022	17,850	2,678	Factsheet
KTT.05.20	Canadian Forage U-Pick: Expanding the Western Canadian Forage U-Pick tool to include Eastern Canada	Aug 2023	43,450	0	Available June 2022[1]
KTT.05.21	Nova Scotia On-Farm Cattle Preconditioning Pilot Project	Oct 2022	28,324	24,075	Available June 2022[1]
KTT.06.21	Improving vaccine usage and efficacy in western Canadian beef herds to reduce disease risks.	Jun 2023	50,000	42,500	Available June 2022[1]
KTT.08.21	Development and Production of a Beef Cattle Animal Health Podcast	Aug 2023	15,807	6,460	Available June 2022[1]

[1]A number of factsheets have been developed but will not be live on the beefresearch.ca website until June 2022 when a website update/re-launch takes place; these have been marked as "Available June 2022"

Total 2021/22 projected National Check-Off funding for Knowledge & Technology Transfer projects = $125,123.

Project highlights:

***KTT.01.19 The Value of Record Keeping for Decision-Making on Canadian Cow-Calf Farms and Ranches* - Factsheet**

Dr. Eric Micheels (University of Saskatchewan) and a team of economists are working to identify the motivation for producers to keep certain production and financial records and how they utilize those records to make management decisions. The project is aimed at learning how cow/calf producers collect, store and analyze their financial and production records, how records are used to make management decisions, and what records and decision-making tools are most commonly used among ranchers who deem themselves as successful and

pleased with their performance. Producers are being interviewed and surveyed to gather this information and results will be available in July 2022.

***KTT.02.20 The Big Beef Podcast* - Factsheet**

Through a series of podcasts, this project shares science-based information about the beef industry to Canadians with an interest in their food and who are also interested in more information about beef and beef production. Dr. Kim Stanford and Dr. Tim McAllister host a regular podcast, titled *Cows on the Planet*, interviewing researchers and industry experts about topics ranging from the role of cattle in recycling food waste, to cows and biodiversity and defining sustainable beef. To date, 18 podcasts have been produced with more than 4,800 downloads. Eighteen more episodes will be produced before the project end date of February 2023. The *Cows on the Planet* podcast series is available across a range of podcasting sites.

ix. Surveillance Research Networks

A key priority identified in the Canadian Beef Research & Technology Transfer Strategy is ensuring the continuation and enhancement of priority surveillance networks related to production limiting diseases and antimicrobial resistance and use. The purpose of these networks is to inform industry practice, policy and regulation, public trust discussions and future research and extension priorities.

Funding for surveillance was allocated in the BCRC's 10-year plan but was not activated prior to 2020/21 due to investments through the current Beef Science Cluster in the Canadian cow-calf surveillance network, and the Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) having funding support through various means to complete antimicrobial resistance and use surveillance work.

With the announcement by CIPARS in early 2022 to provide funding for feedlot surveillance on an ongoing basis, the BCRC will begin the development of a more formal surveillance program in 2022/23 to address gaps not covered by CIPARS, the cluster or other external program funding.

The first year that specific projects were invested in through the BCRC's surveillance research network and outside of the Science Cluster was 2020/21. The BCRC provided continued funding for three projects in 2021/22 as listed in the table below. The projects include 1) a Western Canadian Animal Health Network beef network which connects farmers, specialists and information systems to improve cattle health in western Canada; 2) continuation of bovine respiratory disease pathogen isolation and susceptibility testing; and 3) a pilot sentinel surveillance project evaluating AMR risk for calves prior to feedlot entry. Additional programs will be evaluated in coming years and selected based on key priorities where it is viewed that industry funding will assist in ensuring surveillance is advanced within government and industry frameworks.

BCRC Surveillance Projects

Project #	Project title	Project end date	Total NCO funding ($)	2021/22 NCO funding ($)	Factsheet
SURV.01.20	The Western Canadian Animal Health Network (WeCAHN) beef network: connecting farmers, specialists and information systems to improve cattle health in western Canada	Mar 2024	86,238	62,803	Available June 2022[1]

SURV.02.20	Surveillance of antimicrobial use (AMU) and antimicrobial resistance (AMR) in Canadian feedlot cattle; continuation of bovine respiratory disease pathogen isolation and susceptibility testing	Dec 2025	360,434	267,826	Available June 2022[1]
SURV.03.20	Respiratory pathogens in calves at weaning: A pilot sentinel surveillance project evaluating AMR risk for calves prior to feedlot entry	Apr 2023	62,137	0	Available June 2022[1]

[1]A number of factsheets have been developed but will not be live on the beefresearch.ca website until June 2022 when a website update/re-launch takes place; these factsheets have been marked as "Available June 2022".

Total 2021/22 projected National Check-Off funding for Surveillance Research Network = $330,629.

Alberta Beef Producers surveillance research project investment in 2021/22 contracted through the BCRC = $17,500

x. Cost of Production Network

As part of surveillance programming in 2021/22, the BCRC continued to support the Canadian Cost of Production (COP) Network with work overseen by Canfax Research Services (CRS). Through its development of economic baseline data and analysis, the COP Network 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. In 2021/22, the COP Network published 58 future farm scenarios for the 25 cow-calf benchmarks and three dairy-beef benchmarks. A results webinar hosted in January 2022 with participating producers and provincial coordinators covered baseline results, comparison to the 2017 Farm Management Survey Results, summaries from the short surveys and a review of how future farm scenarios impacted different farms differently. A recording of the webinar along with other resources such as case studies and fact sheets can be found at canfax.ca/COPAnalysis. The COP Network was expanded in 2021/22 with 43 additional producers taking part in focus groups and an estimated 13-16 benchmark farms currently being developed. Future farm scenarios will be developed for these new farms in 2022/23. Five graduate students from Dalhousie University, University of Manitoba and University of Saskatchewan have started thesis projects utilizing the COP Network data with funding from Alberta Beef Producers and the Canadian Roundtable for Sustainable Beef. Thesis topics that will be addressed include success factors for small operations in eastern Canada, economic viability of dairy-beef operations in the Maritimes, win-win scenarios that reduced cost of production and net GHG emissions, and culling strategies.

Total 2021/22 projected National Check-Off funding for Cost of Production Network = $115,500

IV. Verified Beef Production Plus

In addition to sponsoring research and technology development in support of the Canadian beef industry, the BCRC oversees the delivery of 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.

VBP+ provides producer training in all areas of certification and sustainability and maintains the VBP+ standard. On behalf of the CCA (BCRC), VBP+ maintains Provincial Delivery Agent agreements with all provinces to deliver training through provincial coordinators. VBP+ Delivery Services Inc. (VBP+ Inc.) is a stand-alone organization of which CCA (BCRC) is the sole member to deliver certification and renewal services across all sectors and in all provinces.

Statistics as of April 2022	
Number of Active Operations	**1,390**
Per Head by Sector	
Backgrounder	263,005
Cow/Calf	355,188
Feedlot	1,084,898
Total # Head (one time capacity)	**1,703,091**
Acres Per Production Type	
Dry land acres for feed production	301,453
Irrigated acres for feed production	41,589
Native grazing acres	2,049,672
Tame grazing acres	359,181
Total Acres	**2,751,895**

The electronic audit platform that was developed in 2020 continues to provide efficiency and key data points to certification operations, producers and industry. The platform, which covers all aspects of certification from assigning auditors through to a producer report card was developed to cover all areas critical to a robust certification system, including conflicts of interest, public health declarations (if applicable), quality assurance, quality control and audit evidence collection. The platform is designed to ensure efficiency with internal reviews as well as providing producers with insights from their certification. The platform will be expanded in 2022/23 to include metrics on renewal events as well as on-farm certification. This data will be valuable for producers but also for industry to show change in producer management practices over the five-year audit cycle.

In 2021/22, VBP+ launched a new learning platform called the *Canadian Cattle Learning Center*. The platform was launched with the enhanced VBP+ 2.0 training which covers all aspects of the VBP+ certification and different scoring levels. The new platform is intended to expand beyond VBP+ training. The platform offers a producer the ability to upload training taken externally for continuing education credit and a transcript, allowing all beef-related training an individual completes to be recognized. The platform also houses auditor, reviewer and coordinator training which can be assigned as needed to meet accreditation obligations. This learning center will work for training similar to how the electronic audit platform works for certification, with powerful reporting features which are valuable for individual producers. It will also be valuable for industry allowing for the mapping of resources producers are seeking out as well as making a strong statement for the value of training towards continuous improvement of our beef sector.

VBP+ and VBP+ Inc. strive to provide the best possible value for producers through their two streams of activity, producer training and certification.

Total 2021/22 projected National Check-Off funding for VBP+ = $375,000

V. BCRC Administration and Management

The BCRC is overseen by an operating committee of 15 cattle producers (including one ex-officio), who 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 the 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 Operations Manager supports the development and implementation of BCRC's business planning, budget management and reporting processes. The Extension and Communications Director and Extension Coordinator support the Technology Transfer & Knowledge Dissemination Strategy. The Technical Director supports the development and advancement of research and technical analysis related to beef quality, food safety, animal health and technical barriers to trade on a part-time basis. In addition to these positions, administrative, financial and technical expertise support the BCRC operations.

The BCRC Executive Director also oversees the VBP+ Business Manager who works with the VBP+ Technical Manager and various contractors and is directly responsible for delivering the national VBP+ program and overseeing VBP+ Delivery Services Inc. the wholly owned non-profit responsible for delivery of VBP+ audit delivery.

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 2021/22 is projected at $618,000.

VI. Financial Notes

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 year-to-date expenditures, as of publication date, and do not reflect BCRC's entire fiscal year. Due to the nature of the BCRC's funding cycle, this will result in a variance between this report and the close of BCRC's year end on June 30th, as a large volume of contracting new projects occurs between May and June of each year.

The BCRC 2021/22 financial summary and CCA audited financial statements will be available to the Agency after August 2022.

Projected Canadian Beef Cattle Check-Off funding allocated to research programming in 2021/22 is outlined in various sections of this report and includes the following:

Beef Science Cluster research projects = **$1,306,165**

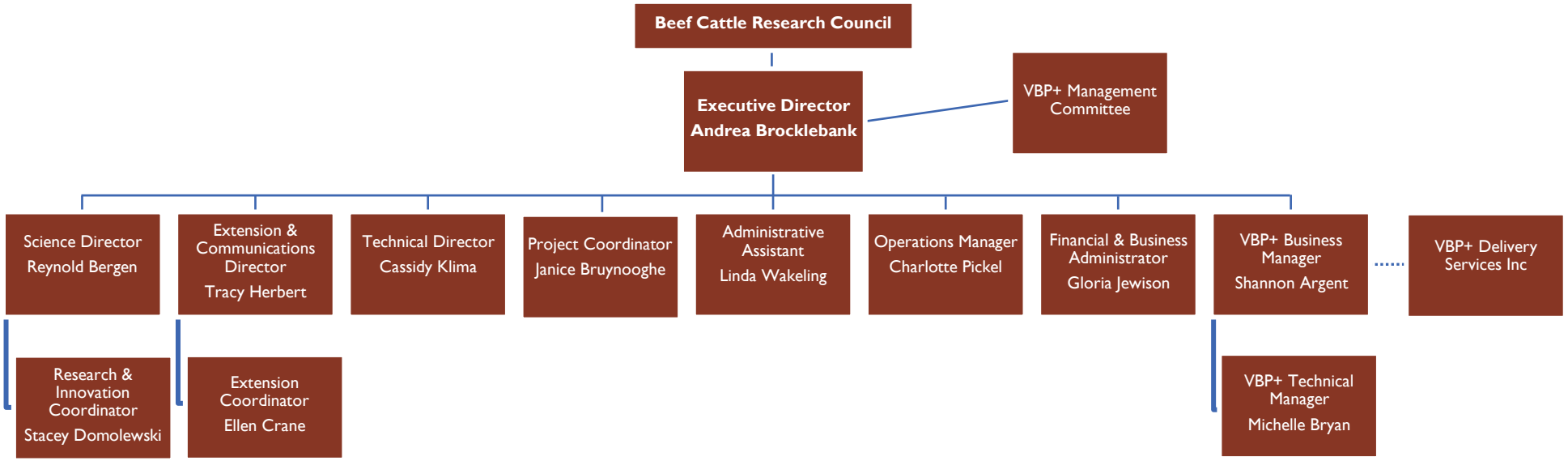
Other BCRC research projects = **$3,505,328**

Verified Beef Production Plus = **$375,000**

BCRC general program management and administration = **$618,000**

Total Beef Cattle Check-Off funding - **$5,804,493**

VII. Appendix – BCRC Organization Chart



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